



# THE KANGALA EXTENSION PROJECT

## BIODIVERSITY SCOPING ASSESSMENT

**Delmas, Mpumalanga Province**

August 2018

**CLIENT**



**Prepared by:**

**The Biodiversity Company**

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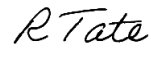
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Report Name	<b>THE KANGALA EXTENSION PROJECT</b>
Reference	<b>Kangala - Biodiversity</b>
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Declaration	<p>The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.</p>



## DOCUMENT GUIDE

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

GNR 326 April 2017	Description	Section in the Report
Specialist Report		
Appendix 6 (a)	A specialist report prepared in terms of these Regulations must contain— details of— i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page i.
Appendix 6 (b)	A declaration that the specialist is independent in a form as may be specified by the competent authority;	Page i
Appendix 6 (c)	An indication of the scope of, and the purpose for which, the report was prepared;	Section 3
Appendix 6 (cA)	<u>An indication of the quality and age of base data used for the specialist report;</u>	Section 6
Appendix 6 (cB)	<u>A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;</u>	N/A – to be finalised
Appendix 6 (d)	The <u>duration</u> , date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A – to be finalised
Appendix 6 (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process <u>inclusive of equipment and modelling used;</u>	Section 5
Appendix 6 (f)	<u>Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a, site plan identifying site alternatives;</u>	N/A – to be finalised
Appendix 6 (g)	An identification of any areas to be avoided, including buffers;	N/A – to be finalised
Appendix 6 (h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A – to be finalised
Appendix 6 (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
Appendix 6 (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity <b>[including identified alternatives on the environment]</b> <u>or activities;</u>	Section 8
Appendix 6 (k)	Any mitigation measures for inclusion in the EMPr;	N/A – to be finalised
Appendix 6 (l)	Any conditions for inclusion in the environmental authorisation;	N/A – to be finalised



GNR 326 April 2017	Description	Section in the Report
Appendix 6 (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A – to be finalised
Appendix 6 (n)	A reasoned opinion— i. <b>[as to]</b> whether the proposed activity, <u>activities</u> or portions thereof should be authorised; <u>(iA) regarding the acceptability of the proposed activity or activities; and</u> ii. if the opinion is that the proposed activity, <u>activities</u> or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	N/A – to be finalised
Appendix 6 (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
Appendix 6 (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
Appendix 6 (q)	Any other information requested by the competent authority.	None



## 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

8<sup>th</sup> August 2018



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## 1 Introduction

The Biodiversity Company (TBC) was appointed by Environmental Impact Management Systems (Pty) Ltd (EIMS) to conduct a biodiversity baseline and impact assessment on the ecosystems associated with the proposed extension of the Kangala Colliery near Delmas in Mpumalanga. The proposed project will include a combination of open pit and underground operations. This report represents the scoping phase assessment only.

Universal Coal Development 1 (hereafter referred to as UCD1), a subsidiary of Universal Coal plc wishes to develop a new opencast coal mining operation covering an extent of 251 hectares (ha), adjacent to the existing Universal Coal's Kangala Colliery on various portions of the Farm Strypan 243 IR - herein referred to as the Kangala Extension Project. The proposed Kangala Extension Project is anticipated to use a standard truck and shovel mining method based on strip mining design and layout. The existing Coal Handling and Processing Plant (CHPP) at the Kangala Colliery will be utilised for the proposed Kangala Extension Project. It is expected that no new surface infrastructure such as offices, dams, stores facility, workshops, or change house will be required for the project.

## 2 Locality

The Kangala Colliery is located approximately 7 km south-west of Delmas, on farm portions Wellaagte 271 IR and Welgevonden 54 IT, in the Mpumalanga Province, South Africa. The area surrounding the project area consists predominantly of agricultural fields, secondary roads and various coal mining operations.

The various land-use activities within, and adjacent to, the project area have impacted upon the associated ecosystems and many of the watercourses are identified as moderately modified according to available desktop information (DWS, 2013). The proposed extension of the Kangala Colliery is situated within the Olifants Water Management Area (WMA) within the B20A quaternary catchment. A locality map of the project area is presented in Figure 1.



