Biodiversity Assessment for the Development of the proposed Pure Source Mine Project

Parys, Free State Province

February 2019

Client

Shango Solutions

Prepared for:

Van Wyk Development Corporation (Pty) Ltd

Prepared by:

The Biodiversity Company
info@thebiodiversitycompany.com
www.thebiodiversitycompany.com

Report Name	**Biodiversity Assessment for the Development of the proposed Pure Source Mine Project**
Submitted to	Shango Solutions
Report Reviewer	**Russell Tate**  Russell Tate is a published, registered Professional Scientist (Pr. Sci. Nat Aquatic Health: 400089/15) with an MSc in aquatic eco-toxicology. Russell Tate has completed specialist projects in South Africa, Mozambique, Botswana, Zambia, Ivory Coast, Ghana, Mali, Liberia, Sierra Leone, Senegal, Cameroon and throughout north eastern and central Democratic Republic of Congo. Considering the wide geographical range of the projects completed, Russell Tate has a good technical understanding on the variable conditions within African landscapes as well as their biological compositions. Russell has worked on numerous mining related assessments which include the monitoring of the impacts of existing surface mines. Russell therefore has a knowledge of the potential impacts arising from the proposed project.
Report Writer	**Michael Adams**  Michael Adams is Cert Sci Nat registered (118544) and is an experienced natural scientist with a specialisation in herpetofauna. He has over 10 years of experience working with reptiles and amphibians as a consultant and through various conservation initiatives.
Report Writer	**Martinus Erasmus**  Martinus Erasmus (Cand Sci Nat) obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting basic assessments and assisting specialists in field during his studies since 2015.
Report Writer	**Lindi Steyn**  Lindi Steyn (Cand Sci Nat) has a PhD in Biodiversity and Conservation from the University of Johannesburg. She specialises in avifauna and has worked in this specialisation since 2013.
Declaration	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, 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.

Executive Summary

GN R982	Appendix 6 (n): Specialist Opinion
It is the specialist's opinion that the proposed activities proceed only if all of the recommendations made (Section 12 - "Recommendations") have been adhered to. This includes rehabilitation plans, the application of all recommended mitigation measures as well as adhering to the 30 m buffer zone for all proposed activities in proximity to rocky ridges or other highly sensitive areas as defined in this report.	

The Biodiversity Company (TBC) was appointed to conduct an Environmental Impact Assessment (EIA) for the Pure Source Mining project. This specialist study is completed to meet the requirements of a Mining Right Application (MRA) and the associated environmental authorisations for a proposed open pit mine.

The proposed project will involve the development of various open pit mines associated with the "roll-over mining" method, a processing plant and associated infrastructure. Commodities to be mined will include sand, gravel and diamond (alluvial) with the Life of Mine (LoM) being envisaged to last 30 years. Northern, central and southern portions of the project area are proposed for aggregate mining and one central and eastern portion are proposed for sand mining.

The applicant has a Prospecting Right (PR) over the proposed MRA area approximately 859 hectares in size and consists of Portion 1 and Portion 3 of Woodlands 407 (District Parys) of which a prospecting right has being issued in terms of Section 18 of the Minerals and Petroleum Reserve Development Act (N.P.R.D.A.), 2002 (Law 28 OF 2002). Approximately 401.67 ha of the property will be mined for aggregate and 283.1 ha for sand.

Impact Assessment Summary

From an ecological perspective the development is situated close to, and within, various natural and semi-disturbed habitats (including Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), riverine habitats and rocky ridge areas). Although disturbed, it was found that these areas support various faunal species and there is a strong likelihood that species of conservation concern (SCC) occur there. Faunal diversity within the project area was found to be high and the habitats within the project area are considered suitable to support faunal and floral SCC. This diversity is indicative of the importance of these systems to collectively provide refugia, food and corridors for dispersal in and through the surrounding area. The preservation of these systems is the most important aspect to consider, even more so due to the sensitivity of the area according to the ecological datasets analysed for this report.

The proposed activities will result in direct loss of habitats (including an Endangered vegetation type – Soweto Highveld Grassland, various rocky ridges, ESAs and a CBA), direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate mining will reduce the habitat available for fauna species and will reduce animal populations and species compositions within the area. Land clearing alters local wildlife habitat and can lead to

the loss of local breeding grounds, nesting sites and wildlife movement corridors such as the ridge, rivers, streams and drainage lines, or other locally important features.

The primary mitigation measure for the proposed project is to avoid CBA areas as well as high biodiversity sensitivity areas (natural vegetation, ridges, watercourses & wetlands) as defined in this report and implement buffer zones. The current project area directly intersects with a large CBA area and therefore the proposed layout options may be incompatible with this mitigation measure and may represent a limitation for the project.

Field surveys (conducted during July and November 2019) confirmed the presence of remaining natural Soweto Highveld Grassland as well as a high diversity of naturally occurring faunal and floral species. Although no species of conservation concern (SCC) were recorded during the field surveys, due to the presence of suitable habitat, the likelihood that certain SCC occur remains moderate to high.

According to the Mining and Biodiversity Guidelines (2013), the project area is predominantly classed as having a ‘Moderate Biodiversity Importance’ and represents a ‘Moderate Risk for Mining’.

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 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.

Martinus Erasmus

Terrestrial Ecologist

The Biodiversity Company

February 2019

DECLARATION

I, Michael Adams, 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.

Michael Adams

Terrestrial Ecologist

The Biodiversity Company

February 2019

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1 Introduction

The Biodiversity Company (TBC) was appointed to conduct a baseline and impact (risk) assessment for the Pure Source Mining project. The specialist studies are completed to meet the requirements of a Mining Right Application (MRA) and the associated environmental authorisations for a proposed open pit mine.

The proposed project will involve the development of various open pit mines, a processing plant and associated infrastructure. Commodities to be mined will include sand, gravel and diamond (alluvial). The Life of Mine (LoM) is envisaged to last 30 years. Northern, central and southern portions of the project area are proposed for aggregate mining and one central and eastern portion are proposed for sand mining.

The applicant has a Prospecting Right over the proposed Mining Right Application area. This area is approximately 859 hectares in extent and is the remaining sections of Portion 1 and Portion 3 of Woodlands 407 (District Parys) for which a prospecting right has being issued in terms of Section 18 of the Minerals and Petroleum Reserve Development Act (N.P.R.D.A.), 2002 (Law 28 OF 2002). Approximately 401.67 ha of the property will be mined for aggregate and 283.1 ha for sand.

Mid-dry season terrestrial biodiversity surveys were conducted on the 6th July 2018 and the 9th – 12th July 2018 by two terrestrial ecologists, a wetland ecologist and two aquatic ecologists. Wet season field work was conducted from the 20th - 23rd November 2018. The surveys primarily focussed on the development footprint area, referred to as the project area herein. Furthermore, the identification and description of any sensitive receptors were recorded across the project area, and the manner in which these sensitive receptors may be affected by the activity was also investigated.

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 the whether any environmental authorisation process or licensing is required for the proposed development.

2 Project Area

The proposed project area is situated about 20 km northeast of Parys, on the border of the Vaal River in the Free State Province of South Africa. The north-eastern and north-western portions of the project area border on the Gauteng and North West Provinces respectively. The Applicant has a Prospecting Right over the proposed Mining Right Application area covering approximately 859 hectares. The land uses surrounding the project area consist of agricultural land, natural areas, existing sand mining operations, the urban area of Vaal Oewer with associated houses, livestock and game farming. Infrastructure such as secondary tar roads, gravel roads and homesteads, occur within the proximity of the project area (Figure 1). The Vaal River forms the northern boundary of the proposed project area.

The infrastructure for the proposed development will consist of the development of a water supply line, access road, open-cast sand mining pits, open-cast aggregate mining pits, cut-off trench, fuel storage area, processing plant, a pollution control dam and 2.5MVA power supply line. The total footprint of the proposed infrastructure is estimated to be approximately 32.4 hectares in extent. Figure 1 shows the layout of the proposed project area.

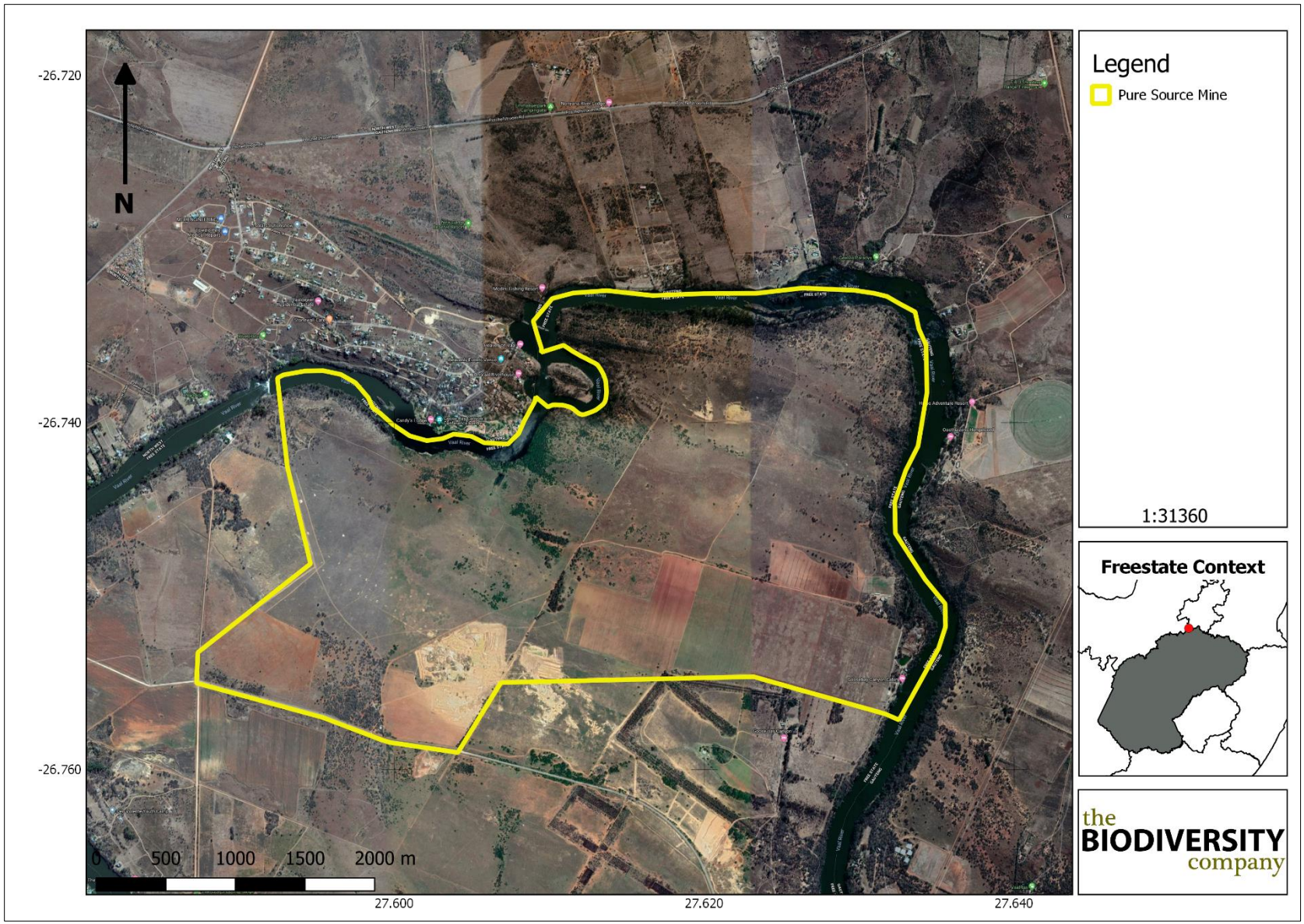

Figure 1: General location of the project area

3 Scope of Work

The Terms of Reference (ToR) included the following:

- Desktop description of the baseline receiving environment specific to the field of expertise (general surrounding area as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity) that occur in the study 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 development areas;
- Identification of conservation significant habitats around the project area which might be impacted by the proposed development;
- Site visit to verify desktop information;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application; and
- Provide a map to identifying sensitive receptors in the study area, based on available maps, database information & site visit verification.

4 Methodologies

4.1 Geographic Information Systems (GIS) Mapping

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

- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina et al., 2006);
- Important Bird Areas 2015 – BirdLife South Africa (vector geospatial dataset); and
- Department of Environmental Affairs (DEA) National Landcover 2015.

Field surveys were conducted to confirm (or refute) the presence of species identified in the desktop assessment. The specialist disciplines completed for this study included:

- Botanical;
- Fauna (mammals and avifauna); and
- Herpetology (reptiles and amphibians).

Brief descriptions of the standardised methodologies applied in each of the specialist disciplines are provided below. More detailed descriptions of survey methodologies are available upon request.

4.2 Botanical Assessment

The botanical study encompassed an assessment of all the vegetation units and habitat types within the 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. A limitation to the number of species were identified as the project area had already been impacted upon due to previous mining activities and/or were being utilised for agriculture which further limited the identification of floral species. The methodology included the following survey techniques:

- Floral species identification;
- Sensitivity analysis based on structural and species diversity; and
- Identification of any potentially occurring floral red-data species or presence of suitable habitat for these species.

4.3 Literature Study

A literature review was conducted as part of the desktop study to identify the potential habitats present within 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 which 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, 2017) was utilized to provide the most current account of the national status of flora. Relevant field guides and texts consulted for identification purposes in the field during the surveys included the following:

- Field Guide to the Wild Flowers of the Highveld (Van Wyk & Malan, 1997);
- A Field Guide to Wild Flowers (Pooley, 1998);
- Guide to Grasses of Southern Africa (Van Oudtshoorn, 1999);
- Orchids of South Africa (Johnson & Bytebier, 2015);
- Guide to the Aloes of South Africa (Van Wyk & Smith, 2014);
- Medicinal Plants of South Africa (Van Wyk et al., 2013);
- Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016); and

- Identification Guide to Southern African Grasses. An identification manual with keys, descriptions and distributions. (Fish et al., 2015).

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, 2012);
- Grassland Ecosystem Guidelines: landscape interpretation for planners and managers (SANBI, 2013); and
- Red List of South African Plants (Raimondo et al., 2009; SANBI, 2016).

4.4 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

- Compilation of expected species lists;
- Compilation of identified species lists;
- Identification of any Red Data or species of conservation concern (SCC) present or potentially occurring in the area; and
- Emphasis was placed on the probability of occurrence of species of provincial, national and international conservation importance.

The field survey component of the study utilised a variety of sampling techniques including, but not limited to, the following:

- Visual observations;
- Camera trapping;
- Identification of tracks and signs; and
- Utilization of local knowledge and results from previous assessments carried out within the project area.

Habitat types sampled included pristine, disturbed and semi-disturbed zones, rocky ridges, drainage lines, wetlands and river habitats.

Mammal distribution data were obtained from the following information 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);

- Animal Demography Unit (ADU) - MammalMap Category (MammalMap, 2017) (mammalmap.adu.org.za); and
- A Field Guide to the Tracks and Signs of Southern, Central and East African Wildlife (Stuart & Stuart, 2013).

4.5 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the project area was also conducted. The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.);
- Visual searches - typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. May include walking transects or using binoculars to view the species from a distance without the animal being disturbed;
- Amphibians – many of the survey techniques listed above will be able to detect species of amphibians. Over and above these techniques, vocalisation sampling techniques are often the best to detect the presence of amphibians as each species has a distinct call. Records from the aquatic ecologists were also utilised for this report;
- Opportunistic sampling - reptiles, especially snakes, are incredibly elusive and difficult to observe. Consequently, all possible opportunities to observe reptiles are taken in order to augment the standard sampling procedures described above. This will include talking to local people and staff at the site and reviewing photographs of reptiles and amphibians that the other biodiversity specialists may come across while on site.

Herpetofauna distributional and species data was 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 (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).

4.6 Fieldwork

The fieldwork and sample sites were placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork.

The focus of the fieldwork was therefore to maximise coverage and navigate to each target site (primarily the three proposed open cast areas) in the field in order to perform a vegetation and ecological habitat assessment at each sample site. Emphasis was placed on sensitive habitats, especially those overlapping with proposed development areas. Due to the timing of the survey, morphological structures used to identify flora, such as inflorescences and flowers, are either limited or absent, thus affecting the floral species identified.

At each sample site notes were made regarding current impacts (e.g. livestock grazing, erosion etc.), subjective recording of dominant vegetation species and any sensitive features (e.g. wetlands, outcrops etc.) present. In addition, opportunistic observations were made while navigating through the project area. Effort was made to cover all the different habitat types within the limits of time and access.

4.7 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 and conservation in the Free State Province

INTERNATIONAL	Convention on Biological Diversity (CBD, 1993) The Convention on Wetlands (RAMSAR Convention, 1971) The United Nations Framework Convention on Climate Change (UNFCC,1994) The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1973) The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
NATIONAL	Constitution of the Republic of South Africa (Act No. 108 of 2006) The National Environmental Management Act (NEMA) (Act No. 107 of 1998) The National Environmental Management Protected Areas Act (Act No. 57 of 2003) The National Environmental Management Biodiversity Act (Act No. 10 of 2004) The National Environmental Management: Waste Act, 2008 (Act 59 of 2008); The Environment Conservation Act (Act No. 73 of 1989) National Environmental Management Air Quality Act (No. 39 of 2004) National Protected Areas Expansion Strategy (NPAES) Natural Scientific Professions Act (Act No. 27 of 2003) National Biodiversity Framework (NBF, 2009) National Forest Act (Act No. 84 of 1998) National Veld and Forest Fire Act (101 of 1998) National Water Act, 1998 (Act 36 of 1998) National Freshwater Ecosystem Priority Areas (NFEPA's) National Spatial Biodiversity Assessment (NSBA) World Heritage Convention Act (Act No. 49 of 1999) National Heritage Resources Act, 1999 (Act 25 of 1999) Municipal Systems Act (Act No. 32 of 2000) Alien and Invasive Species Regulations, 2014 South Africa's National Biodiversity Strategy and Action Plan (NBSAP) Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) Sustainable Utilisation of Agricultural Resources (Draft Legislation). White Paper on Biodiversity
PROVINCIAL	Boputhatswana Nature Conservation Act 3 of 1973 Free State Nature Conservation Ordinance 8 of 1969

International Legislation and Policy

- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival; and

- The IUCN (World Conservation Union). The IUCN's mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.

National Level

- Constitution of the Republic of South Africa (Act 108 of 1996). The Bill of Rights, in the Constitution of South Africa states that everyone has a right to a nonthreatening environment and requires that reasonable measures be applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development;
- The National Environmental Management: Biodiversity Act (NEM:BA) No. 10 of 2004: specifically, the management and conservation of biological diversity within the RSA and of the components of such biological diversity;
- National Forests Act, 1998 (Act 84 of 1998), specifically with reference to Protected Tree species;
- National Biodiversity Assessment (NBA): The National Biodiversity Assessment (NBA) was completed as a collaboration between the South African National Biodiversity Institute (SANBI), the Department of Environmental Affairs (DEA) and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Driver et al., 2011). The purpose of the NBA 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 (Driver et al., 2011).

Provincial and Municipal Level

In addition to national legislation, South Africa's nine provinces have their own provincial biodiversity legislation, as nature conservation is a concurrent function of national and provincial government in terms of the Constitution (Act 108 of 1996). The Department is currently in the process of developing a Provincial Biodiversity Plan. State of the environment Report for the Province can be viewed at: www.environment.gov.za/soer/reports/freestate.html.

4.8 Protected Area's Buffer

As defined under the National Environmental Management: Protected Areas Act 57 Of 2003, approximately 7.2 million hectares or 5.9% of the surface area of South Africa is recognized as protected areas. Fifty six percent of this total area is made up by 21 national parks. These range in size from 1 915 671 ha (Kruger National Park) to 2 662 ha (Wilderness National Park), with a total area (excluding marine areas) of approximately 3.8 million hectares.

In terms of section 20(2) of the Act a national park may be declared to:

- Protect:
    - Areas of national or international importance for their biodiversity;
    - Areas which contain viable, representative samples of South Africa's natural systems, scenic areas or cultural heritage sites; or
    - The ecological integrity of one or more ecosystems;
- Prevent exploitation or occupation inconsistent with the protection of the ecological integrity of the area;
- Provide spiritual, scientific, educational, recreational and tourism opportunities which are environmentally compatible; and
- Contribute to economic development, where feasible.

Unfortunately, due to the rate and extent of development in the country, these national parks are becoming increasingly isolated from the wider natural areas. This is leading to the values of many of the national parks being impacted negatively from activities outside the national parks;

- Extinction of populations of animals outside of a national park due to their isolation from the national park population;
- Excessive disturbance in a national park due to a development on its border; and where the national park is used for access to that development. In addition to affecting national park values some developments may have negative regional economic impacts including;
- Excessive development which negates the primary attraction of the national park; and
- Development clustered round a national park which success is due to the intrinsic value of the national park, but which has negative effects on the national park (e.g. ribbon development along the Crocodile River on the border of the Kruger National Park).

Therefore, the concept of a buffer zone around national parks has been established. This buffer's function is to reduce or mitigate the negative influences of activities taking place outside the parks on the parks and, to better integrate parks into their surrounding landscapes. This concept has been widely recommended, including in the operational guidelines of UNESCO's World Heritage Convention.

Therefore, the purpose of a buffer zone is to: Protect the purpose and values of the national park, which is to be explicitly defined in the management plan submitted in terms of section 39(2) of the Act;

- Protect important areas of high value for biodiversity and/or to society where these extend beyond the boundary of the Protected Area;

- Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972; and
- Assist adjacent and affected communities to secure appropriate and sustainable benefits from the national park and buffer zone area itself by promoting a conservation economy, ecotourism and its supporting infrastructure and services, and sustainability through properly planned harvesting.

A buffer zone may be established around a national park when considered necessary for the proper conservation and effective protection of the national park in achieving its objectives. The buffer zone is an area surrounding a national park which has complementary legal and management restrictions placed on its use and development, aimed at providing an extra layer of protection to the integrity of the national park. This should include the immediate setting of the national park, important views and other areas or attributes that are functionally important as a support to the national park and its protection.

A special case is made in the Biodiversity Policy for paying attention to areas adjacent to national parks, given that activities occurring in such areas may be critical to the protected area's success. Furthermore, the ecological landscape is often a continuum between designated protected areas and surrounding regions. The viability of protected areas is thus dependent upon the extent to which such areas are socially, economically, and ecologically integrated into the surrounding region. This fact is also recognised by the Convention on Biological Diversity, which has a specific provision aimed at promoting sustainable development in areas adjacent to protected areas.

5 Limitations

The following limitations should be noted for the study:

- The proposed MRA and environmental authorisation, if successful, is only applicable to the areas and impacts outlined in this report;
- The central core of the Vredefort Dome World Heritage Site is situated approximately 15 km south-west of the proposed project area. This has not been directly considered as part of this assessment but the distance of the project area relative to this site was assessed; and
- The SoW does not include a rehabilitation plan, biodiversity management plan, nor a storm water management plan.

6 Spatial Context of the Project Area

6.1 General Land Use and Cover

The land uses surrounding the project area consists of agricultural land, natural areas, existing historical sand mining operations, the urban area of Vaal Oewer with associated houses, livestock and game farming. Infrastructure such as secondary tar roads, gravel roads and

homesteads, occur within the proximity of the project area. The Vaal river forms the northern boundary of the proposed project area.

The following infrastructure exists within the project area and surroundings:

- Historical diamond mining and sand mining activities (open cast and underground), other sand mining activities are on-going on neighbouring farms;
- Certain portions of the project area are currently being used for agriculture, maize monocultures at present;
- Game farming – the majority of the central and northern portions of the property are currently being used for large game farming and a number of species are currently stocked including Springbok, Waterbuck and Zebra, amongst others;
- A number of farm dams have been constructed on the property;
- Large excavations, different from ones to the historical diamond mining, have been made across much of the property presumably to test the quality of the sand and aggregate, the majority of which have not been back-filled and pose a threat to wildlife;
- Farm housing / dwellings;
- Various secondary gravel access roads; and
- Electrical infrastructure, especially a major Eskom transmission line which bisects the property.

6.2 Free State Biodiversity Plan

It is important to note that the Critical Biodiversity Areas (CBA) map accounts for terrestrial fauna and flora only. The inclusion of the aquatic component was limited to the Freshwater Ecosystem Priority Areas (FEPA) catchments (included in the cost layer and for the identification of Ecological Support Areas (ESAs)) and wetland clusters (included in the ESAs only).

A CBA is considered a significant and ecologically sensitive area and needs to be kept in a pristine or near-natural state to ensure the continued functioning of ecosystems (SANBI, 2017). A CBA represents the best choice for achieving biodiversity targets. ESAs are not essential for achieving targets, but they play a vital role in the continued functioning of ecosystems and often are essential for proper functioning of adjacent CBAs.

According to the Free State Terrestrial CBA Plan, the project area is comprised of three identified areas: Critical Biodiversity Area2, Ecological Support Area1 and Ecological Support Area2 (Figure 2). All of these areas will have a high or moderately-high biodiversity value. Three areas across the central portion are considered CBA2s. These areas coincide with areas which are considered to be rocky ridges and or wetland areas (both high biodiversity areas) based on desktop analyses.

The Gauteng C-Plan spatial data is also included in Figure 2 and highlights important CBAs to the east and north of the project area.

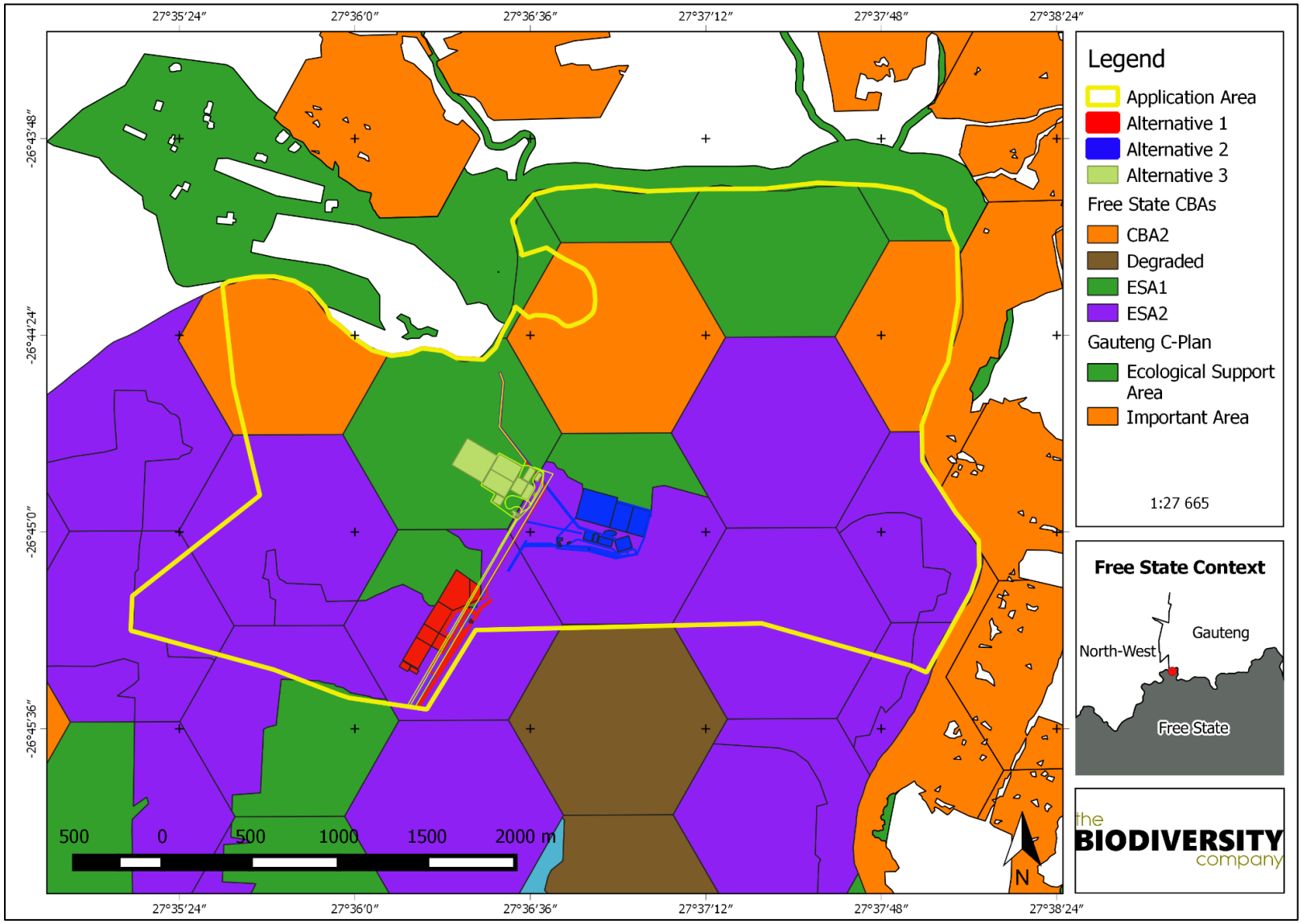

Figure 2: The project area superimposed on the Free State Terrestrial CBA spatial data (BGIS, 2018)

6.3 National Biodiversity Assessment

The National Biodiversity Assessment 2011 (NBA) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA 2011 was led by the South African National Biodiversity Institute (SANBI) in partnership with a range of organisations, including the Department of Environmental Affairs (DEA), CSIR and SANParks. It follows on from the National Spatial Biodiversity Assessment 2004, broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA 2011 includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local level.