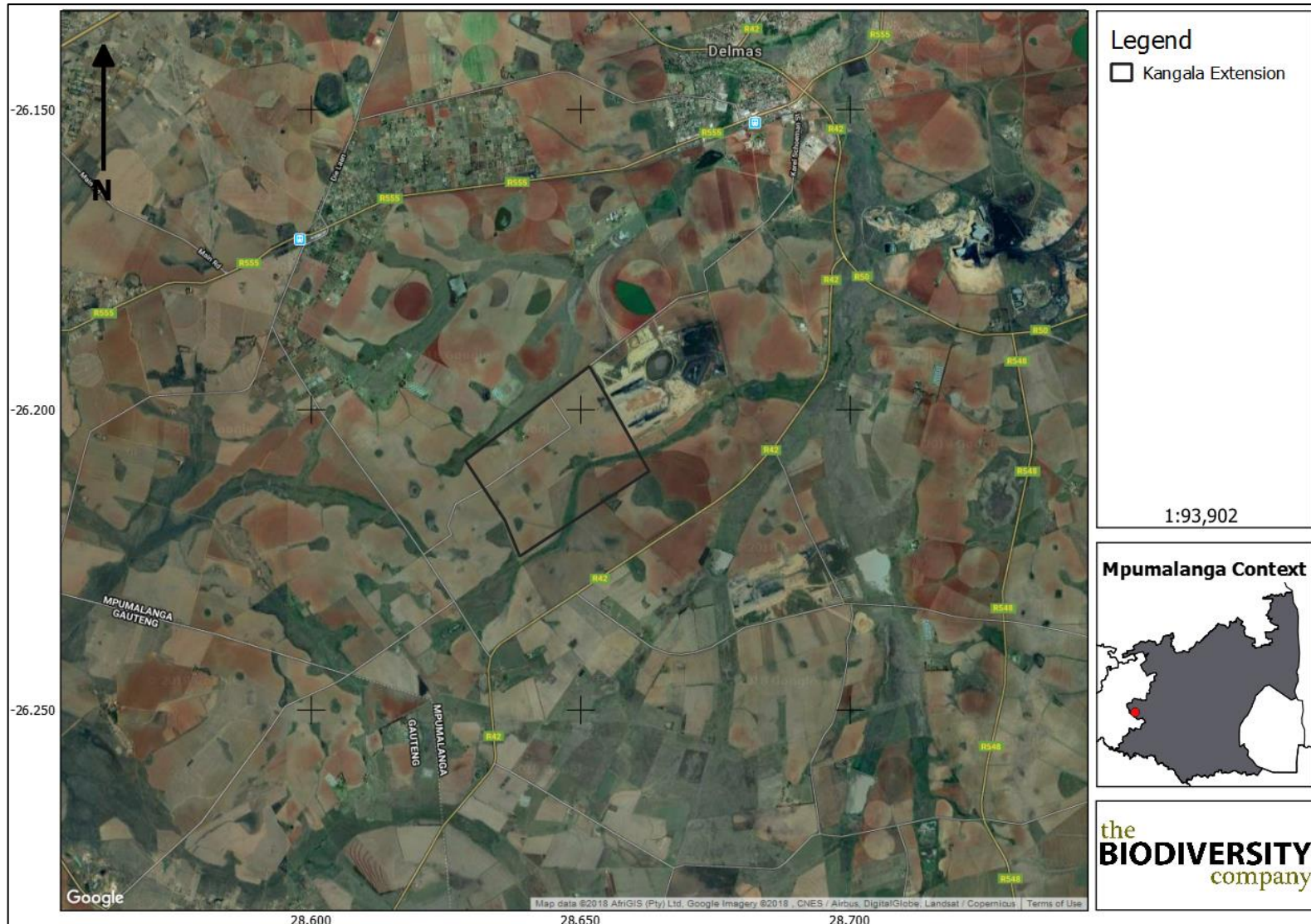


Figure 1: The proposed Kangala project area

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### 3 Limitations

The following limitations should be noted for the study:

- This assessment represents the Scoping Phase of the project only. After further field surveys a final biodiversity baseline and impact assessment report will be submitted.

### 4 Methodologies

#### 4.1 Geographic Information Systems (GIS) Mapping

A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software that encompassed a slope, landforms and channel network analyses in order to detect ridges, potential landscape depressions and drainage lines respectively.

Additional existing data layers were incorporated into a GIS to establish how the proposed the mining operation interact with these important entities. Emphasis was placed around the following spatial datasets:

- Vegetation Map of South Africa, Lesotho and Swaziland (Mucina et al., 2007);
- Mpumalanga Biodiversity Sector Plan (MBSP) Terrestrial Assessment 2014 (MTPA, 2014);
- MBSP Landcover 2010 (MTPA, 2010);
- Department of Environmental Affairs (DEA) National Landcover 2015 (DEA, 2015); and
- Mining and Biodiversity Guideline (SANBI & SAMBF 2012).

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

- 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.

#### 4.2 Botanical Assessment

The botanical study will encompass an assessment of all the vegetation units and habitat types within the project area. The focus will be a full assessment of habitat types as well as identification for any red-data species within the known distribution of the project area. The methodology included the following survey techniques:

- Timed meanders;



- Sensitivity analysis based on structural and species diversity; and
- Identification of floral red-data 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<sup>1</sup>. 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. However, the BODATSA database provides distribution data as point coordinates. The literature study therefore, focussed on querying the database to generate species lists for the extent seen in Figure 13) in order to increase the likelihood of obtaining a representative species list for the Project Area. The Red List of South African Plants website (SANBI, 2016) 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, Guide to the Aloes of South Africa, 2014)
- Mesembs of the World (Smith, et al., 1998)
- Medicinal Plants of South Africa (Van Wyk, Van Oudtshoorn, & Gericke, Medicinal Plants of South Africa, 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, Mashau, Moeaha, & Nembudani, 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, 2011);
- Grassland Ecosystem Guidelines: landscape interpretation for planners and managers (SANBI, 2013); and

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<sup>1</sup> Data is obtained from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH)



- Red List of South African Plants (Raimondo, et al., 2009; SANBI, 2016).

## 4.4 Wet Season Fieldwork

### 4.4.1 Floristic Analysis

The wet season fieldwork and sample sites are placed within targeted areas (i.e. target sites) perceived as ecologically sensitive based on the preliminary interpretation of satellite imagery (Google Corporation) and GIS analysis (which included the latest applicable biodiversity datasets) available prior to the fieldwork. The focus of the fieldwork will therefore be to maximise coverage and navigate to each target site in the field in order to perform a rapid vegetation and ecological assessment at each sample site. Emphasis will be placed on sensitive habitats, especially those overlapping with proposed infrastructure development areas.

Homogenous vegetation units will be subjectively identified using satellite imagery and existing land cover maps. The floristic diversity and search for flora SCC will be conducted through timed meanders within representative habitat units delineated during the scoping fieldwork. Emphasis will be placed mostly on sensitive habitats overlapping with the proposed infrastructure or mining areas.

The timed random meander method is a highly efficient method for conducting floristic analysis, specifically in detecting flora SCC and maximising floristic coverage. In addition, the method is time and cost effective and highly suited for compiling flora species lists and therefore gives a rapid indication of flora diversity. The timed meander search was performed based on the original technique described by Goff *et al.* (1982). Suitable habitat for SCC were identified according to Raimondo *et al.* (2009) and targeted as part of the timed meanders.

At each sample site notes will be 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.). In addition, opportunistic observations will be made while navigating through the project area. Effort will be made to cover all the different habitat types within the limits of time and access.

### 4.4.2 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 (especially relating to avifauna); 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 will utilise a variety of sampling techniques including, but not limited to, the following:

- Camera trapping (Figure 2);
- Visual observations;



- Small mammal trapping (Sherman Traps);
- Identification of tracks and signs; and
- Utilization of local knowledge.

Site selection for trapping will focus on the representative habitats within the project area. Sites will be selected on the basis of GIS mapping and Google Earth imagery and then final selection shall be confirmed through ground truthing during the surveys. Habitat types sampled may include pristine, disturbed and semi-disturbed zones, drainage lines, wetlands and rocky ridges.