The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level (Driver et al., 2011).

6.3.1 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 (Driver et al., 2011). 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 (Driver et al., 2011).

The proposed project area was superimposed on the terrestrial ecosystem threat status (Figure 3). As seen in Figure 3 the project area according to the NBA (2011) falls entirely within one ecosystem, which is listed as a Vulnerable (VU) ecosystem.

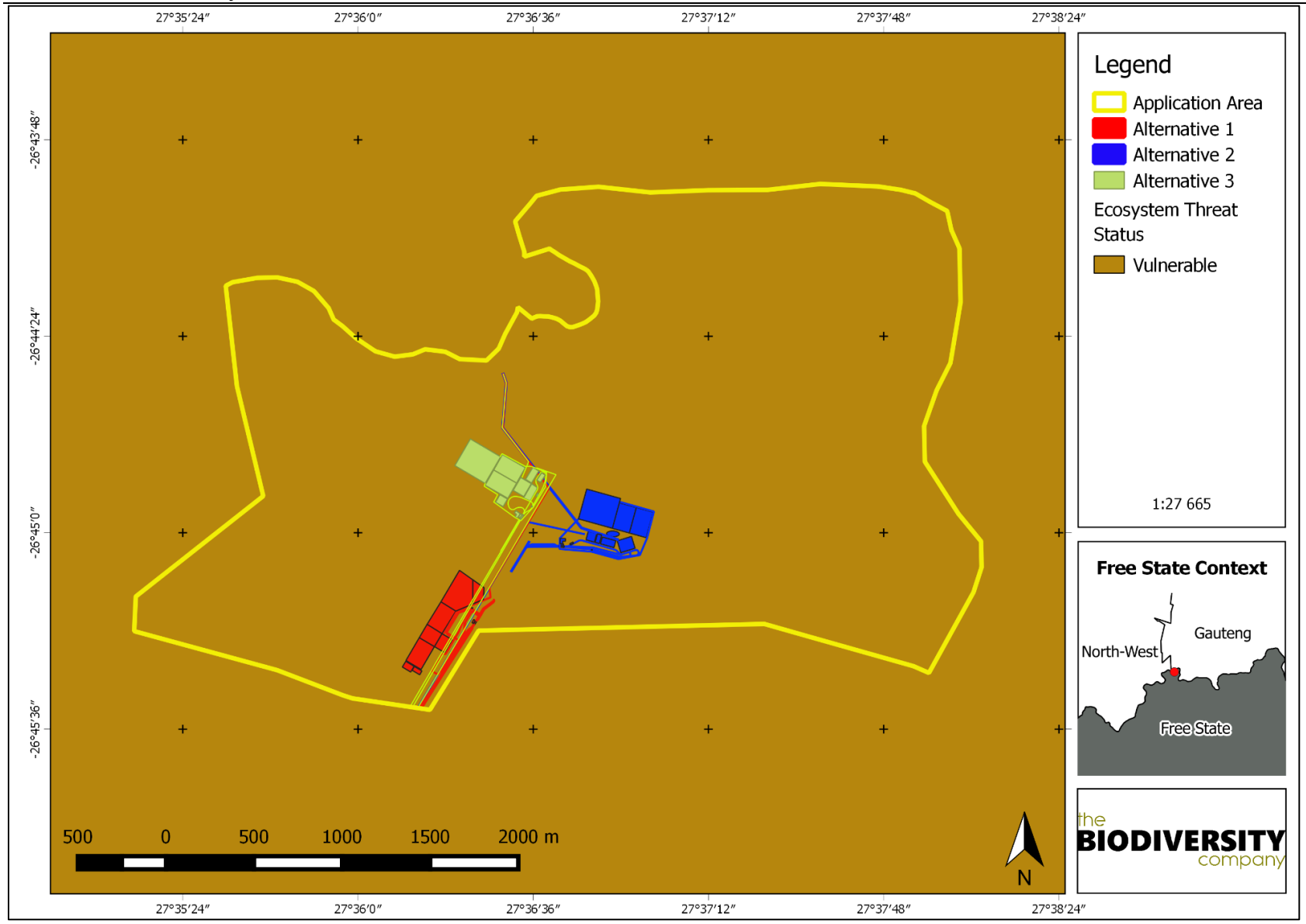

Figure 3: The project area showing the ecosystem threat status of the associated terrestrial ecosystems (BGIS, 2018)

6.3.2 Ecosystem Protection Level

Ecosystem protection level indicate 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 (Driver et al., 2011).

The project 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 Figure 4 the terrestrial ecosystems associated with the proposed project area are rated as *not protected*. This means that this ecosystem type (and associated habitats) are not well protected anywhere in the country (such as in nationally protected areas).

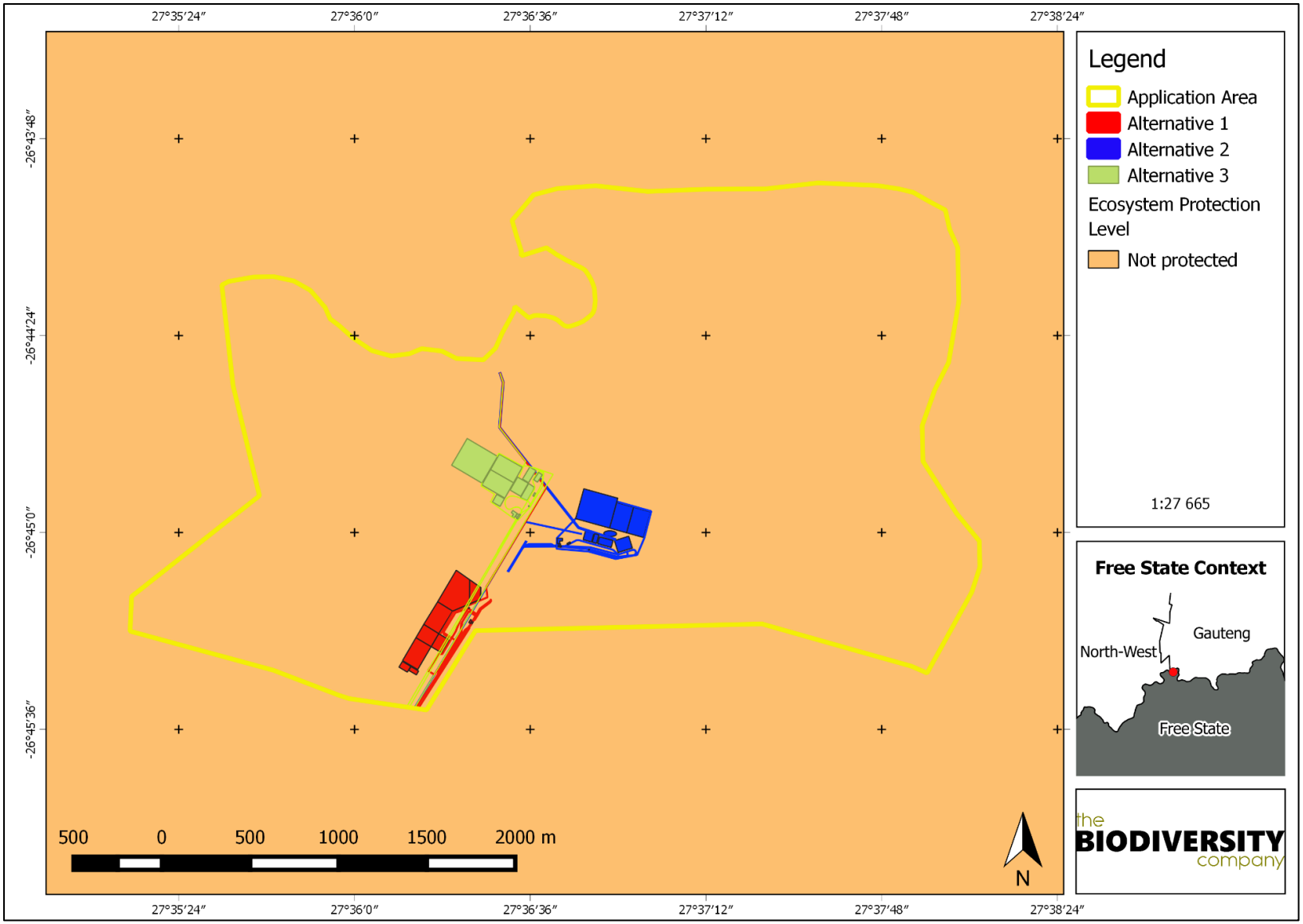

Figure 4: The project area showing the level of protection of terrestrial ecosystems (BGIS, 2018)

6.4 Protected Areas

Formally protected areas refer to areas protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map and the National Protected Areas Expansion Strategy (NPAES) the project area does not overlap with, nor will it impact upon, any formally protected area.

6.5 Rocky Ridges and Outcrops

Ridges are characterized by high spatial heterogeneity due to the range of differing aspects, slopes and altitudes all resulting in differing soil, temperature, elevation, light and hydrological conditions. This variation is an especially important predictor of biodiversity. Topography (e.g. hills and valleys) significantly influences biodiversity. Variations in aspect, drainage and altitude create a host of micro-environments that offer a range of conditions for plants and animals to flourish (GDARD, 2012).

Ridges can be defined as any long, narrow, elevated strip of land or any raised strip or band. Typical rocky ridges in the Highveld are characterised by changes in elevation, slope or aspect. Even moderate changes in slope or contour, in the order of five degrees or more typically constitute the start of a defined ridge.

Ridges are thus characterized by a particularly high biodiversity and it follows that their protection will contribute significantly to the conservation of biodiversity in the country. According to the Gauteng Conservation C-Plan, the ridges of this Province are vital habitat for many threatened plant species. Sixty-five percent of Gauteng's threatened plant species and 71% of Gauteng’s endemic plant species have been recorded on ridges. This policy, however, does not exist as yet within Free State legislation.

Class 1 and Class 2 ridges are given the highest level of protection within Gauteng. Where Class 1 ridges occur, no further development is permitted (including residential) and where Class 2 ridges occur either no further development is permitted, or only low impact development is permitted (full EIA required). A 200meter buffer of low impact development is required around Class 1 and 2 ridges. This is applicable in Gauteng, and the classification of these ridges may not be applicable in the Free State. Nonetheless, ridges represent important areas for biodiversity and as per section 24 of the constitution: ecological sustainable development and use of natural resources must be secured while promoting development.

A Class 1 ridge occurs on the eastern boundary of the project area. A Class 2 ridge occurs on the western boundary of the project area. This ridge extends across the Vaal River and into the project area (Figure 5). It is the opinion of the specialists that the ridge within the project area represents a Class 1 ridge due to the relatively pristine nature of this area and the low levels of current impacts.

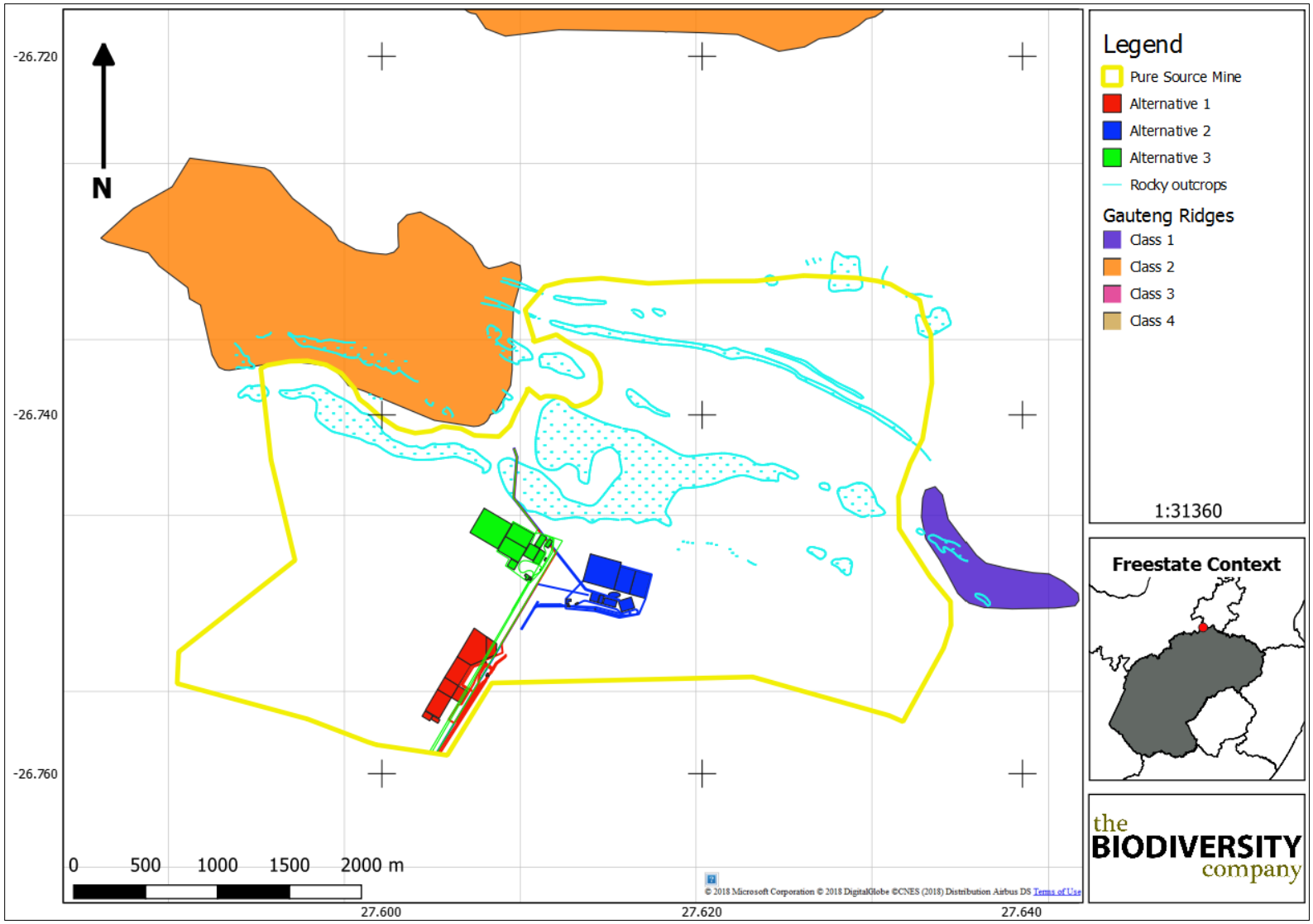

Figure 5: The project area superimposed on the Gauteng Ridge Guidelines and showing rocky ridges (BGIS, 2018)

6.6 The Mining and Biodiversity Guidelines

The Mining and Biodiversity Guidelines (2013) was developed by the Department of Mineral Resources, the Chamber of Mines, the South African National Biodiversity Institute and the South African Mining and Biodiversity Forum, with the intention to find a balance between economic growth and environmental sustainability. The Guideline is envisioned as a tool to "foster a strong relationship between biodiversity and mining which will eventually translate into best practice within the mining sector. In identifying biodiversity priority areas, which have different levels of risk against mining, the Guideline categorises biodiversity priority areas into four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas:

A) Legally protected areas, where mining is prohibited;

B) Areas of highest biodiversity importance, which are at the highest risk for mining;

C) Areas of high biodiversity importance, which are at a high risk for mining; and

D) Areas of moderate biodiversity importance, which are at a moderate risk for mining.

Table 2 shows the four different categories and the implications for mining within each of these categories.

The Guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user- friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. The Guideline provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining.

Overall, proponents of a mining activity in biodiversity priority areas should demonstrate that:

- There is significant cause to undertake mining – by commenting on whether the biodiversity priority area coincides with mineral or petroleum reserves that are strategically in the national interest to exploit. Reference should also be made to whether alternative deposits or reserves exist that could be exploited in areas that are not biodiversity priority areas or are less environmentally sensitive areas.
- Through the process of a rigorous EIA and associated specialist biodiversity studies the impacts of the proposed mining are properly assessed following good practice. It is critical that sufficient time and resources are budgeted to do so early in the planning and impact assessment process, including appointing appropriate team of people with the relevant skills and knowledge as required by legislation.
- Cumulative impacts have been taken into account.

- The mitigation hierarchy has been systematically applied and alternatives have been rigorously considered.
- The issues related to biodiversity priority areas have been incorporated into a robust EMP as the main tool for describing how the mining or prospecting operation's environmental impacts are to be mitigated and managed.
- Good practice environmental management is followed and monitoring, and compliance enforcement is ensured.

Table 2: The mining and biodiversity guidelines categories

Category	Biodiversity priority areas	Risk for mining	Implications for mining
A. Legally protected	• Protected areas (including National Parks, Nature Reserves, World Heritage Sites, Protected Environments, Nature Reserves) Areas declared under Section 49 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002)	**Mining prohibited**	Mining projects cannot commence as mining is legally prohibited. Although mining is prohibited in Protected Areas, it may be allowed in Protected Environments if both the Minister of Mineral Resources and Minister of Environmental Affairs approve it. In cases where mining activities were conducted lawfully in protected areas before Section 48 of the Protected Areas Act (No. 57 of 2003) came into effect, the Minister of Environmental Affairs may, after consulting with the Minister of Mineral Resources, allow such mining activities to continue, subject to prescribed conditions that reduce environmental impacts.
B. Highest biodiversity importance	• Critically endangered and endangered ecosystems • Critical Biodiversity Areas (or equivalent areas) from provincial spatial biodiversity plans • River and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs • Ramsar Sites	**Highest risk for mining**	Environmental screening, environmental impact assessment (EIA) and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licenses, and environmental authorisations. If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. An EIA should include the strategic assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. This assessment should fully take into account the environmental sensitivity of the area, the overall environmental and socio-economic costs and benefits of mining, as well as the potential strategic importance of the minerals to the country. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts and may specify biodiversity offsets that would be written into license agreements and/or authorisations.

C. High biodiversity importance	• Protected area buffers (including buffers around National Parks, World Heritage Sites* and Nature Reserves) • Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas) • Other identified priorities from provincial spatial biodiversity plans • High water yield areas • Coastal Protection Zone • Estuarine functional zone	**High risk for mining**	These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and limitations for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.
D. Moderate biodiversity importance	• Ecological support areas • Vulnerable ecosystems • Focus areas for protected area expansion (land-based and offshore protection)	**Moderate risk for mining**	These areas are of moderate biodiversity value. EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g. threatened species) not included in the existing datasets, and on providing site-specific information to guide the application of the mitigation hierarchy. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.

According to the above guidelines, the project area is predominantly classed as having a 'Moderate Biodiversity Importance' and represents a 'Moderate Risk for Mining' (Figure 6). Existing agricultural areas in the southern portion are not given any classification level.

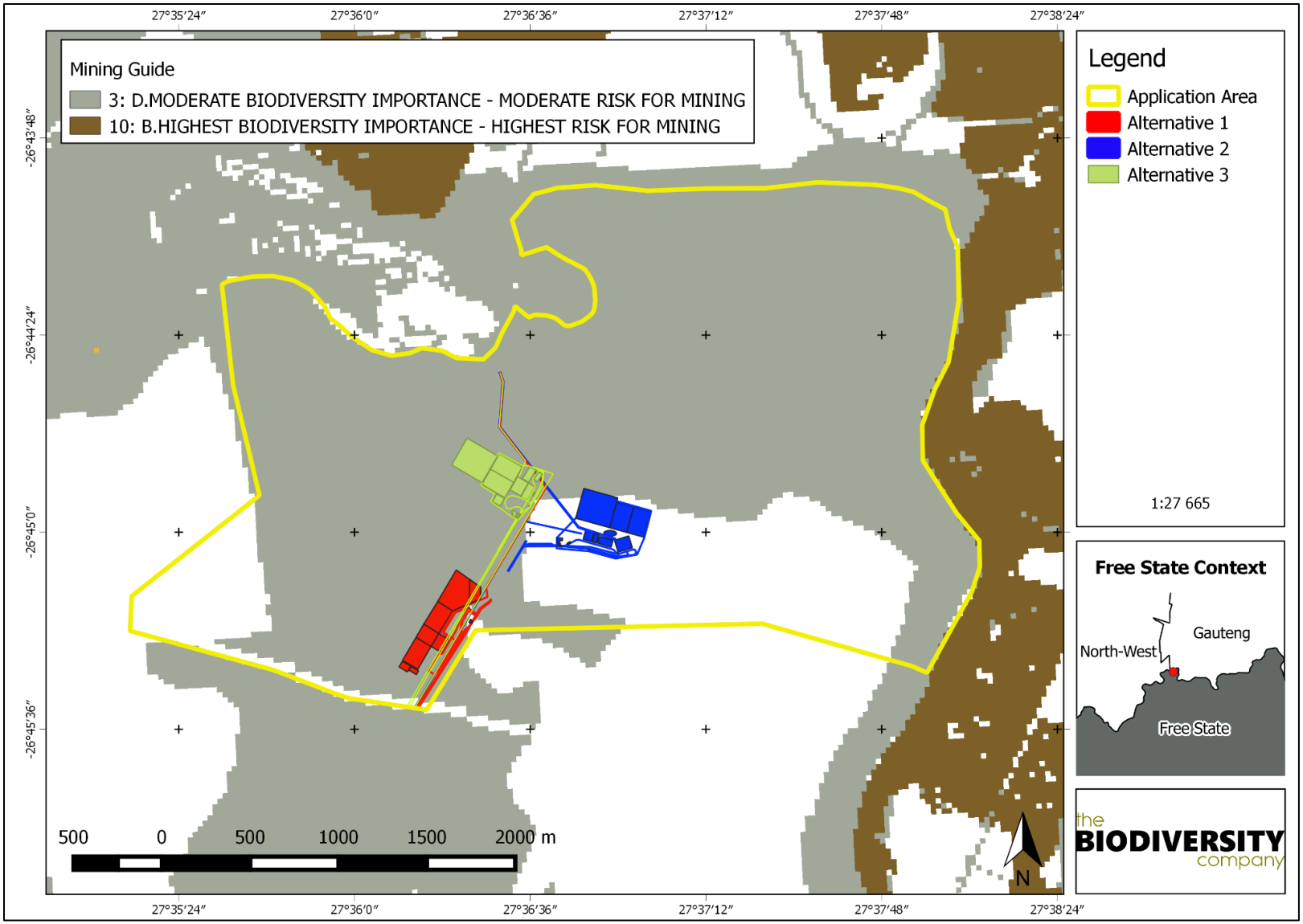

Figure 6: The project area superimposed on the Mining and Biodiversity Guidelines spatial dataset (BGIS,2018)

7 Results and Discussion

7.1 Desktop Assessment

7.1.1 Vegetation Assessment

The project area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

a) Seasonal precipitation; and
b) The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees.

7.1.1.1 Vegetation Types

The grassland biome comprises many different vegetation types. The project area is situated within a single vegetation type, namely the Soweto Highveld Grassland (Gs4) vegetation type according to Mucina & Rutherford (2006) (Figure 7).

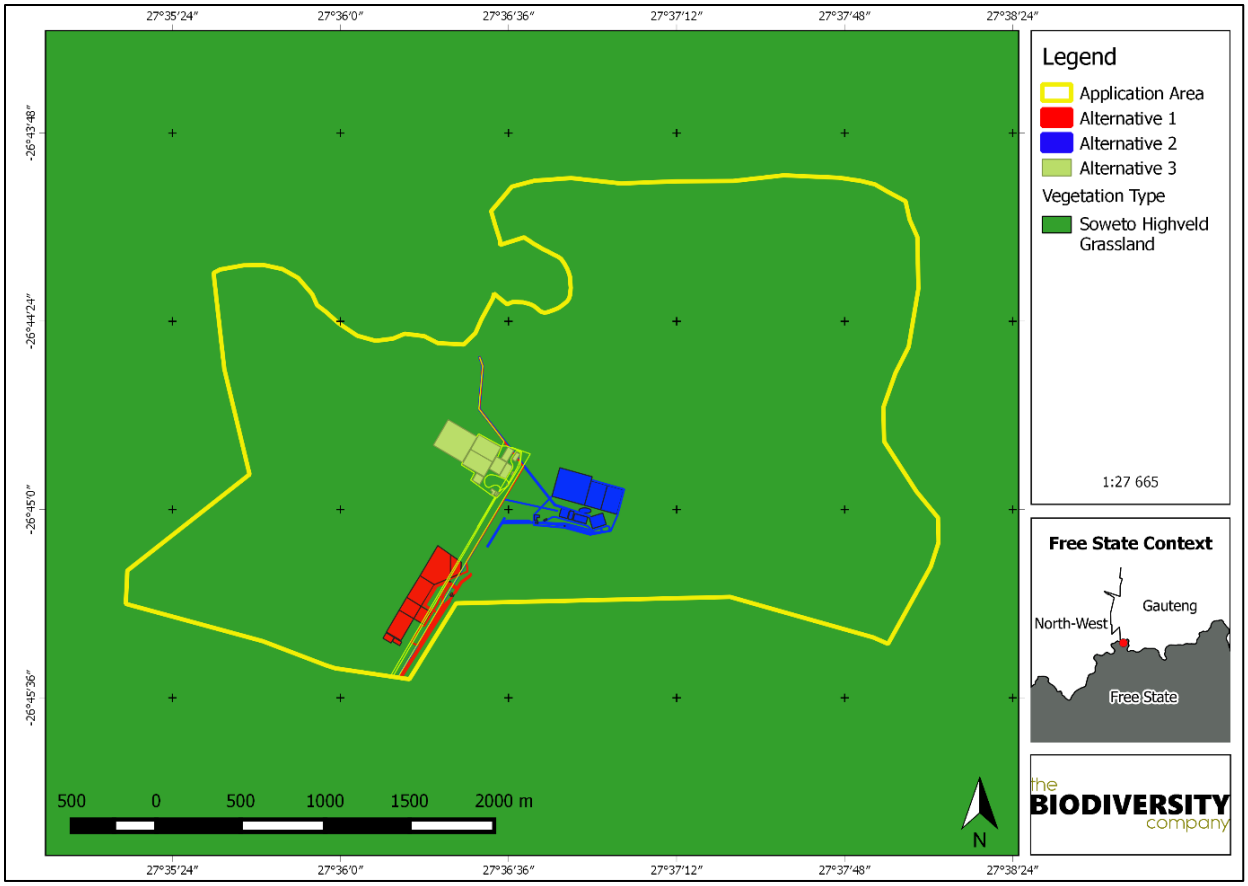

Figure 7: The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS,2017)

7.1.1.2 Soweto Highveld Grassland

The Soweto Highveld Grassland vegetation type is found in Mpumalanga, Gauteng and to a little extent also in neighbouring Free State and North-West Provinces. This vegetation type typically comprises of an undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. Scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover (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 Soweto Highveld Grassland.

Graminoids: *Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus , Eragrostis capensis, E. chloromelas, E. curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus, Hyparrhenia hirta, Setaria*

nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum (Mucina & Rutherford, 2006).

Herbs: *Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Vernonia oligocephala, Wahlenbergia undulata* (Mucina & Rutherford, 2006).

Geophytic Herbs: *Haemanthus humilis subsp. hirsutus, H. montanus. Herbaceous Climber: Rhynchosia totta* (Mucina & Rutherford, 2006).

Low Shrubs: *Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana* (Mucina & Rutherford, 2006).

7.1.1.2.2 Conservation Status of the Vegetation Type

According to Mucina & Rutherford (2006), the Soweto Highveld Grassland vegetation type is classified as Endangered. The national target for conservation protection for both these vegetation types is 24%, but only a few patches are statutorily conserved in Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, Rolfe's Pan Nature Reserves or privately conserved in Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves and the Heidelberg Natural Heritage Site.

By 2006 nearly half of the area of occupancy of this vegetation type had already been transformed by cultivation, urban sprawl, mining and building of road infrastructure. The amount of area transformed has most likely increased substantially. Some Soweto Grassland areas have been flooded by dams including Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer.

7.1.1.3 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 445 plant species are expected to occur in the project area. Figure 8 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 list of expected plant species is provided in Appendix A.

Of the 445-plant species, one (1) species is listed as being a Species of Conservation Concern (SCC) (Table 3).

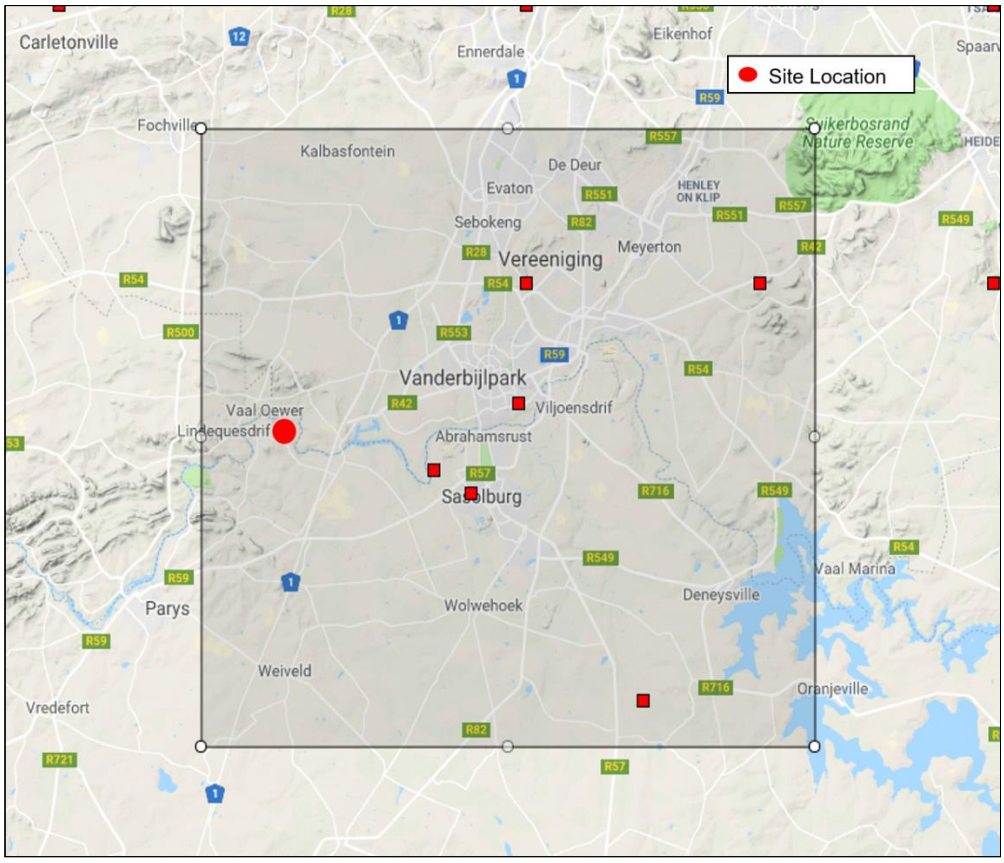

Figure 8: Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016)

Table 3: Plant Species of Conservation Concern (SCC) expected to occur in the project area (BODATSA-POSA, 2016)

Family	Taxon	Author	IUCN	Ecology
Asphodelaceae	*Miraglossum laeve*	Kupicha	**CR**	Indigenous; Endemic

Miraglossum laeve is a rare and poorly known species. It has been collected twice only: first in 1930, from hills south of Pretoria, and again in 1960, from the hills of the Vredefort Dome north-east of Parys, a disjunction of about 130 km. Despite dedicated searches, this species has not been found again. The 1960 collection has a fairly precise locality description, which indicates that it occurs in Gold Reef Mountain Bushveld, a vegetation type with a limited distribution on the rocky ridges of Gauteng and adjacent areas in North West Province. The older collection's locality description is too imprecise to determine its habitat, but hills to the south of Pretoria also has another limited vegetation type on them, Gauteng Shale Mountain Bushveld, which is found on three ridges across Gauteng Province, and also extending somewhat into North West Province. It is therefore likely that this species is a rare, localized endemic of ridges in Gauteng Province (von Staden & Victor, 2005).

Threats

Habitat loss and degradation due to urban expansion is a severe threat across Gauteng, and very little natural areas remain. Efforts have been made to limit development on ridges, but these natural areas are now becoming increasingly isolated, and continue to be degraded due to fire exclusion and encroachment of alien invasive plants.

7.1.2 Faunal Assessment

7.1.2.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 317 bird species are expected to occur in the vicinity of the project area (pentads 2635_2730; 2635_2735; 2635_2740; 2640_2730; 2640_2735; 2640_2640; 2640_2740; 2645_2735; 2645_2740). The full list of potential bird species is provided in Appendix B.

Of the expected bird species, twenty-four (24) species are listed as SCC either on a regional scale or international scale (Table 4). The SCC include the following:

- Four (4) species that are listed as Endangered (EN) on a regional basis;
- Six (6) species that are listed as Vulnerable (VU) on a regional basis; and
- Twelve (12) species that are listed as Near Threatened (NT) on a regional basis.

Table 4: List of bird species of regional or global conservation importance that are expected to occur in pentads 2635_2730; 2635_2735; 2635_2740; 2640_2730; 2640_2735; 2640_2640; 2640_2740; 2645_2735; 2645_2740 (SABAP2, 2018, ESKOM, 2015; IUCN, 2017)

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC	Moderate
Anthropoides paradiseus	Crane, Blue	NT	VU	Moderate
Aquila verreauxii	Eagle, Verreaux's	VU	LC	High
Balearica regulorum	Crane, Grey Crowned	EN	EN	High
Calidris ferruginea	Sandpiper, Curlew	LC	NT	Moderate
Ciconia abdimii	Stork, Abdim's	NT	LC	Moderate
Circus macrourus	Harrier, Pallid	NT	NT	Moderate
Circus ranivorus	Marsh-harrier, African	EN	LC	High
Coracias garrulus	Roller, European	NT	LC	Moderate
Eupodotis caerulescens	Korhaan, Blue	LC	NT	High
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC	High
Falco biarmicus	Falcon, Lanner	VU	LC	High
Falco vespertinus	Falcon, Red-footed	NT	NT	High
Glareola nordmanni	Pratincole, Black-winged	NT	NT	High

Mycteria ibis	Stork, Yellow-billed	EN	LC	Moderate
Oxyura maccoa	Duck, Maccoa	NT	NT	High
Phalacrocorax capensis	Cormorant, Cape	EN	EN	High
Phoeniconaias minor	Flamingo, Lesser	NT	NT	Moderate
Phoenicopterus ruber	Flamingo, Greater	NT	LC	Moderate
Rostratula benghalensis	Painted-snipe, Greater	NT	LC	Moderate
Sagittarius serpentarius	Secretary bird	VU	VU	High
Sterna caspia	Tern, Caspian	VU	LC	High
Tyto capensis	Grass-owl, African	VU	LC	High

Alcedo semitorquata (Half-collared Kingfisher) is listed as NT on a regional scale and occurs across a large range. This species generally prefers narrow rivers, streams, and estuaries with dense vegetation onshore, but it may also move into coastal lagoons and lakes. It mainly feeds on fish (IUCN, 2017). The possibility of occurrence is regarded as moderate due to the fact that the Vaal River is on the boundary of the project area, and there are some small dams on the property, both of which could provide suitable habitat for this species.

Anthropoides paradiseus (Blue Crane) is listed as NT on a regional scale and as VU on a global scale, while *Balearica regulorum* (Grey Crowned Crane) is listed as EN both globally and regionally. Populations of these two species have declined, largely owing to direct poisoning, power-line collisions and loss of their grassland breeding habitats owing to afforestation, mining, agriculture and development (IUCN, 2017). These species breed in natural grass and sedge-dominated habitats, preferring secluded grasslands at high elevations where the vegetation is thick and short. Due to the presence of some open grassland areas within the project site the likelihood of occurrence is rated as moderate for both of these crane species.

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). Based on the expected habitat, the close proximity of the various rocky outcrops and the availability of prey items, the likelihood of occurrence of this species at the project site is rated as high. Furthermore, this species was recorded in the project area during previous surveys.

Calidris ferruginea (Curlew Sandpiper) is migratory species which breeds on slightly elevated areas in the lowlands of the high Arctic and may be seen in parts of South Africa during winter. During winter, the species occurs at the coast, but also inland on the muddy edges of marshes, large rivers and lakes (both saline and freshwater), irrigated land, flooded areas, dams and saltpans (IUCN, 2017). Due to the presence of some of these habitat types within the project area the likelihood of occurrence of this species was rated as moderate.

Ciconia abdimii (Abdim's Stork) is listed as NT on a local scale and the species is known to be found in open grassland and savanna woodland often near water but also in semi-arid areas, gathering beside pools and water-holes. They tend to roost in trees or cliffs (IUCN, 2017). The existence of some wet areas and suitable savanna woodland creates the potential for this species to occur in the area and the likelihood of occurrence was rated as moderate.

Circus macrourus (Pallid Harrier) is listed as NT on a regional and global scale, and overwinters in semi-desert, scrub, savanna and wetlands. The species is migratory, with most birds wintering in sub-Saharan Africa or south-east Asia (IUCN, 2017). The species is most likely only to use the area as a migratory route or a temporary overwintering location from August to March, the likelihood of occurrence is moderate.

Circus ranivorus (African Marsh Harrier) is listed as EN in South Africa (ESKOM, 2014). This species has an extremely large distributional range in sub-equatorial Africa. South African populations of this species are declining due to the degradation of wetland habitats, loss of habitat through over-grazing and human disturbance and possibly, poisoning owing to over-use of pesticides (IUCN, 2017). This species breeds in wetlands and forages primarily over reeds and lake margins. There are some wetlands and marsh areas in the project area as well as the Vaal River, and thus the occurrence of *C. ranivorus* in the Project area is therefore considered to be high.

Coracias garrulous (European Roller) is a winter migrant from most of South-central Europe and Asia occurring throughout sub-Saharan Africa (IUCN, 2017). The European Roller has a preference for bushy plains and dry savannah areas (IUCN, 2017). There is a moderate chance of this species occurring in the project area as they prefer to forage in open/disturbed agricultural areas which are present in the project area.

Eupodotis caerulescens (Blue Korhaan) is listed as NT according to the IUCN (2017). Their moderately rapid decline is accredited to habitat loss that is a result of intensive agriculture. They are found in high grassveld in close proximity to water, usually above an altitude of 1 500m (del Hoyo, et al. 1996). The species nests in bare open ground, situated in thick grass or cropland. Based on the presence of required habitat in the project area the likelihood of occurrence of this species is rated as high.

Eupodotis senegalensis (White-bellied Korhaan) is Near-endemic to South Africa, occurring from the Limpopo Province and adjacent provinces, south through Swaziland to KwaZulu-Natal and the Eastern Cape. It generally prefers tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land, much of which is present in the project area thus the likelihood of occurrence was rated as high (Hockey et al, 2005).

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 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.

Falco vespertinus (Red-footed Falcon) is known to breed from eastern Europe and northern Asia to north-western China, heading south in the non-breeding season to southern Angola and southern Africa. Within southern Africa it is locally uncommon to common in Botswana, northern Namibia, central Zimbabwe and the area in and around Gauteng, South Africa (Hockey et al., 2005). The habitat it generally prefers is open habitats with scattered trees, such as open grassy woodland, wetlands, forest fringes and croplands. Many of these habitats are present in the project area and thus the likelihood of occurrence is rated as high.

Glareola nordmanni (Black-winged Pratincole) is a migratory species which is listed as NT both globally and regionally. This species has a very large range, breeding mostly in Europe and Russia, before migrating to southern Africa. Overall population declines of approximately 20% for this species are suspected (IUCN, 2017). This species generally occurs near water and damp meadows, or marshes overgrown with dense grass. Due to its migratory nature, this species will only be present in South Africa for a few months during the year and will not breed locally. There is a small amount of suitable habitat within the project area and adjacent to it and as such the likelihood of occurrence is rated as moderate.

Mycteria ibis (Yellow-billed Stork) is listed as EN on a regional scale and LC on a global scale. This species is migratory and has a large distributional range which includes much of sub-Saharan Africa. It is typically associated with freshwater ecosystems, especially wetlands and the margins of lakes and dams (IUCN, 2017). The presence of some water bodies and the Vaal River within the project area creates a moderate possibility that this species may occur there.

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). The likelihood of occurrence of this species in the project area was rated as moderate.

Phoeniconaias minor (Lesser Flamingo) is listed as NT on a global and regional scale whereas *Phoenicopterus roseus* (Greater Flamingo) is listed as NT on a regional scale only. Both species have similar habitat requirements and the species breed on large undisturbed alkaline and saline lakes, salt pans or coastal lagoons, usually far out from the shore after seasonal rains have provided the flooding necessary to isolate remote breeding sites from terrestrial predators and the soft muddy material for nest building (IUCN, 2017). Due to the absence of its preferred habitat within the project area, combined the proximity of the urban area, the likelihood of occurrence is moderate to low.

Rostratula benghalensis (Greater Painted-snipe) shows a preference for recently flooded areas in shallow lowland freshwater temporary or permanent wetland, it has a wide range of these freshwater habitats which they occur in including sewage pools, reservoirs and mudflats overgrown with marsh grass. Due to the presence of some dams and the Vaal River which may provide habitat for this species the likelihood of occurrence is regarded as moderate.

Sagittarius serpentarius (Secretary bird) occurs in sub-Saharan Africa and inhabits grasslands, open plains, and lightly wooded savanna. It is also found in agricultural areas and sub-desert (IUCN, 2017). The likelihood of occurrence is rated as high due to the extensive grasslands and some wetland areas present in the project area, as well as the agricultural areas present in which this species may forage.

Sterna caspia (Caspian Tern) is native to South Africa and are known to occur in inland freshwater systems such as large rivers, creeks, floodlands, reservoirs and sewage ponds. Due to the presence of the Vaal River, habitat suitability was found to be high and thus the likelihood of occurrence is regarded as high.

Tyto capensis (African Grass-owl) is rated as VU on a regional basis. The distribution of the species includes the eastern parts of South Africa. The species is generally solitary, but it does also occur in pairs, in moist grasslands where it roosts (IUCN, 2017). The species prefers thick grasses around wetlands and rivers which are not present in the project area. Furthermore, this species specifically has a preference for nesting in dense stands of the grass species *Imperata cylindrica*. At least four patches of this grass species are evident within the project area and as such the likelihood of occurrence is rated as high.

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 (2017), the selection of IBAs is achieved through the application of quantitative ornithological criteria, 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.

No IBAs occurs within the proximity of the proposed project area. The nearest IBA to the project area is the Suikerbosrand Nature Reserve which is situated approximately 64 km’s north-east of the project area.

7.1.2.1.2 Owl Species Expected

Table 5 shows the four owl species expected to occur in the project area. These species are only known to perform partial migrations which means that they only move/migrate out of their breeding habitat. An example of this is the Barn Owl that will move up to 580km within South Africa (IUCN, 2016) but is not known to migrate further than this. These four Southern African owl species may therefore move to neighboring countries but will not move further into Africa.

Table 5: The following owl species are expected in the project area.

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Asio capensis	Owl, Marsh	Unlisted	LC
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Tyto capensis	Grass-owl, African	VU	LC

7.1.2.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 78 mammal species that could be expected to occur within the vicinity of the project area (Appendix C). Of these species, 10 are medium to large conservation dependant species, such as *Ceratotherium simum* (Southern White Rhinoceros) and *Equus quagga* (Plains Zebra) 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.

Of the remaining 67 small to medium sized mammal species, eleven (11) are listed as being of conservation concern on a regional or global basis (Table 6). The list of potential species includes:

- Two (2) that is listed as EN on a regional basis;
- Five (5) that are listed as VU on a regional basis; and
- Six (6) 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)	
Aonyx capensis	Cape Clawless Otter	NT	NT	High
Atelerix frontalis	South African Hedgehog	NT	LC	High
Crocidura maquassiensis	Makwassie Musk Shrew	VU	LC	High
Crocidura mariquensis	Swamp Musk Shrew	NT	LC	Moderate
Felis nigripes	Black-footed Cat	VU	VU	Moderate
Hydrictis maculicollis	Spotted-necked Otter	VU	NT	Moderate
Leptailurus serval	Serval	NT	LC	High
Mystromys albicaudatus	White-tailed Rat	VU	EN	Moderate
Panthera pardus	Leopard	VU	VU	Low

Parahyaena brunnea	Brown Hyaena	**NT**	**NT**	High
Poecilogale albinucha	African Striped Weasel	**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. Based on the presence of the Vaal River and a few dams in the project area the likelihood of occurrence of this species occurring is considered to be high.

Atelerix frontalis (South African Hedgehog) has a tolerance of a degree of habitat modification and occurs in a wide variety of semi-arid and sub-temperate habitats (IUCN, 2017). Based on the Red List of Mammals of South Africa, Lesotho and Swaziland (2016), *A. frontalis* populations are decreasing due to the threats of electrocution, veld fires, road collisions, predation from domestic pets and illegal harvesting. Although the species is cryptic and therefore not often seen, there is suitable habitat in the project area and therefore the likelihood of occurrence is rated as high.

Crocidura mariquensis (Swamp Musk Shrew) has very specific habitat requirements. It occurs in close proximity to open water with a distinct preference for marshy ponds, and riverine and semi-aquatic vegetation such as reed beds (IUCN, 2017). It is considered to be common in suitable habitats. Due to the presence of some of this habitat type in the project area the likelihood of occurrence of this species was rated as moderate.

Crocidura maquassiensis (Maquassie Musk Shrew) is listed as VU on a regional basis and is known to be found in rocky, mountain habitats. It may tolerate a wider range of habitats and individuals have been collected in Kwa-Zulu Natal from a garden, and in mixed bracken and grassland alongside a river at 1,500 m (IUCN, 2017). There is presence of extensive rocky areas for this species in the project area and therefore the likelihood of occurrence is rated as high.

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 to be sub-optimal for the species and the likelihood of occurrence is rated as moderate.

Hydrictis maculicollis (Spotted-necked Otter) inhabits freshwater habitats where water is un-silted, unpolluted, and rich in small to medium sized fishes (IUCN, 2017). Suitable habitat may be available in Vaal River and dams to the west of the project area, and therefore the likelihood of occurrence is regarded as moderate.

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa and is commonly recorded from most major national parks and reserves (IUCN, 2017). The Serval's status outside reserves is not certain, but they are inconspicuous and may be common in suitable habitat as they are tolerant of farming practices provided there is cover and food available. In sub-Saharan

Africa, they are found in habitat with well-watered savanna long-grass environments and are particularly associated with reedbeds and other riparian vegetation types. Due to the presence of natural grassland areas in the project area, the likelihood of occurrence for this species is rated as high.

Mystromys albicaudatus (White-tailed Rat) is listed as VU on a regional basis and Endangered (EN) on a global scale. It is relatively widespread across South Africa and Lesotho; the species is known to occur in shrubland and grassland areas. A major requirement of the species is black loam soils with good vegetation cover. Although the vegetation type is suitable, no black loam seems to be present on site, therefore the likelihood of occurrence of this species is rated as moderate.

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 regarded as low.

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 high. The presence of moderate to large herbivores on the property and extensive suitable habitat increases the likelihood of occurrence of this species. Records of this species occurring on site were noted during previous surveys.

Poecilogale albinucha (African Striped Weasel) is usually associated with savanna habitats, although it probably has a wider habitat tolerance (IUCN, 2017). Due to its secretive nature, it is often overlooked in many areas where it does occur. There is sufficient habitat for this species in the project area and the likelihood of occurrence of this species is therefore considered to be high.

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, 2017) 20 reptile species are expected to occur in the project area (Appendix D). No reptile species of conservation concern are expected to be present in the project area.

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) twenty (20) amphibian species are expected to occur in the project area (Appendix E). One (1) amphibian SCC could be present in the project area according to the above-mentioned sources (Table 7).

Table 7: Amphibian species of conservation concern which may occur in the project area

Species	Common Name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Moderate

The Giant Bull Frog (*Pyxicephalus adspersus*) is a species of conservation concern that will possibly occur in the project area. The Giant Bull Frog is listed as near threatened on a regional scale. It is a species of drier savannahs. It is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary waters in pools, pans and ditches (IUCN, 2017). There appears to be minimal suitable habitat for this species in the project area and therefore the likelihood of occurrence is regarded as low.

7.2 Field Assessment

Mid-dry season terrestrial biodiversity surveys were conducted on the 6th July 2018 and the 9th – 12th July 2018 by two terrestrial ecologists and two aquatic ecologists while wet season field work was conducted on the 20th - 23rd of November 2018. During the surveys the floral and faunal communities within the project development footprint were assessed. The project area was ground-truthed on foot, which included spot checks in pre-selected areas to validate desktop data.

Photographs were recorded during the site visits and some are provided in the results section of the report. All site photographs are available on request. An extensive camera trap survey was conducted across the project area with ten (10) baited camera traps being deployed for a period of a week for both seasons. The results of the camera trap survey are presented under the Results section of this report.

7.2.1 Vegetation Assessment

The vegetation assessment was conducted throughout the extent of the project area. The results below are a combination of the two seasons, with more flowering plants identified in the wet season. Several different habitat types were observed and can be seen in Figure 9 and Figure 10, and was delineated in Figure 11

'Rocky Grassland and Ridges' are habitats that consists of rocky ridges interspersed with grassy and rocky slopes, with rocks being of various sizes. This habitat type is regarded as

primary grassland and therefore natural in certain areas, but slightly disturbed due to grazing by the game stocked within the area. Plant species such as *Elionurus muticus, Lasiosiphon triplinervis* and *Searsia rigida* occurred in high densities throughout. The ridge plays a vital role in providing refugia, food and corridors for dispersal in and through the surrounding area, especially in this fragmented environment.

'Secondary Grassland' habitats represent areas that are not rocky grassland or mixed woodland, but rather connected to both. This area is recovering secondary grassland due to the constant overgrazing by the game that are present within the area. This area is dominated by *Elephantorrhiza elephantina, Stoebe plumosa* and *Eragrostis pallens.* As with the rest of the habitats, some areas are more degraded than others within this habitat but a key role that this habitat has is to function as a buffer for the more sensitive areas.

'Mixed Woodland' are small fragments of habitat that has a woody component other than the secondary grassland, that is dominated by *Vachellia karoo.* This habitat overall has also been degraded due to the overgrazing of the game and has large patched of bare soil.

'Transformed Areas' are habitats that include agriculture, housing infrastructure, roads, exotic tree thickets and old sand mining areas. Due to the extremely altered nature of this habitat, it is regarded as having a low sensitivity.

'Wetland Habitats' are areas where the soil is saturated for long periods throughout the year and play a vital role within the water resource scheme. These habitats were delineated by the wetland specialist and play an important role in providing water as well refugia for various species. *Typha capensis* and *Phragmites australis* are species commonly found in these habitats.

'Riparian Zone' is an area that has been designated as a No-Go area in regard to any development within this buffer. This area is dominated by *Eucalyptus camaldulensis* in regard to the woody component, especially next to the riverbank to the north.

A total of 87 tree, shrub and herbaceous plant species were recorded in the project area during the field assessment (Table 8). Plants listed as Category 1 alien or invasive species under the National Environmental Management: Biodiversity Act (NEMBA) appear in green text. Plants listed in Category 2 or as 'not indigenous' or 'naturalised' according to NEMBA, appear in blue text.

Table 8:Trees, shrubs and weeds recorded at the proposed project area

Species	Threat status (SANBI, 2017)	SA Endemic	NEMBA Category
Acalypha angustata	LC	Not Endemic	
Aloe greatheadii	LC	Not Endemic	
Aristida junciformis	LC	Not Endemic	
Aristida stipitata	LC	Not Endemic	

Asparagus sp			
Bewsia biflora	LC	Not Endemic	
Bidens pilosa			**Not Indigenous; Naturalised**
Boscia albitrunca	LC	Not Endemic	
Brachiaria serrata	LC	Not Endemic	
Celtis africana	LC	Not Endemic	
Cheilanthes eckloniana	LC	Not Endemic	
Cheilanthes viridis	LC	Not Endemic	
Cirsium vulgare			**NEMBA Category 1b**
Commelina africana	LC	Not Endemic	
Conyza bonariensis			**Not Indigenous; Naturalised**
Crinum bulbispermum	LC	Not Endemic	
Cymbopogon caesius	LC	Not Endemic	
Cynodon dactylon			**NEMBA Category 2**
Datura ferox			**NEMBA Category 1b**
Dianthus mooiensis	NE	Not Endemic	
Dicoma anomala	LC	Not Endemic	
Digitaria eriantha	LC	Not Endemic	
Diospyros lycioides	LC	Not Endemic	
Ehretia rigida	LC	Endemic	
Elephantorrhiza elephantina	LC	Not Endemic	
Elionurus muticus (Dominates)	LC	Not Endemic	
Eragrostis curvula	LC	Not Endemic	
Eragrostis gummiflua	LC	Not Endemic	
Eragrostis lehmanniana	LC	Not Endemic	
Eragrostis pallens	LC	Not Endemic	
Eragrostis racemosa	LC	Not Endemic	
Eragrostis rigidior	LC	Not Endemic	
Eragrostis superba	LC	Not Endemic	
Eucalyptus camaldulensis			**NEMBA Category 1b**
Euclea crispa	LC	Not Endemic	
Felicia muricata	LC	Not Endemic	
Gazania krebsiana	LC	Not Endemic	
Gomphocarpus fruticosus	LC	Not Endemic	

Gymnosporia buxifolia	LC	Not Endemic	
Harpochloa falx	LC	Not Endemic	
Hermannia transvaalensis	LC	Endemic	
Heteropogon contortus	LC	Not Endemic	
Hilliardiella oligocephala	LC	Not Endemic	
Hyparrhenia hirta	LC	Not Endemic	
Imperata cylindrica	LC	Not Endemic	
Lasiosiphon kraussianus	LC	Not Endemic	
Lasiosiphon triplinervis	LC	Endemic	
Ledebouria floribunda	LC	Not Endemic	
Ledebouria ovatifolia	LC	Not Endemic	
Melia azedarach			**NEMBA Category 1b**
Melinis nerviglumis	LC	Not Endemic	
Monsonia burkeana	LC	Not Endemic	
Nemesia fruticans	LC	Not Endemic	
Ocimum obovatum subsp. obovatum	LC	Not Endemic	
Olea europaea	LC	Not Endemic	
Opuntia ficus-indica			**NEMBA Category 1b**
Pelargonium luridum	LC	Not Endemic	
Pentanisia angustifolia	LC	Not Endemic	
Lasiosiphon triplinervis	LC	Not Endemic	
Plantago lanceolata	LC	Not Endemic	
Pogonarthria squarrosa	LC	Not Endemic	
Robinia pseudoacacia			**NEMBA Category 1b**
Rotheca hirsuta	LC	Not Endemic	
Scabiosa columbaria	LC	Not Endemic	
Schizachyrium sanguineum	LC	Not Endemic	
Schkuhria pinnata			
Searsia pyroides	LC	Not Endemic	
Searsia rigida	LC	Endemic	
Senegalia caffra	LC	Not Endemic	
Sesbania punicea			**NEMBA Category 1b**
Stoebe plumosa	LC	Not Endemic	
Tagetes minuta			**Not Indigenous; Naturalised**