Figure 2: A) & B) Active Searching, C & D) Camera Traps and E) Photography for Avifauna Assessments

#### 4.4.3 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the project area will be conducted, including in-depth, site-specific research and focused searching. Ideally, surveys for herpetofauna should be conducted at those times when the target species or communities are known to be active because these periods of activity are more likely to lead to capture success (for most species). In South Africa this is during the summer months and ideally after or during periods when rainfall is most likely or has recently occurred.

Surveys will be conducted in each habitat or vegetation type within the project area, as identified from the desktop study, with a focus on those areas which will be most impacted by the proposed development (i.e. any infrastructure development or mining areas).

The herpetological field survey will comprise 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.

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include walking transects or using binoculars to view species from a distance without them 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; and
- Opportunistic sampling - Reptiles, especially snakes, are incredibly illusive 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.

## 5 Key Legislative Requirements

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

Explanation of certain documents or organisations is provided where these have a high degree of relevance to the project and/or are referred to in this assessment.

### International Legislation and Policy

- Convention on Biological Diversity (Rio de Janeiro, 1992);
- The Ramsar Convention (on wetlands of international importance);
- 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 Act (NEMA) No. 107 of 1998: Environmental Impact Assessment Regulations, 2014. Specifically, the requirements of the specialist report as per the requirements of Appendix 6;





- 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 Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations;
- National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003);
- National Environmental Management: Waste Act, 2008 (Act 59 of 2008);
- National Water Act, 1998 (Act 36 of 1998);
- National Veld and Forest Fire Act (101 of 1998);
- Environmental Conservation Act, 1989 (ECA), (Act no. 73 of 1989);
- National Forests Act, 1998 (Act 84 of 1998), specifically with reference to Protected Tree species;
- National Heritage Resources Act, 1999 (Act 25 of 1999);
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983); and
- Sustainable Utilisation of Agricultural Resources (Draft Legislation).

#### National Policy and Guidelines

- South Africa's National Biodiversity Strategy and Action Plan (NBSAP);
- National Spatial Biodiversity Assessment (NSBA); and
- National Freshwater Ecosystem Priority Areas (NFEPA's).

#### 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 Provincial Department responsible for environmental matters in Mpumalanga is the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET). Relevant provincial legislation includes, but is not limited to:

#### 5.1 Mpumalanga Parks Board Act 6 of 1995

- The Mpumalanga Parks Board was established in terms of the Mpumalanga Parks Board Act 6 of 1995 as amended. The objectives of this Act are inter alia as follows:
  - To provide effective conservation management of natural resources of the Mpumalanga Province;
  - To promote the creation of economic and employment opportunities in pursuit of nature conservation and biodiversity;



- To ensure that natural systems, biodiversity and ecological functions and processes in the Mpumalanga Province are maintained;
- To determine and enforce limits to sustainable utilization of natural resources;
- To contribute to the advancement of scientific knowledge, and facilitate technology transfer in respect of conservation; and
- Provide information and extension services to the public on conservation management, problem species, legal aspects of conservation and other conservation matters.

## 5.2 Mpumalanga Conservation Act, 1998 (Act 10 of 1998)

The aim of this Act is to consolidate and amend the laws relating to nature conservation within the Province and to provide for matters connected therewith.

## 5.3 Mpumalanga Tourism and Parks Agency Act, No 5 of 2005

This act provides for the establishment of the Mpumalanga Tourism and Parks Agency (MTPA) and for the management thereof by a Board; to provide for the sustainable development and improvement of the tourism industry in Mpumalanga; to provide for conservation management of the natural resources of Mpumalanga; to confer powers and functions upon the Agency; to provide for the registration of certain persons and entities directly involved in tourism; to provide for transitional arrangements; and to provide for matters incidental thereto.

## 5.4 Mpumalanga Conservation Plan

Mpumalanga's Conservation Plan Version 2 (C-Plan 2) database (MPSB, 2006), is intended to guide conservation and land-use decisions in support of sustainable development at a strategic level, have been identified. The C-Plan 2 maps the distribution of the Province's known biodiversity into categories according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

## 5.5 Mpumalanga Biodiversity Sector Plan (MBSP)

In 2006 the MTPA and the Department of Agriculture and Land Administration (DALA) initiated the development of the Mpumalanga Biodiversity Conservation Plan (MBSP). As the first such plan produced for the Province, it was intended to guide conservation and land-use decisions in support of sustainable development. The MBSP provided a spatial framework that supported land-use planning and helped to streamline and monitor environmental decision-making (Ferrari & Lotter, 2007).