Themeda triandra	LC	Not Endemic	
Trichoneura grandiglumis	LC	Not Endemic	
Trifolium medium var. medium	LC	Not Endemic	
Tristachya leucothrix	LC	Not Endemic	
Triumfetta sonderi	LC	Endemic	
Typha capensis	LC	Not Endemic	
Vachellia karroo	LC	Not Endemic	
Vachellia nilotica	LC	Not Endemic	
Vangueria infausta	LC	Not Endemic	
Verbena aristigera			**Not Indigenous; Naturalised**
Verbena bonariensis			**NEMBA Category 1b**
Vernonia galpinii	LC	Not Endemic	
Walafrida densiflora	LC	Not Endemic	
Ziziphus mucronata	LC	Not Endemic	
Ziziphus zeyheriana	LC	Not Endemic	

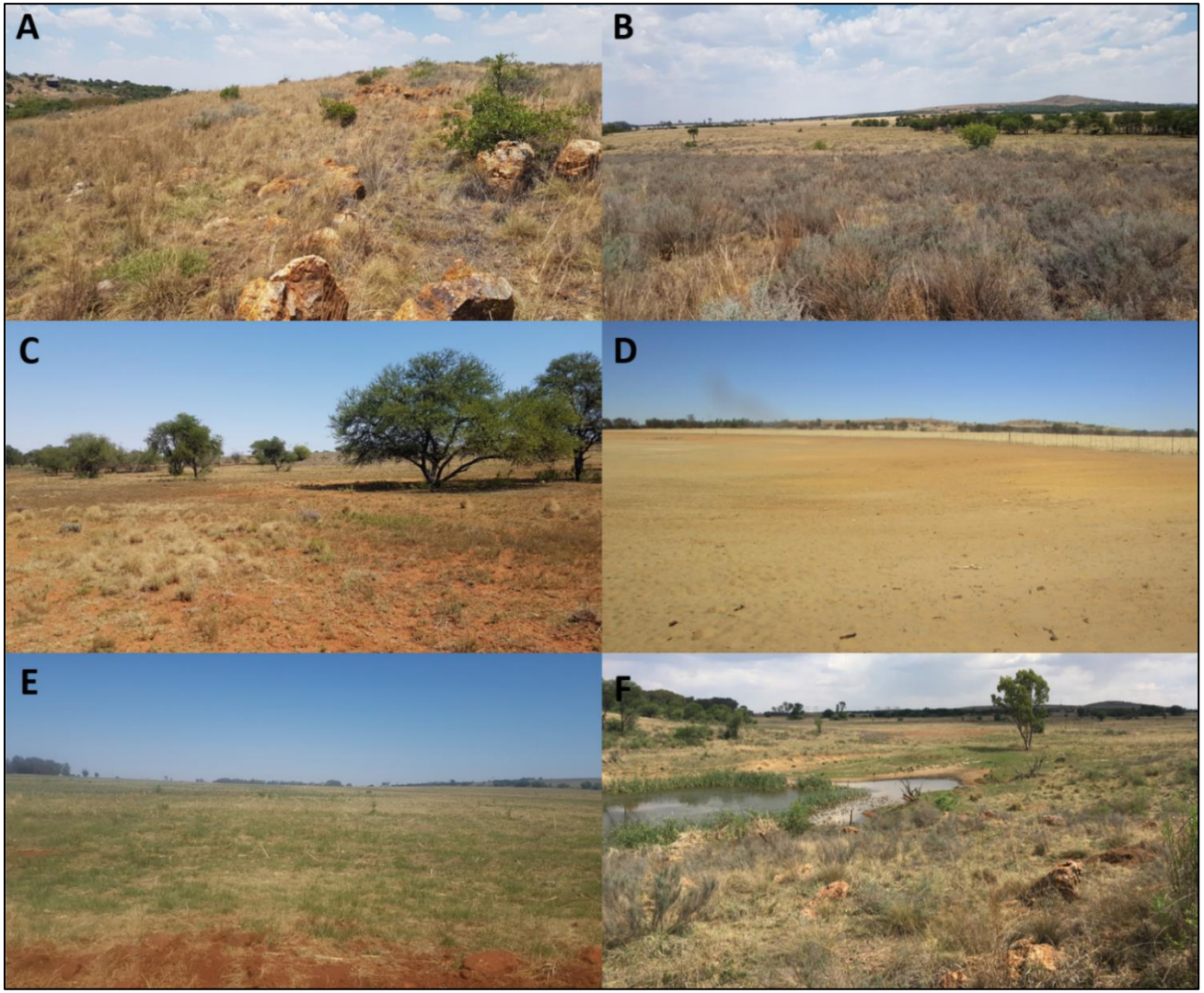

Figure 9: Some habitat types observed during the field survey: A) Rocky Grassland, B) Secondary Grassland, C) Mixed Woodland, D & E) Transformed (Agriculture) and F) Wetland

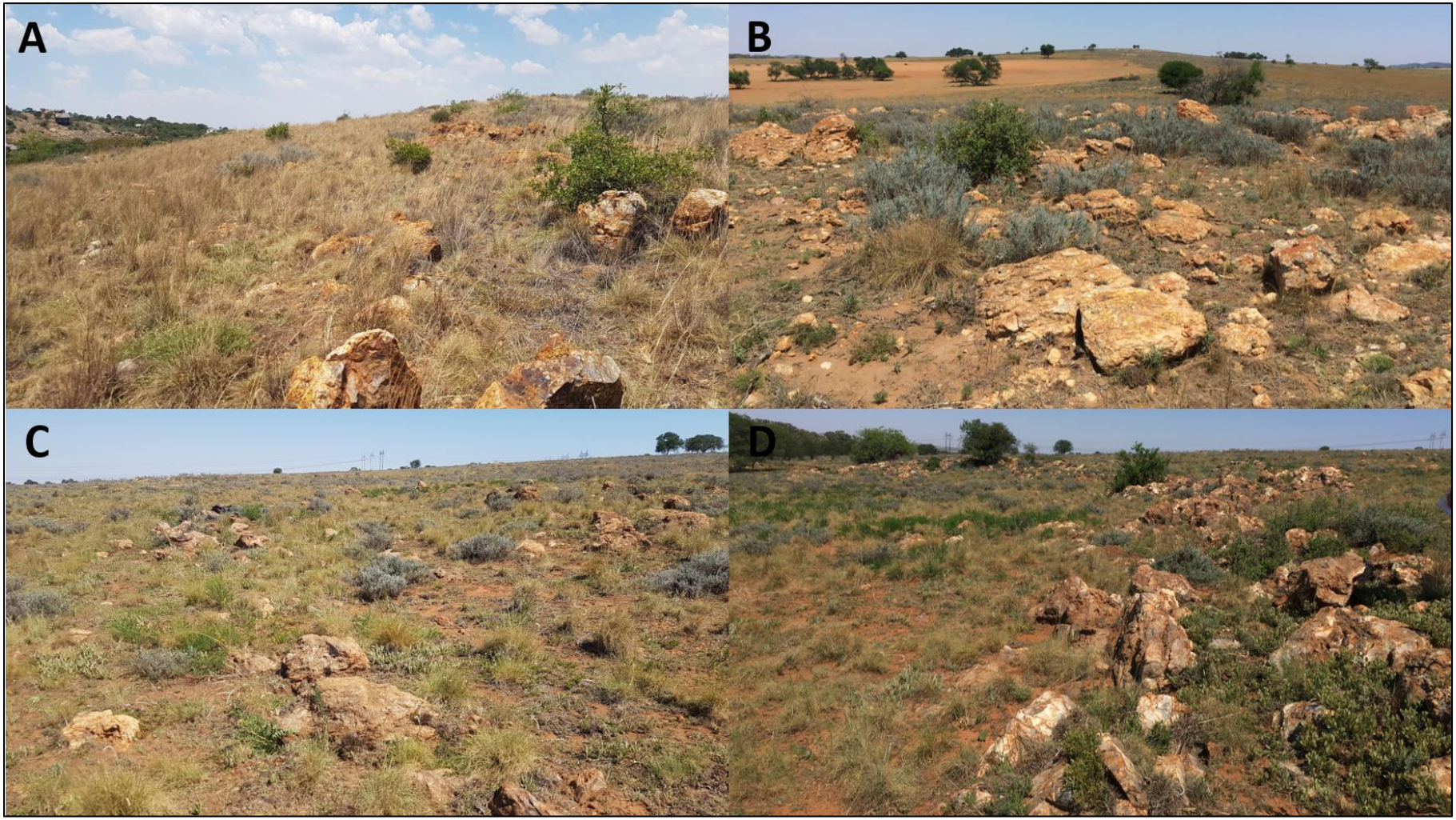

Figure 10: Images of some of the rocky ridges and outcrops that occur in the project area and the condition A) Natural, B & D) Disturbed and C) Semi-Natural

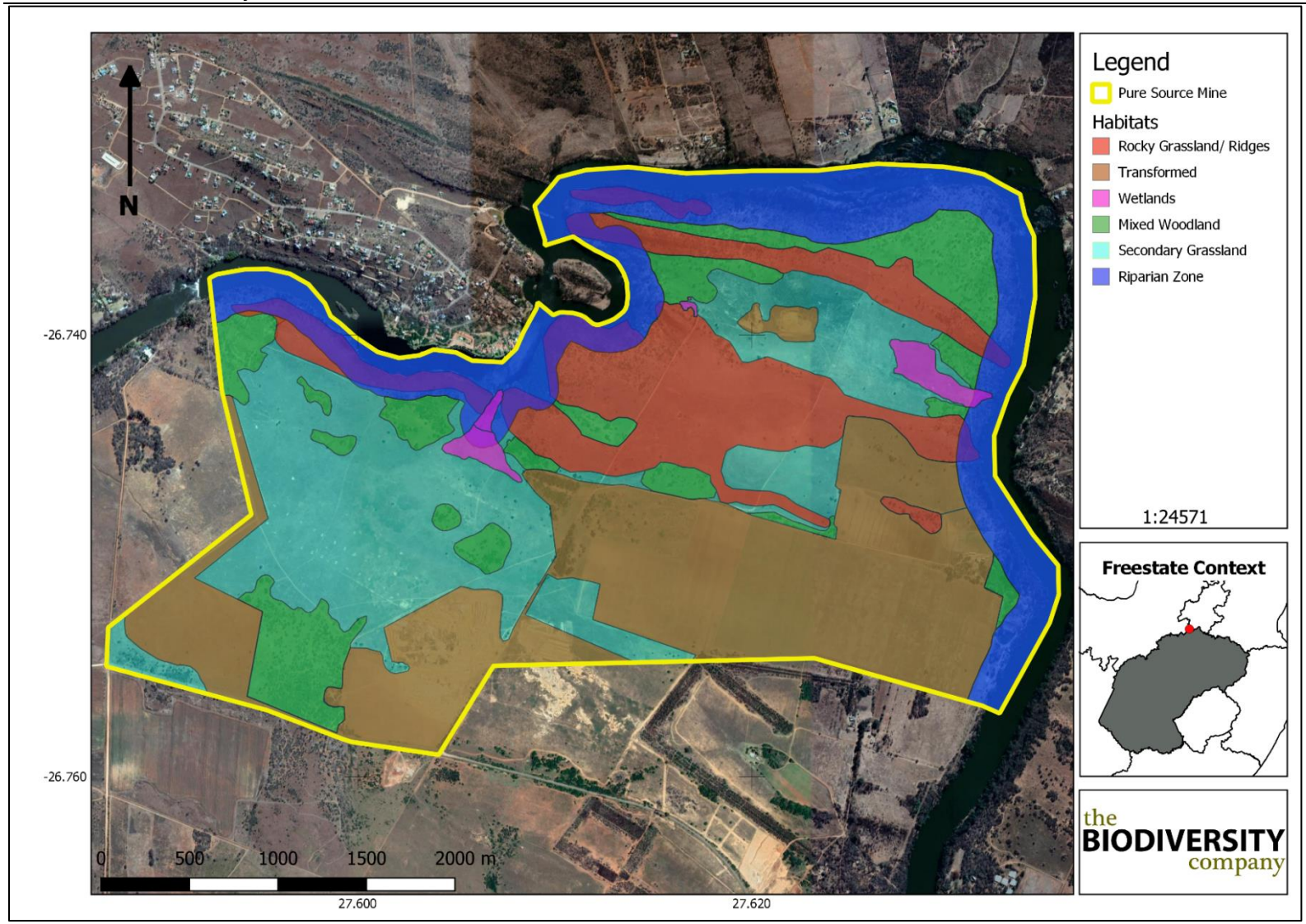

Figure 11: Habitat map for the project area.

7.2.1.1 Alien and Invasive Plants

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of these systems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations were published in the Government Gazette No. 37886, 1 August 2014. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

Below is a brief explanation of the three categories in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA):

- Category 1a: Invasive species requiring compulsory control. Remove and destroy. Any specimens of Category 1a listed species need, by law, to be eradicated from the environment. No permits will be issued.
- Category 1b: Invasive species requiring compulsory control as part of an invasive species control programme. Remove and destroy. These plants are deemed to have such a high invasive potential that infestations can qualify to be placed under a government sponsored invasive species management programme. No permits will be issued.
- Category 2: Invasive species regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Category 2 plants to exist in riparian zones.
- Category 3: Invasive species regulated by activity. An individual plant permit is required to undertake any of the following restricted activities (import, possess, grow, breed, move, sell, buy or accept as a gift) involving a Category 3 species. No permits will be issued for Category 3 plants to exist in riparian zones.

Note that according to the regulations, a person who has under his or her control a category 1b listed invasive species must immediately:

- Notify the competent authority in writing
- Take steps to manage the listed invasive species in compliance with:
    - Section 75 of the Act;
    - The relevant invasive species management programme developed in terms of regulation 4; and
    - Any directive issued in terms of section 73(3) of the Act.

Eight (8) Category 1b invasive plant species were recorded within the project area and it is recommended that an alien invasive plant management programme be implemented in compliance of section 75 of the Act as stated above, should the development proceed. The NEMBA listed species identified within the project area are marked in green (Table 8).

7.2.2 Fauna

7.2.2.1 Avifauna

One hundred and seventeen (117) bird species were recorded in the project area during the July 2018 survey (dry season), while 69 were observed during the November 2018 (wet season) based on either direct observations, vocalisations, or the presence of visual tracks & signs (Table 9) (Figure 12 to Figure 16).

Based on the presence of suitable grassland habitat, there is a moderate to high probability that various bird SCC may occur within the project area – especially grassland and riverine bird species.

Table 9: A list of avifaunal species recorded for the project area

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Dry Season			
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus arundinaceus	Reed-warbler, Great	Unlisted	LC
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC
Amblyospiza albifrons	Weaver, Thick-billed	Unlisted	LC
Anas platyrhynchos	Duck, Mallard	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anser anser	Goose, Domestic	Unlisted	LC
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Ardea goliath	Heron, Goliath	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Batis molitor	Batis, Chinspot	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradornis mariquensis	Flycatcher, Marico	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Butorides striata	Heron, Green-backed	Unlisted	LC
Calandrella cinerea	Lark, Red-capped	Unlisted	LC
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Certhilauda curvirostris	Lark, Cape Long-billed	Unlisted	LC
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Circaetus cinereus	Snake-eagle, Brown	Unlisted	LC
Cisticola chiniana	Cisticola, Rattling	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba arquatrix	Olive-pigeon, African	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corythaixoides concolor	Go-away-bird, Grey	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Crithagra flaviventris	Canary, Yellow	Unlisted	LC
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Egretta intermedia	Egret, Yellow-billed	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza capensis	Bunting, Cape	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Euplectes afer	Bishop, Yellow-crowned	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Falco rupicolus	Kestrel, Rock	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallinago nigripennis	Snipe, African	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Indicator indicator	Honeyguide, Greater	Unlisted	LC
Indicator minor	Honeyguide, Lesser	Unlisted	LC
Jynx ruficollis	Wryneck, Red-throated	Unlisted	LC
Lagonosticta rhodopareia	Firefinch, Jameson's	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Larus cirrocephalus	Gull, Grey-headed	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Megaceryle maximus	Kingfisher, Giant	Unlisted	Unlisted
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Oenanthe pileata	Wheatear, Capped	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC
Ploceus velatus	Southern Masked-weaver	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Spermestes cucullatus	Mannikin, Bronze	Unlisted	Unlisted
Spizocorys conirostris	Lark, Pink-billed	Unlisted	LC
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Upupa africana	Hoopoe, African	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC
Wet Season			
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus arundinaceus	Reed-warbler, Great	Unlisted	LC
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anthus cinnamomeus	Pipit, African	Unlisted	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Calandrella cinerea	Lark, Red-capped	Unlisted	LC
Calendulauda sabota	Lark, Sabota	Unlisted	LC
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Cuculus solitarius	Cuckoo, Red-chested	Unlisted	LC
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC
Dendroperdix sephaena	Francolin, Crested	Unlisted	LC
Egretta alba	Egret, Great	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Hirundo cucullata	Swallow, Greater Striped	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Larus cirrocephalus	Gull, Grey-headed	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Merops pusillus	Bee-eater, Little	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Netta erythrophthalma	Pochard, Southern	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Pandion haliaetus	Osprey, Osprey	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Pernis apivorus	Honey-buzzard, European	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Phalacrocorax carbo	Cormorant, White-breasted	LC	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC
Ploceus velatus	Southern Masked-weaver, Southern	Unlisted	LC
Prinia flavicans	Prinia, Black-chested	Unlisted	LC
Pternistis afer	Spurfowl, Red-necked	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Scopus umbretta	Hamerkop	Unlisted	LC
Spreo bicolor	Starling, Pied	Unlisted	LC
Sterna vittata	Tern, Antarctic	LC	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

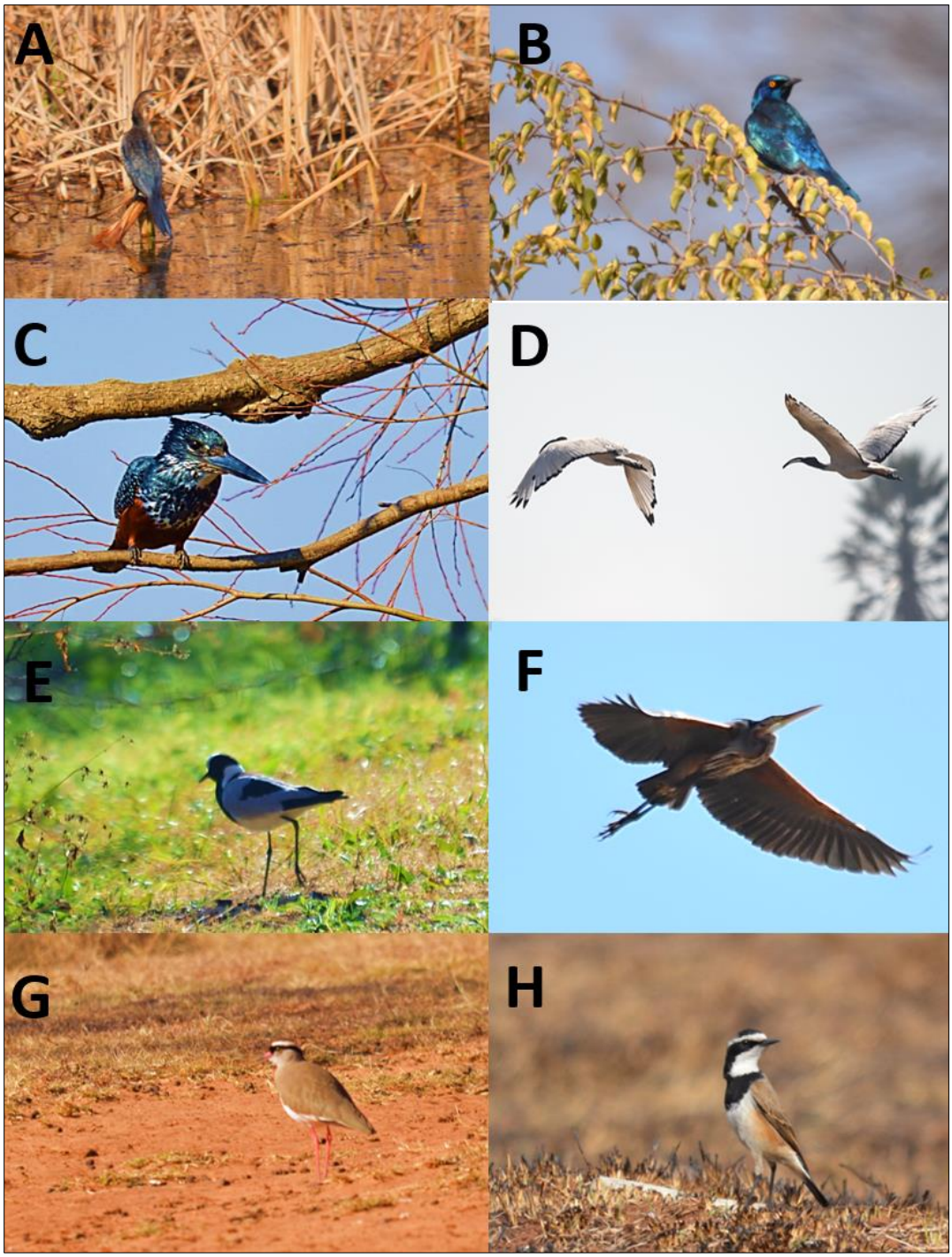

Figure 12: Some of the avifauna recorded within the project area: A) Reed Cormorant (Microcarpon africanus) B) Cape Glossy Starling (Lamprotornis nitens); C) Giant Kingfisher (Megaceryle maxima); D) African Sacred Ibis (Threskiornis aethiopicus); E) Blacksmith Lapwing Vanellus armatus; F) Purple Heron (Ardea purpurea); G) Crowned Lapwing (Vanellus coronatus); and H) Capped Wheatear (Oenanthe pileata)

Figure 13: Some of the avifauna recorded in the project area; A) Purple Heron (Ardea purpurea), B) Red-necked Spurfowl (Pternistis afer), C) African Sacred Ibis (Threskiornis aethiopicus), D) Egyptian Goose (Alopochen aegyptiacus), E) Red-billed Quelea (Quelea quelea) and E) Cape Glossy Starling (Lamprotornis nitens)

Figure 14: Some of the avifauna recorded in the project area: A) African Red-eyed Bulbul (Pycnonotus nigricans), B) Pied Starling (Spreo bicolor), C) Southern Pochard (Netta

erythrophthalma), D) Spur-winged Goose (Plectropterus gambensis), E) Hamerkop (Scopus umbretta) and F) Red-chested Cuckoo (Cuculus solitarius)

Figure 15: Some of the avifauna observed in the project area: A) European Honey-buzzard (Pernis apivorus), B) Crested Barbet(Trachyphonus vaillantii), C) Anteating Chat (Myrmecocichla formicivora), D) Northern Black Korhaan (Afrotis afraoides), E) White-breasted Cormorant (Phalacrocorax carbo) and F) Southern Red-Bishop (Euplectes orix)

Figure 16: Some of the avifaunal species observed: A) White faced Whistling Duck (Dendrocygna viduata), B) Helmeted Guineafowl (Numida meleagris), C) Yellow-billed Duck (Anas undulata), D) Great Egret (Egretta alba), E) Blacksmith Lapwing (Vanellus armatus) and F) African Spoonbill (Platalea alba)

7.2.2.2 Mammals

Overall, mammal diversity in the project area was high, with fifteen (15) mammal species being recorded during the July 2018 survey and thirteen (13) in the November 2018 based on direct observations and/or the presence of visual tracks & signs (Table **10**) (Figure 17- Figure 19). A further eight (8) large mammal species (dry and wet seasons combined) were recorded and are included in Table 10 under the 'Stocked Game' sections, as these animals are not necessarily naturally occurring in the region and are considered farmed game species.

Table 10: Mammal species recorded in the project area during the July 2018 and November 2018 survey (species highlighted in red are listed species)

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Dry Season			
Atilax paludinosus	Water Mongoose	LC	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Cryptomys hottentotus	Common Mole-rat	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC

Genetta genetta	Small-spotted Genet	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Lepus victoriae	African Savanna Hare	LC	LC
Orycteropus afer	Aardvark	LC	LC
Pedetes capensis	Springhare	LC	LC
Procavia capensis	Rock Hyrax	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Suricata suricatta	Suricate	LC	LC
Xerus inauris	Cape Ground Squirrel	LC	LC
Stocked Game			
Aepyceros melampus	Impala	LC	LC
Connochaetes gnou	Black Wildebeest	LC	LC
Damaliscus pygargus	Blesbok	LC	LC
Equus quagga	Plains Zebra	LC	NT
Kobus ellipsiprymnus	Waterbuck	LC	LC
Oryx gazella	Gemsbok	LC	LC
Tragelaphus oryx	Eland	LC	LC
Wet Season			
Canis mesomelas	Black-backed Jackal	LC	LC
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Crocidura cyanea	Reddish-grey Musk Shrew	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Lepus saxatilis	Scrub Hare	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mus minutoides	Pygmy Mouse	LC	LC
Pedetes capensis	Springhare	LC	LC
Suricata suricatta	Suricate	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Xerus inauris	Cape Ground Squirrel	LC	LC
Stocked Game			
Aepyceros melampus	Impala	LC	LC
Alcelaphus buselaphus	Hartebeest	LC	LC
Connochaetes gnou	Black Wildebeest	LC	LC
Damaliscus pygargus	Blesbok	LC	LC
Equus quagga	Plains Zebra	LC	NT
Oryx gazella	Gemsbok	LC	LC
Tragelaphus strepsiceros	Kudu	Unlisted	LC

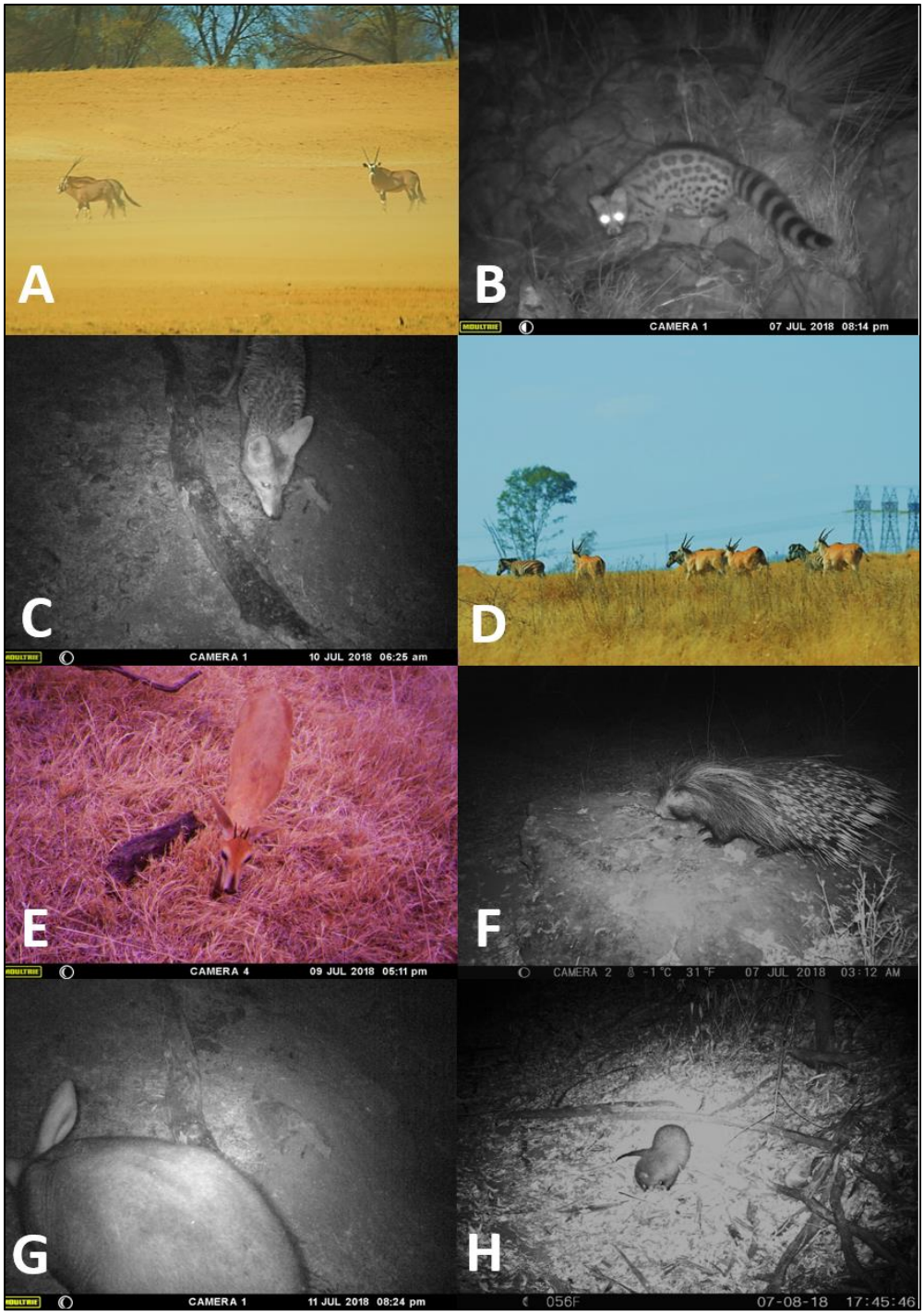

Figure 17: Some of the mammal species recorded in the project area: A) Gemsbok (Oryx gazella); B) Small-spotted Genet (Genetta genetta); C) Black-backed Jackal (Canis mesomelas); D) Eland (Tragelaphus oryx); E) Common Duiker (Sylvicapra grimmia); F) Cape Porcupine (Hystrix africaeaustralis); G) Aardvark (Orycteropus afer); and H) Water Mongoose (Atilax paludinosus)

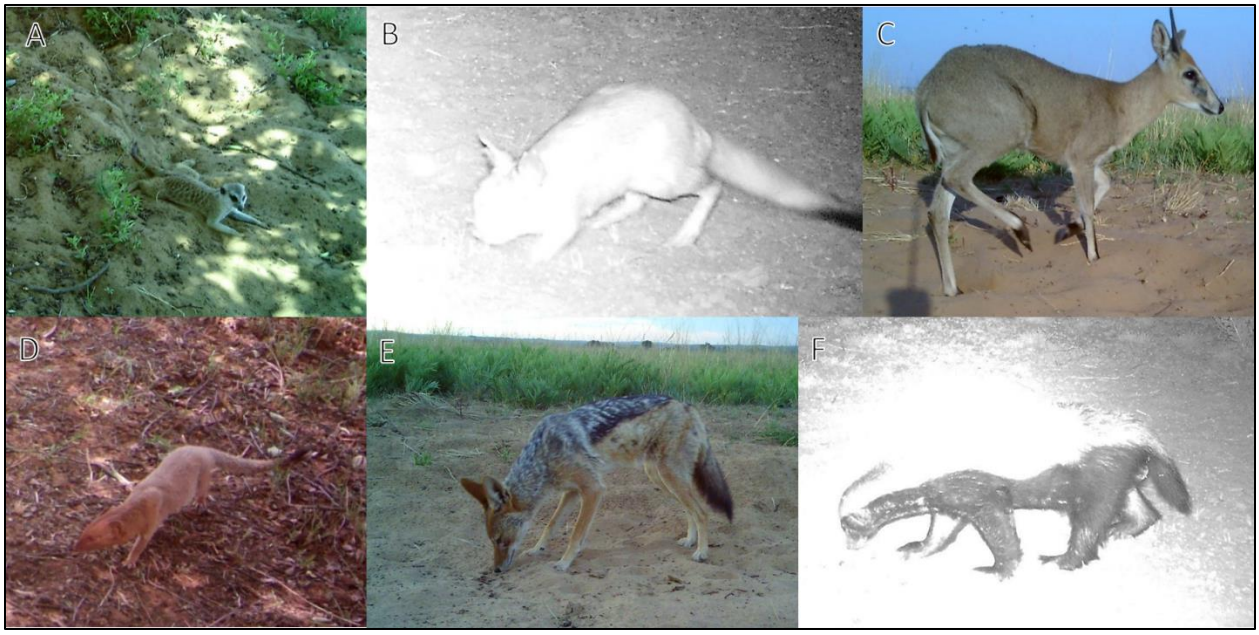

Figure 18: Some of the mammal species recorded in the project area: A) Suricate (Suricata suricatta), B) Springhare (Pedetes capensis), C) Common Duiker (Sylvicapra grimmia), D) Slender Mongoose (Herpestes sanguineus), E) Black-backed Jackal (Canis mesomelas), F) Honey Badger (Mellivora capensis)

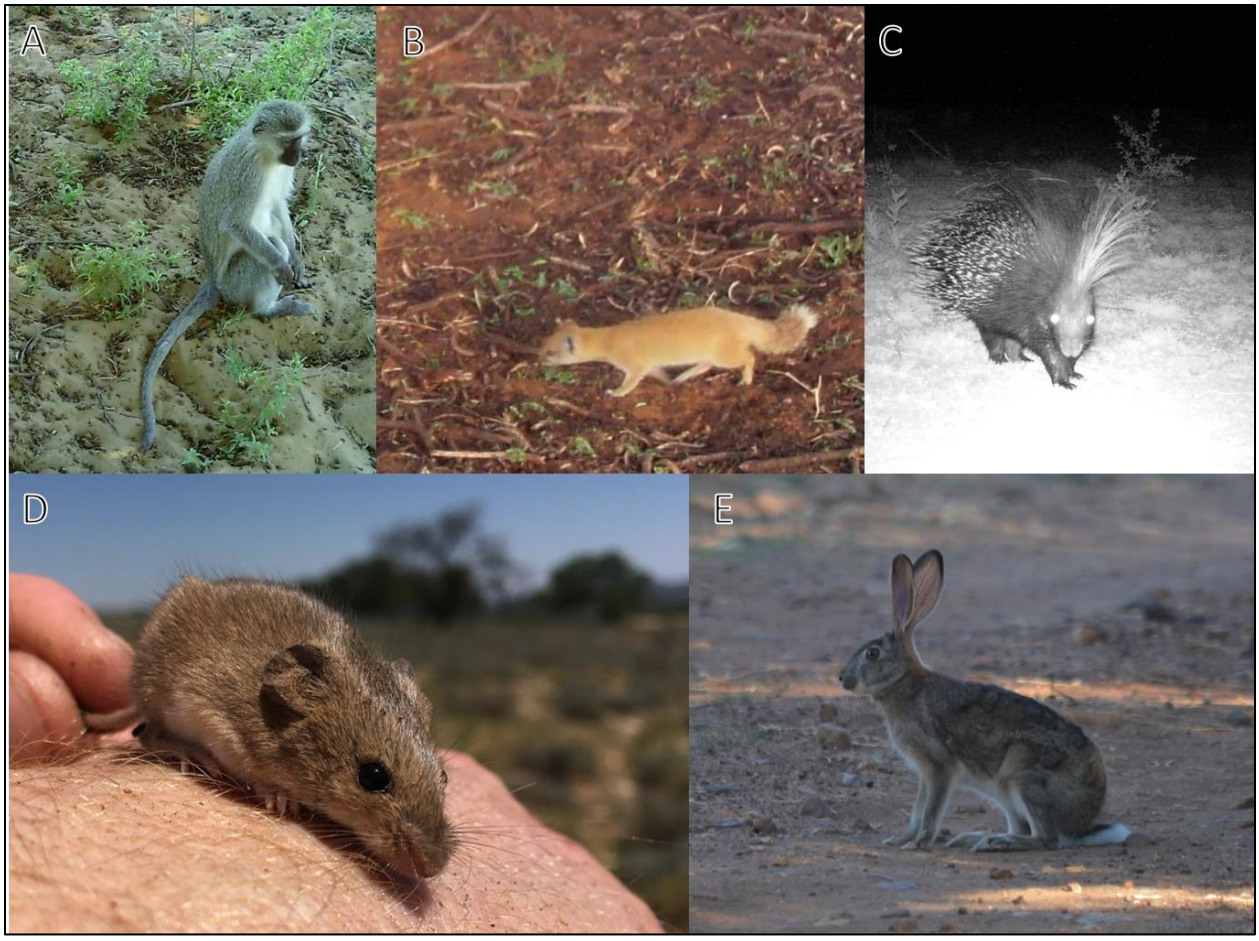

Figure 19: Some of the mammal species recorded in the project area: Some of the mammal species recorded during the wet season survey, A) Vervet monkey (Chlorocebus pygerythrus), B) Yellow mongoose (Cynictis penicillata), C) Cape Porcupine (Hystrix africaeaustralis), D) Pygmy Mouse (Mus minutoides) and E) Scrub Hare (Lepus saxatilis)

7.2.2.3 Herpetofauna (Reptiles & Amphibians)

Herpetofauna diversity was considered to be moderate to low with seven (7) reptile species observed during the July 2018 survey and six (6) reptile species being recorded in the November 2018 survey in the project area (Table 11)(Figure 20-Figure 21). Two amphibian species were recorded in the project area during the wet season survey (Table 12) (Figure 22). Based on the presence of suitable grassland, river system and rocky ridge habitat, herpetofauna diversity in the area is expected to be moderate to high.

Table 11: Herpetofauna recorded within the project area

Species	Common Name	Conservation Status	
		Regional (Eskom, 2016	Global (IUCN, 2017)
Dry season			
Aparallactus capensis	Black Headed Centipede Eater	LC	LC
Crotaphopeltis hotamboeia	Red-lipped Snake	LC	Unlisted
Hemidactylus mabouia	Common Tropical House Gecko	LC	Unlisted
Panaspis wahlbergii	Snake-eyed Skink	LC	LC
Rhinotyphlops lalandei	Delalande's Beaked Blind Snake	LC	Unlisted
Trachylepis punctatissima	Speckled Rock Skink	LC	LC
Trachylepis varia	Variable Skink	LC	LC
Varanus niloticus	Water Monitor	LC	LC
Wet Season			
Chondrodactylus turneri	Turner's Gecko	LC	Unlisted
Pachydactylus capensis	Cape Thick-toed Gecko	LC	Unlisted
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	LC	Unlisted
Prosymna sundevallii	Sundevall's Shovel-snout	LC	LC
Trachylepis striata	Striped Skink	LC	Unlisted
Varanus niloticus	Water Monitor	LC	Unlisted

Figure 20: Some of the reptile recorded within the project area: A) Red-lipped Snake (Crotaphopeltis hotamboeia); B) Delalande's Beaked Blind Snake (Rhinotyphlops lalandei); and C) Black Headed Centipede Eater (Aparallactus capensis)

Figure 21: Some of the reptile species recorded: A) Water monitor (Varanus niloticus), B) Turner's Gecko (Chondrodactylus turneri), C) Striped Skink (Trachylepis striata), D) Cape Thick-toed Gecko (Pachydactylus capensis), E) Sundevall's Shovel-snout (Prosymna sundevallii) and F) Wahlberg's Snake-eyed Skink (Panaspis wahlbergii)

Table 12: Amphibian species recorded in the project area.

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Sclerophrys gutturalis	Guttural Toad	LC	LC
Sclerophrys pusilla	Flat-backed Toad	LC	LC

Figure 22: The amphibian species recorded in the project area: A) Guttural Toad (Sclerophrys gutturalis) and B) Flat-backed Toad (Sclerophrys pusilla)

8 Habitat Sensitivity Mapping

As per the terms of reference for the project, a GIS sensitivity map is required in order to identify sensitive features in terms of the relevant specialist discipline/s within the project area, especially in reference to the development, and in this case the project area created which surrounds the proposed activity. The sensitivity scores identified during the field survey for each habitat were then visually mapped (Figure 24).

Areas that were classified as having low or moderate sensitivities are those areas which were deemed by the specialists to have been most impacted upon and/or were modified from their original condition due to factors such as over-grazing, human activity, sand mining and/or presence of alien invasive species.

Areas given a high sensitivity rating are those areas with existing natural vegetation, are classified as a functional CBA/ESA and/or area's that have the capacity to serve as habitat or important corridors for various species (especially SCC).

8.1 Rocky Ridge Delineations

Due to the ridges within the project area, and the ridges in proximity on the opposite riverbank being classed as highly sensitive, a 30m buffer was assigned to the ridges that obtained a high sensitivity in the project area. This sensitivity was derived after assessing the ecological state of these areas during the field surveys as well as the broad role they play as habitat and movement corridors for faunal species.

During the field surveys, a large range of faunal species were recorded utilising these areas and they are considered to be in a natural, functional state. Although no SCC were recorded during the survey, threatened species such as Serval and South African Hedgehogs are expected to occur here. Floral diversity on the ridges was also considered to be high based on the species recorded and the opinion of the specialist.

As per the GDARD (2012) guidelines, a 200m buffer of any remaining natural ridges within the project area was initially proposed. Ridges were delineated via GPS and via analysis of current and historic imagery, as well as by the contour lines (hillslopes and rocky outcrops) present. Some of the vegetation and habitat within the outer limits of the original 200m buffer was considered marginal, disturbed or semi-disturbed (these coincide with the areas marked with a low sensitivity (Figure 24)), and therefore the buffer was decreased to 30m. Due to the width of the ridges on site, the addition of a 30m buffer on either side is considered sufficient to maintain enough natural habitat along the ridges to preserve faunal species that occur there and to continue functioning as movement corridors. According to Macfarlane et al., (2009) to maintain habitat for many species of wildlife, buffer zones with a length of between 50 and 300m have been proposed, the table indicating these different lengths can be seen in Figure 23.

It is important to note that this map does not replace any local, provincial or government legislation relating to these areas or the land use capabilities or sensitivities of these environments (such as CBA classifications).

Author	Date	Min. Buffer (m)	Max. Buffer (m)	Comments
Palone and Todd	1997	40	270	Recommended widths for wildlife habitat
CWP & USEPA	2005	50	-	To maintain species diversity in rural areas. Cited in Biohabitats Inc. (2007)
Howard and Allen	1989	60	60	For most wildlife
Groffman *et al.*	1991	60	100	For most wildlife
USDA NRSC	2003	72		No specific details provided
CWP & USEPA	2005	100	-	To maintain species diversity in urban areas. Cited in Biohabitats Inc. (2007)
CWP & USEPA	2005	100	-	If only unthreatened species are present. Cited in Biohabitats Inc. (2007)
CWP & USEPA	2005	200	300	If rare, threatened or endangered species are present. Cited in Biohabitats Inc. (2007)

Figure 23: An extract of the proposed buffer widths for maintaining the habitat required for effective general, conservation according to various authors (Macfarlane et al, 2009).

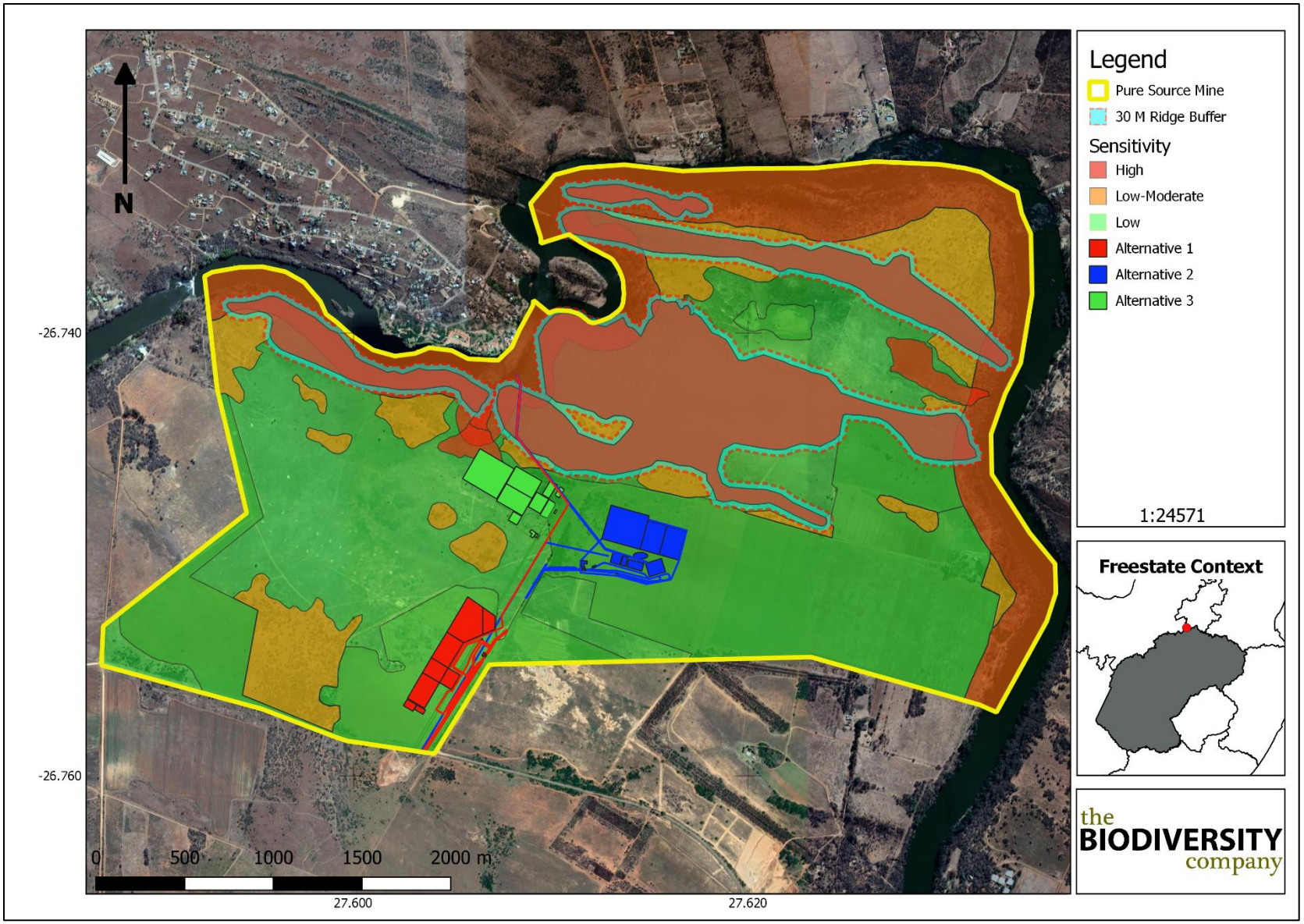

Figure 24: Habitat sensitivity map of the project area with the alternatives superimposed

9 Impact Assessment

Mining and related activities have significant impacts on biodiversity and ecosystem services, often causing irreversible and large-scale habitat loss across areas important for the provision of important ecosystem services. Depending on the mining methods adopted, mining activities can cause considerable environmental degradation. These disturbances have numerous direct, indirect, short- and long-term potentially adverse effects on the landscape.

The most obvious environmental impact of the proposed aggregate mining is the conversion of land use, most likely from undeveloped or agricultural land use, to an open-cast mine area (pre-rehabilitation). This impact is accompanied by loss of habitat, noise, dust, blasting effects, erosion, and possible sedimentation (Langer *et al.,* 2002).

Key impacts commonly associated with open cast mining activities on terrestrial biodiversity are discussed below. The listed activities are merely indicative, and the proposed developments may either have additional or fewer activities depending on the circumstances. It should be noted that these categories, with associated impact descriptions is not exhaustive, and more impacts may be identified at a later stage as more information becomes available. The significance (quantification) of potential environmental impacts has been assessed in terms of the Guideline Documentation on EIA Regulation; Department of Environmental Affairs and Tourism, 2014 (Impact Assessment Methodology, Appendix 6).

9.1 Impact Assessment Methodology

Potential impacts were evaluated against the data captured during the desktop-and field assessment to identify relevance to the study area. The relevant impacts associated with the proposed project were then subjected to a prescribed impact assessment methodology which is available on request.

9.2 Current Impacts

During the field survey the current impacts that have a negative impact on the area were identified, and are listed below, some are shown in

- Erosion;
- Fish kills due to pollution;
- Agricultural fields;
- Old iron mines;
- Old sand mines; and
- Invasive plant species.

Figure 25: Some of the impacts observed in the project area; A) Dead fish on the river banks, B) Old iron mine, C) Agricultural fields and D) Old sand mining area

9.3 Impact Assessment

The proposed development is associated with mining activities, namely the open cast mining of the areas identified in this report. The proposed activities will result in direct loss of habitats, direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate mining will reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as rivers, streams and drainage lines, or other locally important features.

The project area provides possible habitat and shelter to a number of endemic and protected mammal and bird species. Although it is assumed that the majority of fauna species will move to

different areas as a result of disturbance, many protected and endemic fauna or flora species have very specific habitat requirements (some of which are present on site), and the destruction of their habitats could result in displacement to less optimal habitats. This will result in a decline in species numbers which may ultimately affect the conservation status of specific species on global, national and provincial scales.

Some other risks associated with open cast mining methods:

- Open cast mining destroys landscapes, forests and wildlife habitats at the site of the mine when trees, plants, and topsoil are cleared from the mining area. This in turn can lead to soil erosion and destruction of agricultural land.

The potential cumulative impacts associated with the various project stages are discussed below, while a consideration for the risks of the alternative are descried in section 10.

9.3.1 Possible Impact of Dust Pollution on Fauna and Flora

Dust can affect both fauna and flora, depending on the quantity, size and the composition of the particles. As the levels found in this project is not known at present, the following information is considered a preliminary guideline and may not be applicable to the current fauna or floral if concentrations are found to be suitably low based on the findings of the air quality specialists report.

Dust's consist of solid matter in a minute and fine state of subdivision so that the particles are small enough to be raised and carried by wind. They may originate from many sources. Dust can be from natural source (i.e. Dust storms) or from human activities (vehicles, mining, construction activities, and land clearing) (Zohaib et al., 2016). Dust can have both a physical and a chemical impact on plants. The physical impact of dust on flora can be through the blocking of the stomata lowering the gas exchange capacity and reducing the chlorophyll a and chlorophyll b levels (Nepali & Gyawali, 2001). Krajickova & Mejstrik (1984) noted that the stomatal diameter was 8-12µm for a range of crops. Thus, particle size is important if dust is to act in this way on stomatal functions. Dusts of diverse origin have very different chemistries. The impact of stomatal blockage is affected by dust emission rates, meteorology and conditions on the leaf surface. Other physical features that is also influenced by the layer of dust on the leave is the transpiration rate, the success of pollination, a reduction in seed set (i.e. arrangement and seed numbers) and then it can ultimately lead to cell death due to a lack of gas exchange (Farmer, 1993). In an exposure study it was found that dust can result in a reduction in photosynthesis and diffusive resistance and an increase in leaf temperature, the latter two effects makes flora more likely to be susceptible to drought (Farmer, 1993).

The chemical effect of dust, either on soil or directly on the plant surface, may be more important than any physical effects. To explain the link between the chemical impact one needs to look at a source of the dust, one relevant example is dust from gravel or unpaved roads. Roberts et al. (1975) found that an unpaved dry gravel road with an average daily traffic (ADT)

of 250 cars produced mean air concentrations of 584 µg.m^{-3}, while a paved road with an ADT of 18 000 produced mean concentrations of 463 µg.m^{-3}. Everett (1980) undertook a detailed study of an unpaved road in Alaska and found that in the summer about 10 g.m^{-2} day^{-1} was deposited at the roadside and that there was a logarithmic decline in deposition away from the road, with deposition still occurring 1 km away. Road dust may also contain significant concentrations of metals, while many unpaved roads produce alkaline dusts, which have high calcium levels. These elements will impact plants in various ways.

The effect of dust on fauna can be direct or indirect, meaning that it can be that the vegetation can be affected and die and in turn resulting in the death of invertebrates and other species that are dependent on the vegetation for a food source. Directly, dust can affect the eyes of vertebrates which can result in irritations that can lead to infections (Shubhrica, 2013). The respiratory system is the main area that is affected by dust and can be impacted mechanically, chemically, or by infections (Hartung & Saleh, 2015). The way the respiratory system responds to inhaled particles depends, to a great extent, on where the particle settles. For example, irritant dust that settles in the nose may lead to rhinitis, an inflammation of the mucous membrane. If the particle attacks the larger air passages, inflammation of the trachea (tracheitis) or the bronchi (bronchitis) may be seen. The most significant reactions of the lung occur in the deepest parts of this organ. Particles that evade elimination in the nose or throat tend to settle in the sacs or close to the end of the airways. But if the amount of dust is large, the macrophage system (part of the immune system) may fail. Dust particles and dust-containing macrophages collect in the lung tissues, causing injury to the lungs (Steyn & Maina, 2015). The amount of dust and the kinds of particles involved influence how serious the lung injury will be. For example, after the macrophages swallow silica particles, they may die and give off toxic substances. These substances cause fibrous or scar tissue to form. This tissue is the body's normal way of repairing itself. However, in the case of crystalline silica so much fibrous tissue and scarring form that lung function can be impaired. The general name for this condition for fibrous tissue formation and scarring is fibrosis. The particles which cause fibrosis or scarring are called fibrogenic. When fibrosis is caused by crystalline silica, the condition is called silicosis (Hartung & Saleh, 2015). This is, however, highly dependent on the amounts of particles the organisms are exposed to and the duration of exposure. The vertebrate body are well adapted and only in extreme cases will it not cope with exposure of dust.

9.3.2 Construction Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Destruction of, and fragmentation of, the vegetation community (including portions of an Endangered vegetation type, extensive ridge areas and areas classified as CBAs and ESAs).

Potential impacts on faunal communities include:

- Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust, poaching and vibration) and/or direct mortalities;
- Disruption / alteration of ecological life cycles (breeding, migration, feeding) due to the restriction of species movement (migration/dispersal); and
- Environmental pollution due to alterations in sediment load and chemical runoff in water courses.

9.3.3 Operational Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Continued removal and fragmentation of an Endangered vegetation community (including portions of areas classified as CBAs and ESAs) due to open cast mining activities and encroachment by alien invasive plant species;
- Potential leaks, discharges, pollutant from mining activities leaching into the surrounding environment;
- Vegetation loss due to erosion as a result of stormwater runoff from the mine; and
- Restricted floras growth due to air pollution caused by dust from the mine.

Potential impacts on faunal communities include:

- Continued displacement and fragmentation of the faunal community (including possible threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching);
- Disruption / alteration of ecological life cycles (breeding, migration, feeding) due to the restriction of species movement (migration/dispersal)

9.3.4 Decommissioning Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Continued encroachment into an indigenous and Endangered vegetation community by alien invasive plant species;

Potential impacts on faunal communities include:

- Continued displacement and fragmentation of the faunal community (including possible threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching).

9.3.5 Closure and Rehabilitation Phase

The following potential impacts were considered on terrestrial vegetation communities:

- Encroachment and displacement of an indigenous and Endangered vegetation community by alien invasive plant species, potential re-establishment of natural species that were removed, the nature of which will depend on the amount of successful vegetation establishment.

Potential impacts on faunal communities include:

- Displacement of the faunal community (including threatened or protected species) due to initial rehabilitation activities and successful rehabilitation resulting in some faunal species potentially re-establishing within the area.

9.4 Assessment of Significance

9.4.1 Construction phase

Table 13 **-** Table 16 presents an overall summary of the significance of potential impacts before and after mitigation for the construction phase. This is a cumulative impact for the whole area and does not include the various alternatives (this can be seen in section 10).

From the tables it can be seen that the vegetation plays a crucial role in the environment, with the impact pre-mitigations being high and staying high post mitigations as sections of the vegetation will be removed. Faunal species will be displaced from the areas and as such the impact is high pre-mitigations and moderate post-mitigations. One of the mitigations that will be important in achieving this will be the relocation of species found on the area, this will then influence the next impact where the dispersal and genetic diversity of the species become a risk. Pre-mitigations this risk is rated as moderate and stays moderate post-mitigations.

Table 13: Impact assessment pre- and post- mitigations for the construction phase

Impact Name	**Destruction of, and fragmentation of, the vegetation community (including portions of an Endangered vegetation type, extensive ridge areas and areas classified as CBAs and ESAs).**				
Alternative	**3**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	4	4	Reversibility of Impact	5	4
Duration of Impact	5	4	Probability	5	5
Environmental Risk (Pre-mitigation)					-23,75
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-20,00
Degree of confidence in impact prediction:					High

Impact Prioritisation	
Public Response	3
Issue has received an intense meaningful and justifiable public response	
Cumulative Impacts	3
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).	
Prioritisation Factor	2,00
Final Significance	-40,00

Table 14: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Name	**Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust, poaching and vibration) and/or direct mortalities.**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	4	3
Duration of Impact	5	4	Probability	5	5
Environmental Risk (Pre-mitigation)					-21,25
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-18,75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,67
Final Significance					-31,25

Table 15: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Name	**Disruption / alteration of ecological life cycles (breeding, migration, feeding) due to the restriction of species movement (migration/dispersal)**

Alternative	0				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	4	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-16,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-11,25
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,33
Final Significance					-15,00

Table 16: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Name	Environmental pollution due to alterations in sediment load and chemical runoff in water courses; Pollution of the water sources for faunal consumption				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	5	5	Reversibility of Impact	4	4
Duration of Impact	4	4	Probability	4	3
Environmental Risk (Pre-mitigation)					-18,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-13,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3

Issue has received an intense meaningful and justifiable public response	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1,67
Final Significance	-22,50

9.4.2 Operational Phase

During the operational phase of the project, majority of the listed activities are considered to pose a High level of risk without mitigation (Table 17-Table 22). Some of the impacts considered for the operational phase of the project could be mitigated, and the significance rating decreases to a Moderate level. The risk of erosion impacting the surrounding vegetation are seen as a Moderate risk pre-mitigations and post-mitigations as the chance of this occurring is high but can be managed with the correct mitigations (Table 19).

Table 17: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Continued removal and fragmentation of an Endangered vegetation community (including portions of areas classified as CBAs and ESAs) due to open cast mining activities and encroachment by alien invasive plant species**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	5	5	Probability	5	4
Environmental Risk (Pre-mitigation)					-22,50
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-17,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					

Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1,67
Final Significance	-28,33

Table 18: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Potential leaks, discharges, pollutant from mining activities leaching into the surrounding environment**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	5	4	Reversibility of Impact	4	3
Duration of Impact	4	4	Probability	5	4
Environmental Risk (Pre-mitigation)					-22,50
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-15,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,67
Final Significance					-25,00

Table 19: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Vegetation loss due to erosion as a result of stormwater runoff from the mine**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of	4	4	Probability	4	3

Impact					
Environmental Risk (Pre-mitigation)					-16,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-10,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,67
Final Significance					-17,50

Table 20: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Restricted floras growth due to air pollution caused by dust from the mine**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of Impact	4	4	Probability	4	3
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-10,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,33

Final Significance	-14,00

Table 21: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Continued displacement and fragmentation of the faunal community (including possible threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching);**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	4	4	Reversibility of Impact	4	3
Duration of Impact	5	4	Probability	5	5
Environmental Risk (Pre-mitigation)					-22,50
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-18,75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,50
Final Significance					-28,13

Table 22: Cumulative impact assessment pre- and post- mitigations for the construction phase

Impact Names	**Disruption / alteration of ecological life cycles (breeding, migration, feeding) due to the restriction of species movement (migration/dispersal)**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	4	3	Probability	4	3

Environmental Risk (Pre-mitigation)	-16,00
Mitigation Measures	
See section 11	
Environmental Risk (Post-mitigation)	-11,25
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	1
Low: Issue not raised in public responses	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1,33
Final Significance	-15,00

9.4.3 Decommissioning Phase

During the decommissioning phase the structures will be broken down and vehicle /human presence will increase initially to remove the infrastructure from the area and then decrease as the process winds down. The risk of alien invasive plants becoming an impact due to now disturbed nature of the area was rated as High pre mitigations and then with the implementation of an alien invasive management plant this was lowered to Moderate post mitigation (Table 23). The risk on faunal species was seen as Moderate pre-mitigations and Low post mitigations (Table 24).

Table 23: Cumulative impact assessment pre- and post- mitigations for the decommissioning phase

Impact Names	**Continued encroachment into an indigenous and Endangered vegetation community by alien invasive plant species**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	3
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	4	3	Probability	5	3
Environmental Risk (Pre-mitigation)					-21,25
Mitigation Measures					
See section 11					

Environmental Risk (Post-mitigation)	-10,50
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	2
Issue has received a meaningful and justifiable public response	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.	
Prioritisation Factor	1,50
Final Significance	-15,75

Table 24: Cumulative impact assessment pre- and post- mitigations for the decommissioning phase

Impact Names	**Continued displacement and fragmentation of the faunal community (including possible threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching).**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	4	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-9,75
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,33

Final Significance	-13,00

9.4.4 Closure and Rehabilitation Phase

Due to the extend and type of disturbance the area will not return to its original state, the aim of the closure and rehabilitation is to revegetate the area with indigenous species and allow fauna to move back into the area. The risk of alien invasive plants reducing the success of natural revegetation was rated as Moderate pre-mitigation and Low post-mitigation (Table 25). The displacement of faunal species during the rehabilitation process was rated as Moderate pre-mitigation and Low post mitigation (Table 26).

Table 25: Cumulative impact assessment pre- and post- mitigations for the closure and rehabilitation phase

Impact Names	**Encroachment and displacement of an indigenous and Endangered vegetation community by alien invasive plant species, potential re-establishment of natural species that were removed, the nature of which will depend on the amount of successful vegetation establishment.**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	4	4	Reversibility of Impact	3	3
Duration of Impact	3	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-14,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-9,75
Degree of confidence in impact prediction:					Medium
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,50
Final Significance					-14,63

Table 26: Cumulative impact assessment pre- and post- mitigations for the closure and rehabilitation phase

Impact Names	**Displacement of the faunal community (including threatened or protected species) due to initial rehabilitation activities and successful rehabilitation resulting in some faunal species potentially re-establishing within the area.**				
Alternative	**0**				
Phase	**Rehab and closure**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of Impact	3	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-14,00
Mitigation Measures					
See section 11					
Environmental Risk (Post-mitigation)					-9,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,67
Final Significance					-15,00

10 Consideration of the Proposed Site Options

A rated criteria options assessment was completed for the proposed project. The method utilises selected criteria and rates them according to suitability on a 1-5 scale with 1 being unsuitable and 5 being very suitable. The various selected criteria as well as the results of their specific ratings for each alternative are presented in the table below (Table 27).

Table 27: Options Assessment

Criteria/Option	Alternative 1	Alternative 2	Alternative 3
Conservation Plan (CBA, ESA, ONA)	4	4	3
Rocky Ridges	5	3	1

Criteria/Option	Alternative 1	Alternative 2	Alternative 3
Mining Guide	3	5	3
Presence of sensitive habitats (River, wetland, sensitive/natural vegetation)	4	3	1
Total Suitability	16	15	8

The results of the options assessment indicate that the Alternative 1 was most suitable in terms of potential impacts to terrestrial ecology and can be seen in Figure 24. In addition to quantitative options assessment, a qualitative assessment was completed for the biodiversity assessment and is presented below

Table 28: Qualitative Biodiversity Option Assessment

Criteria	Alternative 1	Alternative 2	Alternative 3
Conservation Plan (CBA, ESA, ONA)	A small section of the infrastructure is located in ESA1, but majority is located in the less sensitive ESA2	All the infrastructure can be found in an area classified as ESA2	The entire proposed infrastructure area falls within a moderately sensitive ESA1 area
Distance from Ridge Areas (Approximate distance between drying plant and edge of ridge)	±1250m	±400m	±10m
Mining guidelines	Moderate Biodiversity importance: moderate risk for mining	Area is not classified, as it is agricultural fields.	Moderate Biodiversity importance: moderate risk for mining
Ecosystem services provided and ecosystem sensitivity	This area has previously been disturbed by mining/agriculture; Unlikely that it is a corridor to surrounding natural areas.	This area has previously been disturbed by mining/agriculture; Based on the condition of the area it might still function as foraging area for faunal species	The habitat is is in a more natural condition compared to the other two proposed sites; Wetlands are found in this area, which is important for water dependant fauna and flora species; Most likely form part of a corridor with surrounding areas including the nearby ridge; Erosion control due to occurrence of natural vegetation.

11 Mitigation Measure Objectives

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

- Prevent the unnecessary destruction of, and fragmentation of, the vegetation community as well as the surrounding environment, including the sensitive ridge areas which are also functioning as possible corridors for faunal species;
- Prevent the loss of the faunal community (including potentially occurring species of conservation concern) associated with these vegetation communities.

11.1 Mitigation Measures for Impacts on Vegetation Communities, CBAs and Rocky Ridges

From an ecological perspective the project area has been impacted upon by game grazing on the whole of the area, it does however still support a large number of natural fauna species and as such the potential impacts need to be mitigated, if possible. If they cannot be properly mitigated for then this may represent a fatal flaw for the project. The recommended mitigation and rehabilitation measures include the following:

- Avoid CBA areas as well as high biodiversity sensitivity areas (natural vegetation, ridges, watercourses & wetlands) and implement buffer zones. The current project area directly intersects with a large CBA area and therefore the current project is considered incompatible with this mitigation measure;
- It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon and preventing movement of workers into sensitive surrounding environments;
- The surrounding areas that were not surveyed should be declared a ‘no-go’ area during the construction and operational phases and all efforts must be made to prevent access to this area from construction workers, machinery, domestic animals and the general public. This should be implemented with the exception of those areas in which authorisation for development has been granted;
- Where possible, existing access routes and walking paths must be made use of, and new routes limited;
- All laydown, storage areas etc should be restricted to within the project area, and preferably areas classed as low sensitivity;

- A qualified environmental control officer must be on site when construction begins to identify species that will be directly disturbed and to relocate fauna/flora that is found during construction and operation (including all reptiles and amphibians);
- An alien invasive plant management plan needs to be compiled and implemented to prevent the growth of invasive species on cleared /disturbed areas;
- A dedicated storage facility according to industry best practice should be constructed away from sensitive habitat types to help control spills;
- Accidental hydrocarbon spills must be cleaned rapidly;
- An environmental induction for all staff members must be mandatory in which specific issues related to the potential of fire or addressed e.g. only smoking in designated areas, no open cooking fires etc;
- Water or dust control agents should be used in working areas and roads will be sprayed for dust suppression on a regular basis in designated susceptible areas during heavy usage, but it is suggested that relevant specialists' recommendations are adhered to; and
- Rehabilitation of the disturbed areas in the project area must be made a priority. Top soils must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type.

11.2 Mitigation Measures for Impacts on Faunal Communities

Recommended mitigation and rehabilitation measures for faunal community's hinge largely on protecting their habitats and ensuring it remains intact. The following measures are recommended:

- If any SCC faunal species are recorded during construction, activities should temporarily cease to allow fauna to move away;
- Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint by a suitably qualified ECO trained in the handling and relocation of animals;
- Prior and during vegetation clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery;
- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site;

- No trapping, killing or poisoning of any wildlife is to be allowed on site and within the surrounding area, including snakes, birds, lizards, frogs, insects or mammals;
- Noise must be kept to an absolute minimum during the evenings and at night to minimise all possible disturbances to amphibian species and nocturnal mammals;
- Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the surrounding environment;
- Storage of chemicals, lubricants and other potentially hazardous liquids should be regulated closely. A dedicated storage facility with spill containment facilities (plastic-lined earth berms) which has restricted access (locked and fenced) must be constructed in a safe location situated as far as possible from the river;
- Chemical spill clean-up kits must be stationed at all sites where spills are probable. Several staff should be trained in the chemical clean-up procedure and at least one member of this unit must be on duty at all times;
- Avoid the use of herbicides and rather resort to regular mechanical clearing of vegetation where necessary;
- All vehicle speeds associated with the project should be monitored and should be limited to 40 km/h (maximum);
- Dust monitoring system must be implemented; and
- Water or dust control agents should be used in working areas and roads will be sprayed for dust suppression on a regular basis in designated susceptible areas during heavy usage.

12 Recommendations for Rehabilitation

The following are recommendations for the rehabilitation of the area, a rehabilitation plan was not included as part of the SoW for this project. Nonetheless the following generic rehabilitation measures are provided.

Relevant specialists need to be contacted to compile and implement a full rehabilitation plan. As the area will be highly disturbed, strict measures will need to be adhered to, to ensure that the rehabilitation is successful. The following steps are recommended:

- Compile and implement a rehab plan from the onset of the project. Which should include roll overmining;
- Avoid wetland / ridge highly sensitive areas and adhere to the buffers;

- The rehab area must be fenced off and all game species must be kept out of the area. The amount of people allowed should also be limited to the workers that are directly involved in the rehabilitation process;
- Shade netting needs to be placed around the fence to protect the newly planted area from sandblasting. The netting should at least be 1m high and be a high-density shade netting;
- The soil needs to be ripped up as the topsoil will be impacted (or completely removed) by previous activities. Ripping needs to be done to a minimum of 10 mm deep (Beukes & Cowling, 2003). Stored topsoil needs to be worked back into the area if it was stored before the mining in area started. The layer of soil should then be tilled to level it out;
- The loosened soil then needs to be fertilized. The exact composition of the fertilizer needs to be confirmed with a fertilization specialist, as this will be dependent on the soil quality and the factors such as the pH (Van den Berg & Keller, 2005);
- In the fenced off area, an irrigation system needs to be placed. This would include a pipeline with sprinklers attached. The design should be confirmed with an irrigation specialist as it is vital that the sprinkler system does not cause runoff and relocating the seeds to one point of the rehabilitation property;
- Seeds must be hand sowed and it must be over-sowed as described by amongst others Snyman (2003) to 2 kg/ha. The specific species that should be planted must be indigenous. Two species that can be suggested are *Eragrostis pallens* and *Elephantorrhiza burkei*. These species can be relocated from other parts of the farm or can be grown from seeds, the species should not be limited to these two species. It is crucial that the correct species should be planted for the area and the soil. A specialist company (e.g. Mayford http://mayford.co.za/veld-grass/) should be consulted for the correct seed mix and after care of the seedlings;
- Should the planted seeds not take/grow in a particular area(s), the process should be repeated, and this process must be repeated until the whole area is revegetated and stable;
- The fencing around the area should not be removed until the area has stabilized, and it is back to its natural state. The timeframe for this must be assessed by a vegetation specialist.

13 Conclusion

From an ecological perspective the development is situated close to, and within, various natural and semi-disturbed habitats (including CBAs, ESAs, riverine habitats and sensitive rocky ridge areas). Although somewhat disturbed, it is believed these areas support various faunal species and there is a strong likelihood that SCC may occur there. This diversity is indicative of the

importance of these systems to collectively provide refugia, food and corridors for dispersal in and through the surrounding area. The preservation of these systems is the most important aspect to consider, even more so due to the sensitivity of the area according to the ecological datasets analysed for this report.

The proposed development is associated with mining activities, namely the open cast mining of the areas identified in this report. The proposed activities will result in direct loss and destruction of habitats (including an Endangered vegetation type), direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate mining will reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area. Land clearing destroys local wildlife habitat and can lead to the loss of local breeding grounds, nesting sites and wildlife movement corridors such as the ridge, rivers, streams and drainage lines, or other locally important features.

The following further conclusions were reached based on the results of this assessment:

- According to the Free State Terrestrial CBA Plan, the project area is comprised of three identified areas: Critical Biodiversity Area2, Ecological Support Area1 and Ecological Support Area2;
- The proposed project was superimposed on the terrestrial ecosystem threat status spatial data. According to this, the project area falls across one ecosystem, which are listed as Vulnerable (VU);
- The project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development. Based on this the terrestrial ecosystems associated with the proposed project area are rated as *not protected.* This means that this ecosystem type (and associated habitats) are not well protected anywhere in the country (such as in nationally protected areas);
- According to the Mining and Biodiversity Guidelines (2013), the project area is predominantly classed as having a ‘Moderate Biodiversity Importance’ and represents a ‘Moderate Risk for Mining’;
- The project area is situated across one vegetation type; the Soweto Highveld Grassland vegetation type which is classified as Endangered;
- Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 445 plant species are expected to occur in the project area. Of the 445-plant species, one (1) species are listed as being SCC;
- One hundred and seventeen (117) bird species were recorded in the project area during the July 2018 survey (dry season), while 69 were observed during the November 2018 (wet season) survey, no species of conservation concern was observed; and

- Natural mammal diversity in the project area was high, with fifteen (15) mammal species being recorded during the July 2018 survey and thirteen (13) in the November 2018 survey based on direct observations and/or the presence of visual tracks & signs.

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

Family	*Taxon*	Author	IUCN	Ecology
Cyperaceae	*Abildgaardia ovata*	(Burm.f.) Kral	LC	Indigenous
Malvaceae	*Abutilon piloso-cinereum*	A.Meeuse	LC	Indigenous
Euphorbiaceae	*Acalypha glabrata var. pilosa*	Thunb.	LC	Indigenous
Euphorbiaceae	*Acalypha segetalis*	Müll.Arg.	LC	Indigenous
Asteraceae	*Adenostemma caffrum*	DC.	LC	Indigenous
Crassulaceae	*Adromischus umbraticola subsp. umbraticola*	C.A.Sm.		Indigenous; Endemic
Rosaceae	*Agrimonia procera*	Wallr.	LC	Not Indigenous; Naturalised; Invasive
Poaceae	*Agrostis lachnantha var. lachnantha*	Nees	LC	Indigenous
Lamiaceae	*Ajuga ophrydis*	Burch. ex Benth.	LC	Indigenous
Hyacinthaceae	*Albuca shawii*	Baker		Indigenous
Hyacinthaceae	*Albuca virens subsp. virens*	(Ker Gawl.) J.C.Manning & Goldblatt		Indigenous
Orobanchaceae	*Alectra orobanchoides*	Benth.	LC	Indigenous
Orobanchaceae	*Alectra pumila*	Benth.	LC	Indigenous
Alismataceae	*Alisma plantago-aquatica*	L.	NE	Not Indigenous; Naturalised; Invasive
Asphodelaceae	*Aloe greatheadii var. davyana*	Schönland	LC	Indigenous
Amaranthaceae	*Alternanthera pungens*	Kunth		Not Indigenous; Naturalised
Amaranthaceae	*Amaranthus thunbergii*	Moq.	LC	Indigenous
Lythraceae	*Ammannia baccifera subsp. baccifera*	L.		Not Indigenous; Naturalised
Lythraceae	*Ammannia prieuriana*	Guill. & Perr.	LC	Indigenous
Amaryllidaceae	*Ammocharis coranica*	(Ker Gawl.) Herb.	LC	Indigenous
Anacampserotaceae	*Anacampseros filamentosa subsp. filamentosa*	(Haw.) Sims		Indigenous; Endemic
Poaceae	*Andropogon eucomus*	Nees	LC	Indigenous
Poaceae	*Andropogon schirensis*	Hochst. ex A.Rich.	LC	Indigenous
Basellaceae	*Anredera cordifolia*	(Ten.) Steenis	NE	Not Indigenous; Naturalised; Invasive
Rubiaceae	*Anthospermum rigidum subsp. rigidum*	Eckl. & Zeyh.	LC	Indigenous
Aponogetonaceae	*Aponogeton junceus*	Lehm.	LC	Indigenous

Aponogetonaceae	*Aponogeton rehmannii*	Oliv.	LC	Indigenous
Scrophulariaceae	*Aptosimum indivisum*	Burch. ex Benth.	LC	Indigenous
Asteraceae	*Arctotis arctotoides*	(L.f.) O.Hoffm.	LC	Indigenous
Papaveraceae	*Argemone ochroleuca subsp. ochroleuca*	Sweet		Not Indigenous; Naturalised; Invasive
Poaceae	*Aristida bipartita*	(Nees) Trin. & Rupr.	LC	Indigenous
Poaceae	*Aristida congesta subsp. barbicollis*	Roem. & Schult.	LC	Indigenous
Poaceae	*Aristida congesta subsp. congesta*	Roem. & Schult.	LC	Indigenous
Poaceae	*Aristida diffusa subsp. burkei*	Trin.	LC	Indigenous
Poaceae	*Aristida junciformis subsp. junciformis*	Trin. & Rupr.	LC	Indigenous
Apocynaceae	*Asclepias meyeriana*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias multicaulis*	(E.Mey.) Schltr.	LC	Indigenous
Asparagaceae	*Asparagus flavicaulis subsp. flavicaulis*	(Oberm.) Fellingham & N.L.Mey.	LC	Indigenous
Asparagaceae	*Asparagus suaveolens*	Burch.	LC	Indigenous
Apocynaceae	*Aspidoglossum biflorum*	E.Mey.	LC	Indigenous
Apocynaceae	*Aspidoglossum interruptum*	(E.Mey.) Bullock	LC	Indigenous
Asteraceae	*Athrixia elata*	Sond.	LC	Indigenous
Amaranthaceae	*Atriplex semibaccata*	R.Br.		Not Indigenous; Naturalised; Invasive
Amaranthaceae	*Atriplex suberecta*	I.Verd.	LC	Indigenous
Salviniaceae	*Azolla filiculoides*	Lam.	NE	Not Indigenous; Naturalised; Invasive
Acanthaceae	*Barleria galpinii*	C.B.Clarke		Indigenous; Endemic
Acanthaceae	*Barleria macrostegia*	Nees		Indigenous
Rhamnaceae	*Berchemia zeyheri*	(Sond.) Grubov		Indigenous
Asteraceae	*Berkheya onopordifolia var. onopordifolia*	(DC.) O.Hoffm. ex Burtt Davy	LC	Indigenous
Asteraceae	*Berkheya pinnatifida subsp. ingrata*	(Thunb.) Thell.	LC	Indigenous; Endemic
Asteraceae	*Berkheya pinnatifida subsp. pinnatifida*	(Thunb.) Thell.	LC	Indigenous; Endemic

Asteraceae	*Berkheya zeyheri subsp. zeyheri*	Oliv. & Hiern	LC	Indigenous
Asteraceae	*Bidens bipinnata*	L.		Not Indigenous; Naturalised
Acanthaceae	*Blepharis squarrosa*	(Nees) T.Anderson		Indigenous; Endemic
Acanthaceae	*Blepharis stainbankiae*	C.B.Clarke		Indigenous; Endemic
Amaryllidaceae	*Boophone disticha*	(L.f.) Herb.	LC	Indigenous
Poaceae	*Brachiaria serrata*	(Thunb.) Stapf	LC	Indigenous
Poaceae	*Bromus catharticus*	Vahl	NE	Not Indigenous; Naturalised
Bryaceae	*Bryum argenteum*	Hedw.		Indigenous
Orobanchaceae	*Buchnera sp.*			
Scrophulariaceae	*Buddleja saligna*	Willd.	LC	Indigenous
Asphodelaceae	*Bulbine abyssinica*	A.Rich.	LC	Indigenous
Asphodelaceae	*Bulbine narcissifolia*	Salm-Dyck	LC	Indigenous
Cyperaceae	*Bulbostylis hispidula subsp. pyriformis*	(Vahl) R.W.Haines	LC	Indigenous
Leucobryaceae	*Campylopus introflexus*	(Hedw.) Brid.		Indigenous
Cyperaceae	*Carex glomerabilis*	V.I.Krecz.	LC	Indigenous
Icacinaceae	*Cassinopsis ilicifolia*	(Hochst.) Kuntze	LC	Indigenous
Apiaceae	*Centella asiatica*	(L.) Urb.	LC	Indigenous
Ceratophyllaceae	*Ceratophyllum demersum var. demersum*	L.	LC	Indigenous
Solanaceae	*Cestrum parqui*	L'Hér.		Not Indigenous; Naturalised; Invasive
Scrophulariaceae	*Chaenostoma leve*	(Hiern) Kornhall	LC	Indigenous
Aizoaceae	*Chasmatophyllum musculinum*	(Haw.) Dinter & Schwantes	LC	Indigenous
Pteridaceae	*Cheilanthes eckloniana*	(Kunze) Mett.	LC	Indigenous
Pteridaceae	*Cheilanthes hirta var. hirta*	Sw.	LC	Indigenous
Amaranthaceae	*Chenopodium phillipsianum*	Aellen		Indigenous
Gentianaceae	*Chironia purpurascens subsp. humilis*	(E.Mey.) Benth. & Hook.f.	LC	Indigenous
Poaceae	*Chloris virgata*	Sw.	LC	Indigenous
Agavaceae	*Chlorophytum fasciculatum*	(Baker) Kativu		Indigenous
Agavaceae	*Chlorophytum transvaalense*	(Baker) Kativu		Indigenous
Asteraceae	*Cineraria albicans*	N.E.Br.	LC	Indigenous

Asteraceae	*Cineraria lyratiformis*	Cron	LC	Indigenous
Asteraceae	*Cirsium vulgare*	(Savi) Ten.		Not Indigenous; Naturalised; Invasive
Ranunculaceae	*Clematis brachiata*	Thunb.	LC	Indigenous
Cleomaceae	*Cleome monophylla*	L.	LC	Indigenous
Cleomaceae	*Cleome rubella*	Burch.	LC	Indigenous
Euphorbiaceae	*Clutia pulchella var. pulchella*	L.	LC	Indigenous
Colchicaceae	*Colchicum longipes*	(Baker) J.C.Manning & Vinn.		Indigenous; Endemic
Cyperaceae	*Coleochloa setifera*	(Ridl.) Gilly	LC	Indigenous
Combretaceae	*Combretum molle*	R.Br. ex G.Don	LC	Indigenous
Commelinaceae	*Commelina africana var. lancispatha*	L.	LC	Indigenous
Asteraceae	*Conyza podocephala*	DC.		Indigenous
Asteraceae	*Conyza sumatrensis var. sumatrensis*	(Retz.) E.Walker		Not Indigenous; Naturalised
Apocynaceae	*Cordylogyne globosa*	E.Mey.	LC	Indigenous
Asteraceae	*Cosmos bipinnatus*	Cav.		Not Indigenous; Naturalised
Asteraceae	*Cotula anthemoides*	L.	LC	Indigenous
Asteraceae	*Cotula sp.*			
Acanthaceae	*Crabbea angustifolia*	Nees		Indigenous; Endemic
Crassulaceae	*Crassula lanceolata subsp. transvaalensis*	(Eckl. & Zeyh.) Endl. ex Walp.	LC	Indigenous
Crassulaceae	*Crassula obovata var. obovata*	Haw.		Indigenous; Endemic
Amaryllidaceae	*Crinum bulbispermum*	(Burm.f.) Milne-Redh. & Schweick.	LC	Indigenous
Fabaceae	*Crotalaria magaliesbergensis*	A.S.Flores & Sch.Rodr.	LC	Indigenous; Endemic
Cucurbitaceae	*Cucumis zeyheri*	Sond.	LC	Indigenous
Commelinaceae	*Cyanotis lapidosa*	E.Phillips	LC	Indigenous
Commelinaceae	*Cyanotis speciosa*	(L.f.) Hassk.	LC	Indigenous
Orobanchaceae	*Cycnium tubulosum subsp. tubulosum*	(L.f.) Engl.	LC	Indigenous
Cactaceae	*Cylindropuntia imbricata*	(Haw.) F.M.Knuth		Not Indigenous; Naturalised; Invasive
Poaceae	*Cymbopogon caesius*	(Hook. & Arn.) Stapf	LC	Indigenous

Poaceae	*Cymbopogon pospischilii*	(K.Schum.) C.E.Hubb.	NE	Indigenous
Apocynaceae	*Cynanchum virens*	(E.Mey.) D.Dietr.	LC	Indigenous
Poaceae	*Cynodon dactylon*	(L.) Pers.	LC	Indigenous
Cyperaceae	*Cyperus decurvatus*	(C.B.Clarke) C.Archer & Goetgh.	LC	Indigenous
Cyperaceae	*Cyperus denudatus*	L.f.	LC	Indigenous
Cyperaceae	*Cyperus difformis*	L.	LC	Indigenous
Cyperaceae	*Cyperus eragrostis*	Lam.		Not Indigenous; Naturalised
Cyperaceae	*Cyperus esculentus var. esculentus*	L.	LC	Indigenous
Cyperaceae	*Cyperus fastigiatus*	Rottb.	LC	Indigenous
Cyperaceae	*Cyperus longus var. tenuiflorus*	L.	NE	Indigenous
Cyperaceae	*Cyperus marginatus*	Thunb.	LC	Indigenous
Cyperaceae	*Cyperus sphaerospermus*	Schrad.	LC	Indigenous
Cyperaceae	*Cyperus squarrosus*	L.	LC	Indigenous
Lobeliaceae	*Cyphia assimilis*	Sond.	LC	Indigenous; Endemic
Lobeliaceae	*Cyphia stenopetala*	Diels	LC	Indigenous
Solanaceae	*Datura ferox*	L.		Not Indigenous; Naturalised; Invasive
Solanaceae	*Datura stramonium*	L.		Not Indigenous; Naturalised; Invasive
Aizoaceae	*Delosperma sp.*			
Asteraceae	*Denekia capensis*	Thunb.	LC	Indigenous
Acanthaceae	*Dicliptera clinopodia*	Nees		Indigenous
Acanthaceae	*Dicliptera leistneri*	K.Balkwill		Indigenous; Endemic
Asteraceae	*Dicoma anomala*	Sond.		Indigenous
Asteraceae	*Dicoma anomala subsp. anomala*	Sond.	LC	Indigenous
Asteraceae	*Dicoma anomala subsp. gerrardii*	Sond.	LC	Indigenous
Asteraceae	*Dicoma macrocephala*	DC.	LC	Indigenous
Poaceae	*Digitaria eriantha*	Steud.	LC	Indigenous
Poaceae	*Digitaria tricholaenoides*	Stapf	LC	Indigenous
Ebenaceae	*Diospyros austro-africana var. microphylla*	De Winter		Indigenous
Hyacinthaceae	*Dipcadi gracillimum*	Baker		Indigenous
Hyacinthaceae	*Dipcadi viride*	(L.) Moench		Indigenous
Hyacinthaceae	*Drimia angustifolia*	Baker		Indigenous

Hyacinthaceae	*Drimia depressa*	(Baker) Jessop		Indigenous
Hyacinthaceae	*Drimia intricata*	(Baker) J.C.Manning & Goldblatt		Indigenous
Acanthaceae	*Dyschoriste setigera*	(Pers.) J.C.Manning & Goldblatt		Indigenous; Endemic
Amaranthaceae	*Dysphania multifida*	(L.) Mosyakin & Clemants		Not Indigenous; Naturalised; Invasive
Poaceae	*Echinochloa holubii*	(Stapf) Stapf	LC	Indigenous
Poaceae	*Echinochloa jubata*	Stapf	LC	Indigenous
Asteraceae	*Eclipta prostrata*	(L.) L.		Not Indigenous; Naturalised
Poaceae	*Ehrharta erecta var. erecta*	Lam.	LC	Indigenous
Cyperaceae	*Eleocharis dregeana*	Steud.	LC	Indigenous
Fabaceae	*Elephantorrhiza elephantina*	(Burch.) Skeels	LC	Indigenous
Poaceae	*Eleusine coracana subsp. africana*	(L.) Gaertn.	LC	Indigenous
Poaceae	*Elionurus muticus*	(Spreng.) Kunth	LC	Indigenous
Poaceae	*Enneapogon pretoriensis*	Stent	LC	Indigenous
Onagraceae	*Epilobium salignum*	Hausskn.	LC	Indigenous
Equisetaceae	*Equisetum ramosissimum subsp. ramosissimum*	Desf.	LC	Indigenous
Poaceae	*Eragrostis capensis*	(Thunb.) Trin.	LC	Indigenous
Poaceae	*Eragrostis chloromelas*	Steud.	LC	Indigenous
Poaceae	*Eragrostis cilianensis*	(All.) Vignolo ex Janch.	LC	Indigenous
Poaceae	*Eragrostis curvula*	(Schrad.) Nees	LC	Indigenous
Poaceae	*Eragrostis gummiflua*	Nees	LC	Indigenous
Poaceae	*Eragrostis micrantha*	Hack.	LC	Indigenous
Poaceae	*Eragrostis obtusa*	Munro ex Ficalho & Hiern	LC	Indigenous
Poaceae	*Eragrostis patentipilosa*	Hack.	LC	Indigenous
Poaceae	*Eragrostis racemosa*	(Thunb.) Steud.	LC	Indigenous
Poaceae	*Eragrostis superba*	Peyr.	LC	Indigenous
Myrtaceae	*Eucalyptus camaldulensis*	Dehnh.		Not Indigenous; Cultivated; Naturalised; Invasive
Myrtaceae	*Eucalyptus globulus subsp. maidenii*	Labill.		Not Indigenous;

				Cultivated; Naturalised
Myrtaceae	*Eucalyptus sp.*			
Hyacinthaceae	*Eucomis autumnalis subsp. amaryllidifolia*	(Mill.) Chitt.	NE	Indigenous
Euphorbiaceae	*Euphorbia hirsuta*	L.		Not Indigenous; Naturalised; Invasive
Euphorbiaceae	*Euphorbia inaequilatera var. inaequilatera*	Sond.	NE	Indigenous
Euphorbiaceae	*Euphorbia rhombifolia*	Boiss.	LC	Indigenous; Endemic
Poaceae	*Eustachys paspaloides*	(Vahl) Lanza & Mattei	LC	Indigenous
Convolvulaceae	*Evolvulus alsinoides*	(L.) L.	LC	Indigenous
Asteraceae	*Felicia muricata subsp. muricata*	(Thunb.) Nees	LC	Indigenous
Poaceae	*Festuca arundinacea*	Schreb.	NE	Not Indigenous; Naturalised
Asteraceae	*Flaveria bidentis*	(L.) Kuntze		Not Indigenous; Naturalised; Invasive
Cyperaceae	*Fuirena pubescens var. pubescens*	(Poir.) Kunth	LC	Indigenous
Asteraceae	*Gamochaeta pensylvanica*	(Willd.) Cabrera		Not Indigenous; Naturalised
Asteraceae	*Gerbera ambigua*	(Cass.) Sch.Bip.	LC	Indigenous
Iridaceae	*Gladiolus permeabilis subsp. edulis*	D.Delaroche	LC	Indigenous
Fabaceae	*Gleditsia triacanthos*	L.	NE	Not Indigenous; Naturalised; Invasive
Apocynaceae	*Gomphocarpus fruticosus subsp. fruticosus*	(L.) Aiton f.	LC	Indigenous
Apocynaceae	*Gomphocarpus tomentosus subsp. tomentosus*	Burch.	LC	Indigenous
Malvaceae	*Grewia flava*	DC.	LC	Indigenous
Malvaceae	*Grewia occidentalis var. occidentalis*	L.	LC	Indigenous
Amaranthaceae	*Guilleminea densa*	(Willd. ex Roem. & Schult.) Moq.		Not Indigenous; Naturalised
Celastraceae	*Gymnosporia buxifolia*	(L.) Szyszyl.	LC	Indigenous
Celastraceae	*Gymnosporia tenuispina*	(Sond.) Szyszyl.	LC	Indigenous
Amaryllidaceae	*Haemanthus humilis subsp. humilis*	Jacq.	LC	Indigenous
Stilbaceae	*Halleria lucida*	L.	LC	Indigenous
Poaceae	*Harpochloa falx*	(L.f.) Kuntze	LC	Indigenous
Asteraceae	*Helichrysum argyrosphaerum*	DC.	LC	Indigenous

Asteraceae	*Helichrysum aureonitens*	Sch.Bip.	LC	Indigenous
Asteraceae	*Helichrysum caespititium*	(DC.) Harv.	LC	Indigenous
Asteraceae	*Helichrysum callicomum*	Harv.	LC	Indigenous
Asteraceae	*Helichrysum cerastioides var. cerastioides*	DC.	LC	Indigenous
Asteraceae	*Helichrysum kraussii*	Sch.Bip.	LC	Indigenous
Asteraceae	*Helichrysum nudifolium var. nudifolium*	(L.) Less.	LC	Indigenous
Asteraceae	*Helichrysum paronychioides*	DC.	LC	Indigenous
Asteraceae	*Helichrysum rugulosum*	Less.	LC	Indigenous
Asteraceae	*Helichrysum setosum*	Harv.	LC	Indigenous
Poaceae	*Helictotrichon turgidulum*	(Stapf) Schweick.	LC	Indigenous
Rhamnaceae	*Helinus integrifolius*	(Lam.) Kuntze	LC	Indigenous
Boraginaceae	*Heliotropium ciliatum*	Kaplan	LC	Indigenous
Malvaceae	*Hermannia cordata*	(E.Mey. ex E.Phillips) De Winter	LC	Indigenous; Endemic
Malvaceae	*Hermannia floribunda*	Harv.	LC	Indigenous
Malvaceae	*Hermannia grandistipula*	(Buchinger ex Hochst.) K.Schum.	LC	Indigenous
Malvaceae	*Hermannia lancifolia*	Szyszyl.	LC	Indigenous; Endemic
Malvaceae	*Hermannia quartiniana*	A.Rich.	LC	Indigenous
Apiaceae	*Heteromorpha arborescens var. abyssinica*	(Spreng.) Cham. & Schltdl.	LC	Indigenous
Malvaceae	*Hibiscus calyphyllus*	Cav.	LC	Indigenous
Malvaceae	*Hibiscus microcarpus*	Garcke	LC	Indigenous
Malvaceae	*Hibiscus pusillus*	Thunb.	LC	Indigenous
Poaceae	*Hyparrhenia hirta*	(L.) Stapf	LC	Indigenous
Hypericaceae	*Hypericum lalandii*	Choisy	LC	Indigenous
Asteraceae	*Hypochaeris brasiliensis*	(Less.) Griseb.		Not Indigenous; Naturalised
Acanthaceae	*Hypoestes forskaolii*	(Vahl) R.Br.		Indigenous
Hypoxidaceae	*Hypoxis argentea var. argentea*	Harv. ex Baker	LC	Indigenous
Asteraceae	*Ifloga glomerata*	(Harv.) Schltr.	LC	Indigenous
Fabaceae	*Indigofera comosa*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera cryptantha var. cryptantha*	Benth. ex Harv.	LC	Indigenous
Fabaceae	*Indigofera daleoides var. daleoides*	Benth. ex	NE	Indigenous

		Harv.		
Fabaceae	*Indigofera filipes*	Benth. ex Harv.	LC	Indigenous
Fabaceae	*Indigofera heterotricha*	DC.	LC	Indigenous
Fabaceae	*Indigofera zeyheri*	Spreng. ex Eckl. & Zeyh.	LC	Indigenous
Convolvulaceae	*Ipomoea magnusiana*	Schinz	LC	Indigenous
Convolvulaceae	*Ipomoea oblongata*	E.Mey. ex Choisy	LC	Indigenous
Convolvulaceae	*Ipomoea obscura var. obscura*	(L.) Ker Gawl.	LC	Indigenous
Convolvulaceae	*Ipomoea oenotherae var. oenotherae*	(Vatke) Hallier f.	LC	Indigenous
Cyperaceae	*Isolepis fluitans var. fluitans*	(L.) R.Br.	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia burkeana*	(Benth.) Hilliard	LC	Indigenous
Scrophulariaceae	*Jamesbrittenia sp.*			
Juncaceae	*Juncus effusus*	L.	LC	Indigenous
Crassulaceae	*Kalanchoe rotundifolia*	(Haw.) Haw.		Indigenous
Asphodelaceae	*Kniphofia sp.*			
Asphodelaceae	*Kniphofia typhoides*	Codd	NT	Indigenous; Endemic
Cyperaceae	*Kyllinga erecta var. erecta*	Schumach.	LC	Indigenous
Asteraceae	*Lactuca inermis*	Forssk.	LC	Indigenous
Verbenaceae	*Lantana rugosa*	Thunb.		Indigenous
Thymelaeaceae	*Lasiosiphon burchellii*	Meisn.	LC	Indigenous; Endemic
Hyacinthaceae	*Ledebouria cooperi*	(Hook.f.) Jessop		Indigenous
Hyacinthaceae	*Ledebouria floribunda*	(Baker) Jessop		Indigenous
Hyacinthaceae	*Ledebouria luteola*	Jessop	LC	Indigenous
Hyacinthaceae	*Ledebouria marginata*	(Baker) Jessop	LC	Indigenous
Lemnaceae	*Lemna gibba*	L.		Indigenous
Fabaceae	*Leobordea eriantha*	(Benth.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Lamiaceae	*Leonotis schinzii*	Gürke	LC	Indigenous
Oleaceae	*Ligustrum lucidum*	W.T.Aiton		Not Indigenous; Cultivated; Naturalised; Invasive
Limeaceae	*Limeum pauciflorum*	Moq.	LC	Indigenous; Endemic

Limeaceae	*Limeum viscosum subsp. viscosum*	(J.Gay) Fenzl	NE	Indigenous
Scrophulariaceae	*Limosella longiflora*	Kuntze	LC	Indigenous
Scrophulariaceae	*Limosella sp.*			
Linderniaceae	*Linderniella nana*	(Engl.) Eb.Fisch., Schäferh. & Kai Müll.		Indigenous
Linaceae	*Linum thunbergii*	Eckl. & Zeyh.	LC	Indigenous
Verbenaceae	*Lippia scaberrima*	Sond.		Indigenous
Fabaceae	*Listia heterophylla*	E.Mey.	LC	Indigenous
Fabaceae	*Listia subulata*	(B.-E.van Wyk) B.-E.van Wyk & Boatwr.	LC	Indigenous; Endemic
Lobeliaceae	*Lobelia erinus*	L.	LC	Indigenous
Lobeliaceae	*Lobelia sonderiana*	(Kuntze) Lammers	LC	Indigenous
Poaceae	*Loudetia simplex*	(Nees) C.E.Hubb.	LC	Indigenous
Scrophulariaceae	*Manulea buchneroides*	Hilliard & B.L.Burtt	LC	Indigenous
Marsileaceae	*Marsilea capensis*	A.Braun	LC	Indigenous
Marsileaceae	*Marsilea macrocarpa*	C.Presl	LC	Indigenous
Celastraceae	*Maytenus undata*	(Thunb.) Blakelock	LC	Indigenous
Malvaceae	*Melhania prostrata*	DC.	LC	Indigenous
Poaceae	*Melinis repens subsp. repens*	(Willd.) Zizka	LC	Indigenous
Fabaceae	*Melolobium calycinum*	Benth.	LC	Indigenous
Lamiaceae	*Mentha longifolia subsp. polyadena*	(L.) Huds.	LC	Indigenous
Phrymaceae	*Mimulus gracilis*	R.Br.	LC	Indigenous
Nyctaginaceae	*Mirabilis jalapa*	L.		Not Indigenous; Naturalised; Invasive
Apocynaceae	*Miraglossum laeve*	Kupicha	CR	Indigenous; Endemic
Anemiaceae	*Mohria vestita*	Baker	LC	Indigenous
Lobeliaceae	*Monopsis decipiens*	(Sond.) Thulin	LC	Indigenous
Geraniaceae	*Monsonia angustifolia*	E.Mey. ex A.Rich.	LC	Indigenous
Geraniaceae	*Monsonia burkeana*	Planch. ex Harv.	LC	Indigenous
Iridaceae	*Moraea pallida*	(Baker) Goldblatt	LC	Indigenous
Iridaceae	*Moraea simulans*	Baker	LC	Indigenous

Fabaceae	*Mundulea sericea subsp. sericea*	(Willd.) A.Chev.	LC	Indigenous
Haloragaceae	*Myriophyllum aquaticum*	(Vell.) Verdc.		Not Indigenous; Naturalised; Invasive
Haloragaceae	*Myriophyllum spicatum*	L.		Not Indigenous; Naturalised; Invasive
Myrothamnaceae	*Myrothamnus flabellifolius*	Welw.	DD	Indigenous
Aizoaceae	*Nananthus vittatus*	(N.E.Br.) Schwantes	DD	Indigenous; Endemic
Scrophulariaceae	*Nemesia fruticans*	(Thunb.) Benth.	LC	Indigenous
Fabaceae	*Neorautanenia ficifolia*	(Benth. ex Harv.) C.A.Sm.	LC	Indigenous
Lythraceae	*Nesaea schinzii*	Koehne		Indigenous
Asteraceae	*Nidorella anomala*	Steetz	LC	Indigenous; Endemic
Asteraceae	*Nidorella hottentotica*	DC.	LC	Indigenous
Asteraceae	*Nidorella resedifolia subsp. resedifolia*	DC.	LC	Indigenous
Alliaceae	*Nothoscordum borbonicum*	Kunth	NE	Not Indigenous; Naturalised; Invasive
Stilbaceae	*Nuxia congesta*	R.Br. ex Fresen.	LC	Indigenous
Nymphaeaceae	*Nymphaea nouchali var. zanzibariensis*	Burm.f.		Indigenous
Ochnaceae	*Ochna pulchra*	Hook.f.	LC	Indigenous
Lamiaceae	*Ocimum angustifolium*	Benth.	LC	Indigenous
Lamiaceae	*Ocimum obovatum subsp. obovatum*	E.Mey. ex Benth.	NE	Indigenous
Onagraceae	*Oenothera tetraptera*	Cav.		Not Indigenous; Naturalised
Oleaceae	*Olea europaea subsp. cuspidata*	L.		Indigenous
Oliniaceae	*Olinia emarginata*	Burtt Davy	LC	Indigenous
Asteraceae	*Oocephala staehelinoides*	(Harv.) H.Rob. & Skvarla		Indigenous; Endemic
Ophioglossaceae	*Ophioglossum costatum*	R.Br.	LC	Indigenous
Ophioglossaceae	*Ophioglossum polyphyllum var. polyphyllum*	A.Braun	LC	Indigenous
Cactaceae	*Opuntia ficus-indica*	(L.) Mill.	NE	Not Indigenous; Cultivated; Naturalised; Invasive

Cactaceae	*Opuntia spinulifera*	Salm-Dyck	NE	Not Indigenous; Cultivated; Naturalised; Invasive
Hyacinthaceae	*Ornithogalum flexuosum*	(Thunb.) U.Müll.-Doblies & D.Müll.-Doblies		Indigenous
Hyacinthaceae	*Ornithogalum juncifolium var. juncifolium*	Jacq.		Indigenous
Asteraceae	*Osteospermum muricatum subsp. muricatum*	E.Mey. ex DC.	LC	Indigenous
Asteraceae	*Osteospermum scariosum var. scariosum*	DC.	NE	Indigenous
Oxalidaceae	*Oxalis corniculata*	L.		Not Indigenous; Naturalised; Invasive
Oxalidaceae	*Oxalis depressa*	Eckl. & Zeyh.	LC	Indigenous
Poaceae	*Panicum coloratum*	L.	LC	Indigenous
Poaceae	*Panicum schinzii*	Hack.	LC	Indigenous
Poaceae	*Panicum volutans*	J.G.Anderson	LC	Indigenous; Endemic
Sapindaceae	*Pappea capensis*	Eckl. & Zeyh.		Indigenous
Poaceae	*Paspalum dilatatum*	Poir.	NE	Not Indigenous; Naturalised
Poaceae	*Paspalum distichum*	L.	LC	Indigenous
Rubiaceae	*Pavetta zeyheri subsp. zeyheri*	Sond.	LC	Indigenous
Malvaceae	*Pavonia burchellii*	(DC.) R.A.Dyer	LC	Indigenous
Fabaceae	*Pearsonia cajanifolia subsp. cajanifolia*	(Harv.) Polhill	LC	Indigenous; Endemic
Fabaceae	*Pearsonia sessilifolia subsp. sessilifolia*	(Harv.) Dümmer	LC	Indigenous
Fabaceae	*Pearsonia uniflora*	(Kensit) Polhill	LC	Indigenous
Geraniaceae	*Pelargonium dolomiticum*	R.Knuth	LC	Indigenous; Endemic
Geraniaceae	*Pelargonium nelsonii*	Burtt Davy	LC	Indigenous; Endemic
Pteridaceae	*Pellaea calomelanos*	(Sw.) Link		Indigenous
Apocynaceae	*Pentarrhinum insipidum*	E.Mey.	LC	Indigenous
Cucurbitaceae	*Peponium caledonicum*	(Sond.) Engl.	LC	Indigenous
Polygonaceae	*Persicaria amphibia*	(L.) Gray	LC	Not Indigenous; Naturalised
Polygonaceae	*Persicaria madagascariensis*	(Meisn.) S.Ortiz &		Indigenous

		Paiva		
Poaceae	*Phragmites australis*	(Cav.) Steud.	LC	Indigenous
Asteraceae	*Phymaspermum athanasioides*	(S.Moore) Källersjö	LC	Indigenous
Solanaceae	*Physalis angulata*	L.		Not Indigenous; Naturalised; Invasive
Phytolaccaceae	*Phytolacca heptandra*	Retz.	LC	Indigenous
Pinaceae	*Pinus sp.*			
Asteraceae	*Platycarphella parvifolia*	(S.Moore) V.A.Funk & H.Rob.	LC	Indigenous; Endemic
Lamiaceae	*Plectranthus ramosior*	(Benth.) Van Jaarsv.	LC	Indigenous; Endemic
Plumbaginaceae	*Plumbago auriculata*	Lam.	LC	Indigenous
Plumbaginaceae	*Plumbago zeylanica*	L.		Not Indigenous; Naturalised
Caryophyllaceae	*Pollichia campestris*	Aiton		Indigenous
Polygalaceae	*Polygala amatymbica*	Eckl. & Zeyh.	LC	Indigenous
Polygalaceae	*Polygala gracilenta*	Burtt Davy	LC	Indigenous
Polygalaceae	*Polygala hottentotta*	C.Presl	LC	Indigenous
Polygalaceae	*Polygala transvaalensis subsp. transvaalensis*	Chodat	LC	Indigenous
Poaceae	*Polypogon monspeliensis*	(L.) Desf.	NE	Not Indigenous; Naturalised
Potamogetonaceae	*Potamogeton crispus*	L.	LC	Indigenous
Potamogetonaceae	*Potamogeton nodosus*	Poir.	LC	Indigenous
Potamogetonaceae	*Potamogeton pectinatus*	L.	LC	Indigenous
Potamogetonaceae	*Potamogeton schweinfurthii*	A.Benn.	LC	Indigenous
Verbenaceae	*Priva meyeri var. meyeri*	Jaub. & Spach		Indigenous
Proteaceae	*Protea caffra subsp. caffra*	Meisn.	LC	Indigenous
Asteraceae	*Pseudognaphalium oligandrum*	(DC.) Hilliard & B.L.Burtt	LC	Indigenous
Malvaceae	*Radyera urens*	(L.f.) Bullock	LC	Indigenous
Ranunculaceae	*Ranunculus dregei*	J.C.Manning & Goldblatt	LC	Indigenous
Ranunculaceae	*Ranunculus multifidus*	Forssk.	LC	Indigenous
Ranunculaceae	*Ranunculus trichophyllus*	Chaix	LC	Indigenous
Vitaceae	*Rhoicissus tridentata subsp. cuneifolia*	(L.f.) Wild & R.B.Drumm.		Indigenous
Fabaceae	*Rhynchosia nervosa var. nervosa*	Benth. ex Harv.	LC	Indigenous
Ricciaceae	*Riccia atropurpurea*	Sim		Indigenous

Ricciaceae	*Riccia cavernosa*	Hoffm.		Indigenous
Ricciaceae	*Riccia okahandjana*	S.W.Arnell		Indigenous
Brassicaceae	*Rorippa nudiuscula*	Thell.	LC	Indigenous
Rubiaceae	*Rubia horrida*	(Thunb.) Puff	LC	Indigenous
Rubiaceae	*Rubia petiolaris*	DC.	LC	Indigenous
Acanthaceae	*Ruellia patula*	Jacq.		Indigenous
Polygonaceae	*Rumex crispus*	L.		Not Indigenous; Naturalised; Invasive
Polygonaceae	*Rumex lanceolatus*	Thunb.	LC	Indigenous
Polygonaceae	*Rumex sagittatus*	Thunb.	LC	Indigenous
Polygonaceae	*Rumex woodii*	N.E.Br.	LC	Indigenous
Aizoaceae	*Ruschia sp.*			
Celastraceae	*Salacia rehmannii*	Schinz	LC	Indigenous; Endemic
Salicaceae	*Salix babylonica*	L.		Not Indigenous; Naturalised; Invasive
Dipsacaceae	*Scabiosa columbaria*	L.	LC	Indigenous
Amaryllidaceae	*Scadoxus puniceus*	(L.) Friis & Nordal	LC	Indigenous
Asteraceae	*Schistostephium crataegifolium*	(DC.) Fenzl ex Harv.	LC	Indigenous
Asteraceae	*Schkuhria pinnata*	(Lam.) Kuntze ex Thell.		Not Indigenous; Naturalised
Cyperaceae	*Schoenoplectus decipiens*	(Nees) J.Raynal	LC	Indigenous
Cyperaceae	*Schoenoplectus muricinux*	(C.B.Clarke) J.Raynal	LC	Indigenous
Cyperaceae	*Scirpoides burkei*	(C.B.Clarke) Goetgh., Muasya & D.A.Simpson	LC	Indigenous
Salicaceae	*Scolopia zeyheri*	(Nees) Harv.	LC	Indigenous
Anacardiaceae	*Searsia dentata*	(Thunb.) F.A.Barkley		Indigenous
Anacardiaceae	*Searsia leptodictya forma leptodictya*	(Diels) T.S.Yi, A.J.Mill. & J.Wen		Indigenous
Anacardiaceae	*Searsia rigida var. margaretae*	(Mill.) F.A.Barkley		Indigenous
Gentianaceae	*Sebaea sedoides var. schoenlandii*	Gilg	LC	Indigenous
Selaginellaceae	*Selaginella dregei*	(C.Presl) Hieron.		Indigenous

Scrophulariaceae	*Selago densiflora*	Rolfe	LC	Indigenous
Scrophulariaceae	*Selago sp.*			
Asteraceae	*Senecio hieracioides*	DC.	LC	Indigenous
Asteraceae	*Senecio inaequidens*	DC.	LC	Indigenous
Asteraceae	*Senecio inornatus*	DC.	LC	Indigenous
Asteraceae	*Senecio polyodon var. polyodon*	DC.	LC	Indigenous
Asteraceae	*Senecio serratuloides*	DC.	LC	Indigenous
Poaceae	*Setaria nigrirostris*	(Nees) T.Durand & Schinz	LC	Indigenous
Poaceae	*Setaria pumila*	(Poir.) Roem. & Schult.	LC	Indigenous
Poaceae	*Setaria sphacelata var. sericea*	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous
Poaceae	*Setaria sphacelata var. torta*	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous
Poaceae	*Setaria verticillata*	(L.) P.Beauv.	LC	Indigenous
Malvaceae	*Sida chrysantha*	Ulbr.	LC	Indigenous
Malvaceae	*Sida dregei*	Burtt Davy	LC	Indigenous
Malvaceae	*Sida rhombifolia subsp. rhombifolia*	L.	LC	Indigenous
Caryophyllaceae	*Silene undulata*	Aiton		Indigenous
Solanaceae	*Solanum catombelense*	Peyr.	LC	Indigenous
Solanaceae	*Solanum lichtensteinii*	Willd.	LC	Indigenous
Solanaceae	*Solanum sisymbriifolium*	Lam.		Not Indigenous; Naturalised; Invasive
Solanaceae	*Solanum supinum var. supinum*	Dunal	LC	Indigenous
Solanaceae	*Solanum tomentosum var. coccineum*	L.	LC	Indigenous; Endemic
Asteraceae	*Sonchus asper subsp. asper*	(L.) Hill		Not Indigenous; Naturalised; Invasive
Malvaceae	*Sphaeralcea bonariensis*	(Cav.) Griseb.		Not Indigenous; Naturalised
Malpighiaceae	*Sphedamnocarpus pruriens subsp. galphimiifolius*	(A.Juss.) Szyszyl.	LC	Indigenous
Lemnaceae	*Spirodela polyrhiza*	(L.) Schleid.		Indigenous
Poaceae	*Sporobolus discosporus*	Nees	LC	Indigenous
Poaceae	*Sporobolus festivus*	Hochst. ex A.Rich.	LC	Indigenous
Poaceae	*Sporobolus ioclados*	(Trin.) Nees	LC	Indigenous

Lamiaceae	*Stachys hyssopoides*	Burch. ex Benth.	LC	Indigenous
Orobanchaceae	*Striga bilabiata subsp. bilabiata*	(Thunb.) Kuntze	LC	Indigenous
Orobanchaceae	*Striga elegans*	Benth.	LC	Indigenous
Asteraceae	*Tagetes minuta*	L.		Not Indigenous; Naturalised; Invasive
Fabaceae	*Tephrosia capensis var. capensis*	(Jacq.) Pers.	LC	Indigenous
Lamiaceae	*Teucrium trifidum*	Retz.	LC	Indigenous
Poaceae	*Themeda triandra*	Forssk.	LC	Indigenous
Acanthaceae	*Thunbergia neglecta*	Sond.	LC	Indigenous
Asphodelaceae	*Trachyandra erythrorrhiza*	(Conrath) Oberm.	LC	Indigenous; Endemic
Asphodelaceae	*Trachyandra saltii var. saltii*	(Baker) Oberm.	LC	Indigenous
Euphorbiaceae	*Tragia rupestris*	Sond.	LC	Indigenous
Asteraceae	*Tragopogon dubius*	Scop.		Not Indigenous; Naturalised
Aizoaceae	*Trianthema salsoloides var. transvaalensis*	Fenzl ex Oliv.	LC	Indigenous
Poaceae	*Trichoneura grandiglumis*	(Nees) Ekman	LC	Indigenous
Pottiaceae	*Trichostomum brachydontium*	Bruch		Indigenous
Fabaceae	*Trifolium medium var. medium*	L.	NE	Not Indigenous; Naturalised
Poaceae	*Triraphis andropogonoides*	(Steud.) E.Phillips	LC	Indigenous
Alliaceae	*Tulbaghia leucantha*	Baker	LC	Indigenous
Typhaceae	*Typha capensis*	(Rohrb.) N.E.Br.		Indigenous
Poaceae	*Urochloa panicoides*	P.Beauv.	LC	Indigenous
Asteraceae	*Ursinia nana subsp. leptophylla*	DC.	LC	Indigenous
Fabaceae	*Vachellia borleae*	(Burtt Davy) Kyal. & Boatwr.	LC	Indigenous
Fabaceae	*Vachellia karroo*	(Hayne) Banfi & Gallaso	LC	Indigenous
Fabaceae	*Vachellia robusta subsp. robusta*	(Burch.) Kyal. & Boatwr.	LC	Indigenous
Vahliaceae	*Vahlia capensis subsp. vulgaris*	(L.f.) Thunb.		Indigenous
Vahliaceae	*Vahlia capensis subsp. vulgaris*	(L.f.) Thunb.		Indigenous
Rubiaceae	*Vangueria infausta subsp. infausta*	Burch.	LC	Indigenous
Verbenaceae	*Verbena brasiliensis*	Vell.		Not Indigenous; Naturalised; Invasive

Fabaceae	*Vigna unguiculata subsp. stenophylla*	(L.) Walp.	LC	Indigenous
Campanulaceae	*Wahlenbergia krebsii subsp. krebsii*	Cham.	LC	Indigenous
Campanulaceae	*Wahlenbergia undulata*	(L.f.) A.DC.	LC	Indigenous
Campanulaceae	*Wahlenbergia virgata*	Engl.	LC	Indigenous
Asteraceae	*Xanthium strumarium*	L.		Not Indigenous; Naturalised; Invasive
Xyridaceae	*Xyris capensis*	Thunb.		Indigenous
Scrophulariaceae	*Zaluzianskya elongata*	Hilliard & B.L.Burtt	LC	Indigenous
Asteraceae	*Zinnia peruviana*	(L.) L.		Not Indigenous; Naturalised
Rhamnaceae	*Ziziphus mucronata subsp. mucronata*	Willd.		Indigenous
Rhamnaceae	*Ziziphus zeyheriana*	Sond.		Indigenous

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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Accipiter melanoleucus	Sparrowhawk, Black	Unlisted	LC
Accipiter minullus	Sparrowhawk, Little	Unlisted	LC
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus arundinaceus	Reed-warbler, Great	Unlisted	LC
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted
Acrocephalus gracilirostris	Swamp-warbler, Lesser	Unlisted	LC
Acrocephalus palustris	Warbler, Marsh	Unlisted	LC
Acrocephalus schoenobaenus	Warbler, Sedge	Unlisted	LC
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Actophilornis africanus	Jacana, African	Unlisted	LC
Afrotis afraoides	Korhaan, Northern Black	Unlisted	LC
Alcedo cristata	Kingfisher, Malachite	Unlisted	Unlisted
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Amadina erythrocephala	Finch, Red-headed	Unlisted	LC
Amandava subflava	Waxbill, Orange-breasted	Unlisted	Unlisted
Amaurornis flavirostris	Crake, Black	Unlisted	LC
Amblyospiza albifrons	Weaver, Thick-billed	Unlisted	LC
Anas capensis	Teal, Cape	Unlisted	LC
Anas erythrorhyncha	Teal, Red-billed	Unlisted	LC
Anas hottentota	Teal, Hottentot	Unlisted	LC
Anas platyrhynchos	Duck, Mallard	Unlisted	LC
Anas smithii	Shoveler, Cape	Unlisted	LC
Anas sparsa	Duck, African Black	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anastomus lamelligerus	Openbill, African	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Anser anser	Goose, Domestic	Unlisted	LC
Anthoscopus minutus	Penduline-tit, Cape	Unlisted	LC
Anthropoides paradiseus	Crane, Blue	NT	VU
Anthus cinnamomeus	Pipit, African	Unlisted	LC
Anthus leucophrys	Pipit, Plain-backed	Unlisted	LC
Anthus similis	Pipit, Long-billed	Unlisted	LC
Anthus vaalensis	Pipit, Buffy	Unlisted	LC
Apalis thoracica	Apalis, Bar-throated	Unlisted	LC

Apus affinis	Swift, Little	Unlisted	LC
Apus apus	Swift, Common	Unlisted	LC
Apus barbatus	Swift, African Black	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Apus horus	Swift, Horus	Unlisted	LC
Aquila spilogaster	Hawk-eagle, African	Unlisted	LC
Aquila verreauxii	Eagle, Verreaux's	VU	LC
Ardea cinerea	Heron, Grey	Unlisted	LC
Ardea goliath	Heron, Goliath	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Ardeola ralloides	Heron, Squacco	Unlisted	LC
Asio capensis	Owl, Marsh	Unlisted	LC
Aviceda cuculoides	Hawk, African Cuckoo	Unlisted	LC
Balearica regulorum	Crane, Grey Crowned	EN	EN
Batis molitor	Batis, Chinspot	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bradornis mariquensis	Flycatcher, Marico	Unlisted	LC
Bradypterus baboecala	Rush-warbler, Little	Unlisted	LC
Bubo africanus	Eagle-owl, Spotted	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Buteo vulpinus	Buzzard, Steppe	Unlisted	Unlisted
Butorides striata	Heron, Green-backed	Unlisted	LC
Calandrella cinerea	Lark, Red-capped	Unlisted	LC
Calendulauda sabota	Lark, Sabota	Unlisted	LC
Calidris ferruginea	Sandpiper, Curlew	LC	NT
Calidris minuta	Stint, Little	LC	LC
Campethera abingoni	Woodpecker, Golden-tailed	Unlisted	LC
Caprimulgus rufigena	Nightjar, Rufous-cheeked	Unlisted	LC
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Centropus superciliosus	Coucal, White-browed	Unlisted	LC
Cercomela familiaris	Chat, Familiar	Unlisted	LC
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Cercotrichas paena	Scrub-robin, Kalahari	Unlisted	LC
Certhilauda curvirostris	Lark, Cape Long-billed	Unlisted	LC
Certhilauda semitorquata	Lark, Eastern Long-billed	Unlisted	LC
Certhilauda subcoronata	Lark, Karoo Long-billed	Unlisted	LC

Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Chalcomitra amethystina	Sunbird, Amethyst	Unlisted	LC
Charadrius hiaticula	Plover, Common Ringed	Unlisted	LC
Charadrius pecuarius	Plover, Kittlitz's	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chersomanes albofasciata	Lark, Spike-heeled	Unlisted	LC
Chlidonias hybrida	Tern, Whiskered	Unlisted	LC
Chlidonias leucopterus	Tern, White-winged	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Chrysococcyx klaas	Cuckoo, Klaas's	Unlisted	LC
Ciconia abdimii	Stork, Abdim's	NT	LC
Ciconia ciconia	Stork, White	Unlisted	LC
Cinnyricinclus leucogaster	Starling, Violet-backed	Unlisted	LC
Cinnyris afer	Sunbird, Greater Double-collared	Unlisted	LC
Cinnyris talatala	Sunbird, White-bellied	Unlisted	LC
Circaetus cinereus	Snake-eagle, Brown	Unlisted	LC
Circaetus pectoralis	Snake-eagle, Black-chested	Unlisted	LC
Circus macrourus	Harrier, Pallid	NT	NT
Circus ranivorus	Marsh-harrier, African	EN	LC
Cisticola aberrans	Cisticola, Lazy	Unlisted	LC
Cisticola aridulus	Cisticola, Desert	Unlisted	LC
Cisticola ayresii	Cisticola, Wing-snapping	Unlisted	LC
Cisticola chiniana	Cisticola, Rattling	Unlisted	LC
Cisticola cinnamomeus	Cisticola, Pale-crowned	Unlisted	LC
Cisticola fulvicapilla	Neddicky, Neddicky	Unlisted	LC
Cisticola juncidis	Cisticola, Zitting	Unlisted	LC
Cisticola lais	Cisticola, Wailing	Unlisted	LC
Cisticola textrix	Cisticola, Cloud	Unlisted	LC
Cisticola tinniens	Cisticola, Levaillant's	Unlisted	LC
Clamator jacobinus	Cuckoo, Jacobin	Unlisted	LC
Colius colius	Mousebird, White-backed	Unlisted	LC
Colius striatus	Mousebird, Speckled	Unlisted	LC
Columba arquatrix	Olive-pigeon, African	Unlisted	LC
Columba guinea	Pigeon, Speckled	Unlisted	LC
Columba livia	Dove, Rock	Unlisted	LC
Coracias caudatus	Roller, Lilac-breasted	Unlisted	LC
Coracias garrulus	Roller, European	NT	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corvus capensis	Crow, Cape	Unlisted	LC

Corythaixoides concolor	Go-away-bird, Grey	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Coturnix coturnix	Quail, Common	Unlisted	LC
Creatophora cinerea	Starling, Wattled	Unlisted	LC
Crithagra atrogularis	Canary, Black-throated	Unlisted	LC
Crithagra flaviventris	Canary, Yellow	Unlisted	LC
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC
Crithagra mozambica	Canary, Yellow-fronted	Unlisted	LC
Cuculus solitarius	Cuckoo, Red-chested	Unlisted	LC
Cypsiurus parvus	Palm-swift, African	Unlisted	LC
Delichon urbicum	House-martin, Common	Unlisted	LC
Dendrocygna bicolor	Duck, Fulvous	Unlisted	LC
Dendrocygna viduata	Duck, White-faced Whistling	Unlisted	LC
Dendropicos fuscescens	Woodpecker, Cardinal	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Dryoscopus cubla	Puffback, Black-backed	Unlisted	LC
Egretta alba	Egret, Great	Unlisted	LC
Egretta ardesiaca	Heron, Black	Unlisted	LC
Egretta garzetta	Egret, Little	Unlisted	LC
Egretta intermedia	Egret, Yellow-billed	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Emberiza capensis	Bunting, Cape	Unlisted	LC
Emberiza flaviventris	Bunting, Golden-breasted	Unlisted	LC
Emberiza impetuani	Bunting, Lark-like	Unlisted	LC
Emberiza tahapisi	Bunting, Cinnamon-breasted	Unlisted	LC
Eremomela icteropygialis	Eremomela, Yellow-bellied	Unlisted	LC
Eremopterix leucotis	Sparrowlark, Chestnut-backed	Unlisted	LC
Eremopterix verticalis	Sparrowlark, Grey-backed	Unlisted	LC
Estrilda astrild	Waxbill, Common	Unlisted	LC
Estrilda erythronotos	Waxbill, Black-faced	Unlisted	LC
Euplectes afer	Bishop, Yellow-crowned	Unlisted	LC
Euplectes albonotatus	Widowbird, White-winged	Unlisted	LC
Euplectes ardens	Widowbird, Red-collared	Unlisted	LC
Euplectes capensis	Bishop, Yellow	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Eupodotis caerulescens	Korhaan, Blue	LC	NT
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC
Falco amurensis	Falcon, Amur	Unlisted	LC

Falco biarmicus	Falcon, Lanner	VU	LC
Falco naumanni	Kestrel, Lesser	Unlisted	LC
Falco peregrinus	Falcon, Peregrine	Unlisted	LC
Falco rupicoloides	Kestrel, Greater	Unlisted	LC
Falco rupicolus	Kestrel, Rock	Unlisted	LC
Falco vespertinus	Falcon, Red-footed	NT	NT
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallinago nigripennis	Snipe, African	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Glareola nordmanni	Pratincole, Black-winged	NT	NT
Granatina granatina	Waxbill, Violet-eared	Unlisted	LC
Halcyon albiventris	Kingfisher, Brown-hooded	Unlisted	LC
Halcyon senegalensis	Kingfisher, Woodland	Unlisted	LC
Haliaeetus vocifer	Fish-eagle, African	Unlisted	LC
Himantopus himantopus	Stilt, Black-winged	Unlisted	LC
Hippolais icterina	Warbler, Icterine	Unlisted	LC
Hirundo abyssinica	Swallow, Lesser Striped	Unlisted	LC
Hirundo albigularis	Swallow, White-throated	Unlisted	LC
Hirundo cucullata	Swallow, Greater Striped	Unlisted	LC
Hirundo dimidiata	Swallow, Pearl-breasted	Unlisted	LC
Hirundo fuligula	Martin, Rock	Unlisted	Unlisted
Hirundo rustica	Swallow, Barn	Unlisted	LC
Hirundo semirufa	Swallow, Red-breasted	Unlisted	LC
Hirundo spilodera	Cliff-swallow, South African	Unlisted	LC
Indicator indicator	Honeyguide, Greater	Unlisted	LC
Indicator minor	Honeyguide, Lesser	Unlisted	LC
Ixobrychus minutus	Bittern, Little	Unlisted	LC
Jynx ruficollis	Wryneck, Red-throated	Unlisted	LC
Lagonosticta rhodopareia	Firefinch, Jameson's	Unlisted	LC
Lagonosticta rubricata	Firefinch, African	Unlisted	LC
Lagonosticta senegala	Firefinch, Red-billed	Unlisted	LC
Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Laniarius atrococcineus	Shrike, Crimson-breasted	Unlisted	LC
Laniarius ferrugineus	Boubou, Southern	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lanius collurio	Shrike, Red-backed	Unlisted	LC
Lanius minor	Shrike, Lesser Grey	Unlisted	LC
Larus cirrocephalus	Gull, Grey-headed	Unlisted	LC
Locustella fluviatilis	Warbler, River	Unlisted	LC

Lophaetus occipitalis	Eagle, Long-crested	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Megaceryle maximus	Kingfisher, Giant	Unlisted	Unlisted
Melierax canorus	Goshawk, Southern Pale Chanting	Unlisted	LC
Merops apiaster	Bee-eater, European	Unlisted	LC
Merops bullockoides	Bee-eater, White-fronted	Unlisted	LC
Merops hirundineus	Bee-eater, Swallow-tailed	Unlisted	LC
Merops pusillus	Bee-eater, Little	Unlisted	LC
Milvus aegyptius	Kite, Yellow-billed	Unlisted	Unlisted
Milvus migrans	Kite, Black	Unlisted	LC
Mirafra africana	Lark, Rufous-naped	Unlisted	LC
Mirafra apiata	Lark, Cape Clapper	Unlisted	LC
Mirafra cheniana	Lark, Melodious	LC	NT
Mirafra fasciolata	Lark, Eastern Clapper	Unlisted	LC
Mirafra marjoriae	Lark, Agulhas Clapper	Unlisted	Unlisted
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Motacilla capensis	Wagtail, Cape	Unlisted	LC
Muscicapa striata	Flycatcher, Spotted	Unlisted	LC
Mycteria ibis	Stork, Yellow-billed	EN	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Nectarinia famosa	Sunbird, Malachite	Unlisted	LC
Netta erythrophthalma	Pochard, Southern	Unlisted	LC
Nilaus afer	Brubru	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Nycticorax nycticorax	Night-Heron, Black-crowned	Unlisted	LC
Oena capensis	Dove, Namaqua	Unlisted	LC
Oenanthe monticola	Wheatear, Mountain	Unlisted	LC
Oenanthe pileata	Wheatear, Capped	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Oriolus oriolus	Oriole, Eurasian Golden	Unlisted	LC
Ortygospiza atricollis	Quailfinch, African	Unlisted	LC
Oxyura maccoa	Duck, Maccoa	NT	NT
Pandion haliaetus	Osprey, Osprey	Unlisted	LC
Parisoma subcaeruleum	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
Parus cinerascens	Tit, Ashy	Unlisted	LC
Passer diffusus	Sparrow, Southern Grey-headed	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer griseus	Sparrow, Northern Grey-headed	Unlisted	LC

Passer melanurus	Sparrow, Cape	Unlisted	LC
Pavo cristatus	Peacock, Common	Unlisted	LC
Peliperdix coqui	Francolin, Coqui	Unlisted	LC
Pernis apivorus	Honey-buzzard, European	Unlisted	LC
Petronia superciliaris	Petronia, Yellow-throated	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Phalacrocorax capensis	Cormorant, Cape	EN	EN
Philomachus pugnax	Ruff	Unlisted	LC
Phoeniconaias minor	Flamingo, Lesser	NT	NT
Phoenicopterus ruber	Flamingo, Greater	NT	LC
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Phylloscopus trochilus	Warbler, Willow	Unlisted	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Plocepasser mahali	Sparrow-weaver, White-browed	Unlisted	LC
Ploceus capensis	Weaver, Cape	Unlisted	LC
Ploceus cucullatus	Weaver, Village	Unlisted	LC
Ploceus velatus	Southern Masked-weaver, Southern	Unlisted	LC
Pluvialis squatarola	Plover, Grey	Unlisted	LC
Podiceps cristatus	Grebe, Great Crested	Unlisted	LC
Podiceps nigricollis	Grebe, Black-necked	Unlisted	LC
Polyboroides typus	Harrier-Hawk, African	Unlisted	LC
Porphyrio madagascariensis	Swamphen, African Purple	Unlisted	Unlisted
Prinia flavicans	Prinia, Black-chested	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Prodotiscus regulus	Honeybird, Brown-backed	Unlisted	LC
Psophocichla litsipsirupa	Thrush, Groundscraper	Unlisted	Unlisted
Pternistis natalensis	Spurfowl, Natal	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Pycnonotus nigricans	Bulbul, African Red-eyed	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Pytilia melba	Pytilia, Green-winged	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Rallus caerulescens	Rail, African	Unlisted	LC
Recurvirostra avosetta	Avocet, Pied	Unlisted	LC
Rhinopomastus cyanomelas	Scimitarbill, Common	Unlisted	LC
Rhinoptilus africanus	Courser, Double-banded	Unlisted	LC

Rhinoptilus chalcopterus	Courser, Bronze-winged	Unlisted	LC
Riparia cincta	Martin, Banded	Unlisted	LC
Riparia paludicola	Martin, Brown-throated	Unlisted	LC
Riparia riparia	Martin, Sand	Unlisted	LC
Rostratula benghalensis	Painted-snipe, Greater	NT	LC
Sagittarius serpentarius	Secretarybird	VU	VU
Sarkidiornis melanotos	Duck, Comb	Unlisted	LC
Sarothrura elegans	Flufftail, Buff-spotted	Unlisted	LC
Sarothrura rufa	Flufftail, Red-chested	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scleroptila levaillantoides	Francolin, Orange River	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Spermestes cucullatus	Mannikin, Bronze	Unlisted	Unlisted
Spizocorys conirostris	Lark, Pink-billed	Unlisted	LC
Sporopipes squamifrons	Finch, Scaly-feathered	Unlisted	LC
Spreo bicolor	Starling, Pied	Unlisted	LC
Stenostira scita	Flycatcher, Fairy	Unlisted	LC
Sterna caspia	Tern, Caspian	VU	LC
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia semitorquata	Dove, Red-eyed	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Struthio camelus	Ostrich, Common	Unlisted	LC
Sturnus vulgaris	Starling, Common	Unlisted	LC
Sylvia borin	Warbler, Garden	Unlisted	LC
Sylvia communis	Whitethroat, Common	Unlisted	LC
Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Tachymarptis melba	Swift, Alpine	Unlisted	LC
Tadorna cana	Shelduck, South African	Unlisted	LC
Tchagra australis	Tchagra, Brown-crowned	Unlisted	LC
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Thalassornis leuconotus	Duck, White-backed	Unlisted	LC
Thamnolaea cinnamomeiventris	Cliff-chat, Mocking	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Tockus nasutus	Hornbill, African Grey	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC

Tringa glareola	Sandpiper, Wood	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Tringa stagnatilis	Sandpiper, Marsh	Unlisted	LC
Turdoides jardineii	Babbler, Arrow-marked	Unlisted	LC
Turdus libonyanus	Thrush, Kurrichane	Unlisted	Unlisted
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turdus smithi	Thrush, Karoo	Unlisted	LC
Turnix sylvaticus	Buttonquail, Kurrichane	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Tyto capensis	Grass-owl, African	VU	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Uraeginthus angolensis	Waxbill, Blue	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua chalybeata	Indigobird, Village	Unlisted	LC
Vidua funerea	Indigobird, Dusky	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Vidua paradisaea	Paradise-whydah, Long-tailed	Unlisted	LC
Vidua purpurascens	Indigobird, Purple	Unlisted	LC
Vidua regia	Whydah, Shaft-tailed	Unlisted	LC
Zosterops pallidus	White-eye, Orange River	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

APPENDIX C: *Mammal species expected to occur in the project area*

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aethomys ineptus	Tete Veld Rat	LC	LC
Aethomys namaquensis	Namaqua rock rat	LC	LC
Alcelaphus buselaphus	Hartebeest	LC	LC
Antidorcas marsupialis	Sclater's Shrew	LC	LC
Aonyx capensis	Cape Clawless Otter	NT	NT
Atelerix frontalis	South Africa Hedgehog	NT	LC
Atilax paludinosus	Water Mongoose	LC	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Caracal caracal	Caracal	LC	LC
Ceratotherium simum	White Rhinoceros	NT	NT
Chlorocebus pygerythrus	Vervet Monkey	LC	LC
Connochaetes gnou	Black Wildebeest	LC	LC
Connochaetes taurinus	Blue Wildebeest	LC	LC
Crocidura cyanea	Reddish-grey Musk Shrew	LC	LC
Crocidura maquassiensis	Makwassie musk shrew	VU	LC
Crocidura mariquensis	Swamp Musk Shrew	NT	LC
Cryptomys hottentotus	Common Mole-rat	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Damaliscus pygargus	Blesbok	LC	LC
Desmodillus auricularis	Short-tailed Gerbil	LC	LC
Diceros bicornis	Black Rhinoceros	EN	CR
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT
Elephantulus myurus	Eastern Rock Sengi	LC	LC
Eptesicus hottentotus	Long-tailed Serotine Bat	LC	LC
Equus quagga	Plains Zebra	LC	NT
Felis nigripes	Black-footed Cat	VU	VU
Felis silvestris	African Wildcat	LC	LC
Genetta genetta	Small-spotted Genet	LC	LC
Gerbilliscus brantsii	Highveld Gerbil	LC	LC
Gerbilliscus leucogaster	Bushveld Gerbil	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hydrictis maculicollis	Spotted-necked Otter	VU	NT
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Ichneumia albicauda	White-tailed Mongoose	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC

Leptailurus serval	Serval	NT	LC
Lepus capensis	Cape Hare	LC	LC
Lepus saxatilis	Scrub Hare	LC	LC
Lepus victoriae	African Savanna Hare	LC	LC
Mastomys coucha	Multimammate Mouse	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mungos mungo	Banded Mongoose	LC	LC
Mus musculus	House Mouse	Unlisted	LC
Myotis tricolor	Temminck's Hairy Bat	LC	LC
Myotis welwitschii	Welwitsch's Hairy Bat	LC	LC
Mystromys albicaudatus	White-tailed Rat	VU	EN
Neoromicia capensis	Cape Serotine Bat	LC	LC
Neoromicia zuluensis	Aloe Bat	LC	LC
Nycteris thebaica	Egyptian Slit-faced Bat	LC	LC
Orycteropus afer	Aardvark	LC	LC
Otocyon megalotis	Bat-eared Fox	LC	LC
Otomys irroratus	Vlei Rat (Fynbos type)	LC	LC
Panthera pardus	Leopard	VU	VU
Papio ursinus	Chacma Baboon	LC	LC
Parahyaena brunnea	Brown Hyaena	NT	NT
Pedetes capensis	Springhare	LC	LC
Phacochoerus africanus	Common Warthog	LC	LC
Poecilogale albinucha	African Striped Weasel	NT	LC
Procavia capensis	Rock Hyrax	LC	LC
Proteles cristata	Aardwolf	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rattus rattus	House Rat	Exotic	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	LC
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	LC
Saccostomus campestris	Pouched Mouse	LC	LC
Scotophilus dinganii	Yellow House Bat	LC	LC
Steatomys krebsii	Krebs's Fat Mouse	LC	LC
Steatomys pratensis	Fat Mouse	LC	LC
Suncus varilla	Lesser Dwarf Shrew	LC	LC
Suricata suricatta	Suricate	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Syncerus caffer	African Buffalo	LC	LC
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC

Thryonomys swinderianus	Greater Cane Rat	LC	LC
Tragelaphus oryx	Eland	LC	LC
Vulpes chama	Cape Fox	LC	LC
Xerus inauris	Cape Ground Squirrel	LC	LC

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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Acontias gracilicauda	Thin-tailed Legless Skink	LC	LC
Afroedura nivaria	Drankensberg Flat Gecko	LC	LC
Afrotyphlops bibronii	Bibron's Blind Snake	LC	LC
Agama atra	Southern Rock Agama	LC	LC
Aparallactus capensis	Black-headed Centipede-eater	LC	LC
Boaedon capensis	Brown House Snake	LC	LC
Causus rhombeatus	Rhombic Night Adder	LC	LC
Chamaeleo dilepis	Common Flap-neck Chameleon	LC	LC
Cordylus vittifer	Common Girdled Lizard	LC	LC
Crotaphopeltis hotamboeia	Red-lipped Snake	LC	Unlisted
Dasypeltis scabra	Common egg eater	LC	LC
Gerrhosaurus flavigularis	Yellow-throated Plated Lizard	LC	Unlisted
Hemachatus haemachatus	Rinkhals	LC	LC
Hemidactylus mabouia	Common Tropical House Gecko	LC	Unlisted
Homoroselaps lacteus	Spotted Harlequin Snake	LC	LC
Lamprophis aurora	Aurora House Snake	LC	LC
Lycodonomorphus rufulus	Brown Water Snake	LC	Unlisted
Lygodactylus capensis	Common Dwarf Gecko	LC	Unlisted
Pachydactylus capensis	Cape Gecko	LC	Unlisted
Panaspis wahlbergii	Wahlberg's Snake-eyed Skink	LC	Unlisted
Pelomedusa galeata	South African Marsh Terrapin	Not evaluated	Unlisted
Philothamnus semivariegatus	Spotted Bush Snake	LC	Unlisted
Prosymna ambigua	Angolan Shovel-snout	Unlisted	LC
Psammophis crucifer	Cross-marked Grass Snake	LC	LC
Psammophylax rhombeatus	Spotted Grass Snake	LC	Unlisted
Psammophylax tritaeniatus	Striped Grass Snake	LC	LC
Python natalensis	Southern African Python	LC	Unlisted
Rhinotyphlops lalandei	Delalamde's Beaked Blind Snake	LC	Unlisted
Stigmochelys pardalis	Leopard Tortoise	LC	LC
Thelotornis capensis	Southern Twig Snake	LC	LC
Trachylepis capensis	Cape Skink	LC	Unlisted
Trachylepis punctatissima	Speckled Rock Skink	LC	LC
Trachylepis varia	Variable Skink	LC	LC
Varanus niloticus	Water Monitor	LC	LC

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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Amietia angolensis	Angola River Frog	LC	LC
Amietia delalandii	Delalande's River Frog	LC	Unlisted
Amietia fuscigula	Cape River Frog	LC	LC
Breviceps adspersus	Bushveld Rain Frog	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC
Chiromantis xerampelina	Southern Foam Nest Frog	LC	LC
Kassina senegalensis	Bubbling Kassina	LC	LC
Phrynobatrachus natalensis	Snoring Puddle Frog	LC	LC
Pyxicephalus adspersus	Giant Bullfrog	NT	LC
Schismaderma carens	African Red Toad	LC	LC
Sclerophrys capensis	Raucous Toad	LC	LC
Sclerophrys garmani	Olive Toad	LC	LC
Sclerophrys gutturalis	Guttural Toad	LC	LC
Sclerophrys poweri	Western Olive Toad	LC	LC
Sclerophrys pusilla	Flatbacked Toad	LC	LC
Semnodactylus wealii	Rattling Frog	LC	LC
Strongylopus fasciatus	Striped Stream Frog	LC	LC
Tomopterna natalensis	Natal Sand Frog	LC	LC
Tomopterna tandyi	Tandy's Sand Frog	LC	LC
Xenopus laevis	Common Platanna	LC	LC