Since 2007 several technical advances and land use changes necessitated the need for an update of the MBSP. The updated product is called the Mpumalanga Biodiversity Sector Plan (MBSP) and builds on the successes of the MBSP but incorporates improvements in science, technology and data, to provide a more comprehensive assessment of the biodiversity of the terrestrial and freshwater environment in Mpumalanga (MTPA, 2014).

The key output of the systematic biodiversity plan is a map of biodiversity priority areas (MTPA, 2014). The MBSP CBA map delineates Critical Biodiversity Areas (CBAs), Ecological Support



Areas (ESAs), Other Natural Areas (ONAs), Protected Areas (PAs), and areas that have been irreversibly modified from their natural state (MTPA, 2014). The MBSP uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- Critical Biodiversity Area – Irreplaceable (CBA: Irreplaceable);
- Critical Biodiversity Area – Optimal (CBA: Optimal);
- Ecological Support Area (ESA);
- Other Natural Area (ONA);
- Protected Area (PA); and
- Moderately or Heavily Modified Areas (MMA's or HMA's).

**Critical Biodiversity Areas (CBAs)** are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

Critical Biodiversity Areas (CBAs) are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (MTPA, 2014). These areas are therefore incompatible with mining developments.

The Mpumalanga Biodiversity Sector Plan (MBSP) specifies two different CBA areas, Irreplaceable CBA's and Optimal CBA's. Irreplaceable CBA's include: (1) areas required to meet targets and with irreplaceability biodiversity values of more than 80%; (2) critical linkages or pinch-points in the landscape that must remain natural; or (3) critically Endangered ecosystems (MTPA, 2014).

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

**Other Natural Areas (ONAs)** consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI-BGIS, 2017).

**Moderately or Heavily Modified Areas** (sometimes called 'transformed' areas) are areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets (MTPA, 2014). Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly, and in many cases irreversibly, compromised.



## 5.6 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 at al., 2012).

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 at al., 2012).

## 5.7 MTPA Guidelines for Biodiversity Assessment

To promote national uniform standards in Environmental Management Plans (EMP's) the Mpumalanga Tourism and Parks Agency (MTPA) have set minimum standards that need to be conformed to in terms of Biodiversity Assessments for development applications. These guidelines cover flora, fauna, aquatic and wetland systems.

# 6 Project Area

## 6.1 General Local Land Use

The dominant land use of the proposed project's surrounding area is cultivated land/agriculture, predominately maize cropping and to a lesser extent other crop plants such as Soya. Remaining areas of natural vegetation within and around the study area are utilized for livestock grazing predominately by cattle. Other land uses nearby include extensive coal mining operations, most of which are open-cast mines.

The following infrastructure exists in the project area and surrounds:

- Various secondary farm roads;
- Open-cast coal mines and related infrastructure and activities;
- Farm dams and at least one large man-made dam;
- Power lines
- Telephone lines;
- Agricultural homesteads; and
- Dwellings.

### 6.1.1 Description of the Project Area

The nearest sizeable town is Delmas, which is approximately 7 km to the north of the project area. The project will be an extension of the existing Kangala Colliery mining pit which is situated adjacent to the proposed project area.



## 6.2 Project Area in Relation to the MBSP

Figure 3 shows the Kangala Extension project area superimposed on the MBSP Terrestrial CBA map. Based on this, the proposed open-cast mining area has the potential to overlap with:

- Heavily Modified Areas (HMA);
- Moderately Modified Areas (Old Lands); and
- Other Natural Areas (ONAs).

Based on this desktop information, much of the project area is identified as being heavily modified, although a portion of the south-eastern project area overlaps with ONAs (Figure 3). The data used for this analysis is often captured remotely and therefore an important aspect of this study will be to ground-truth the boundaries of these areas.



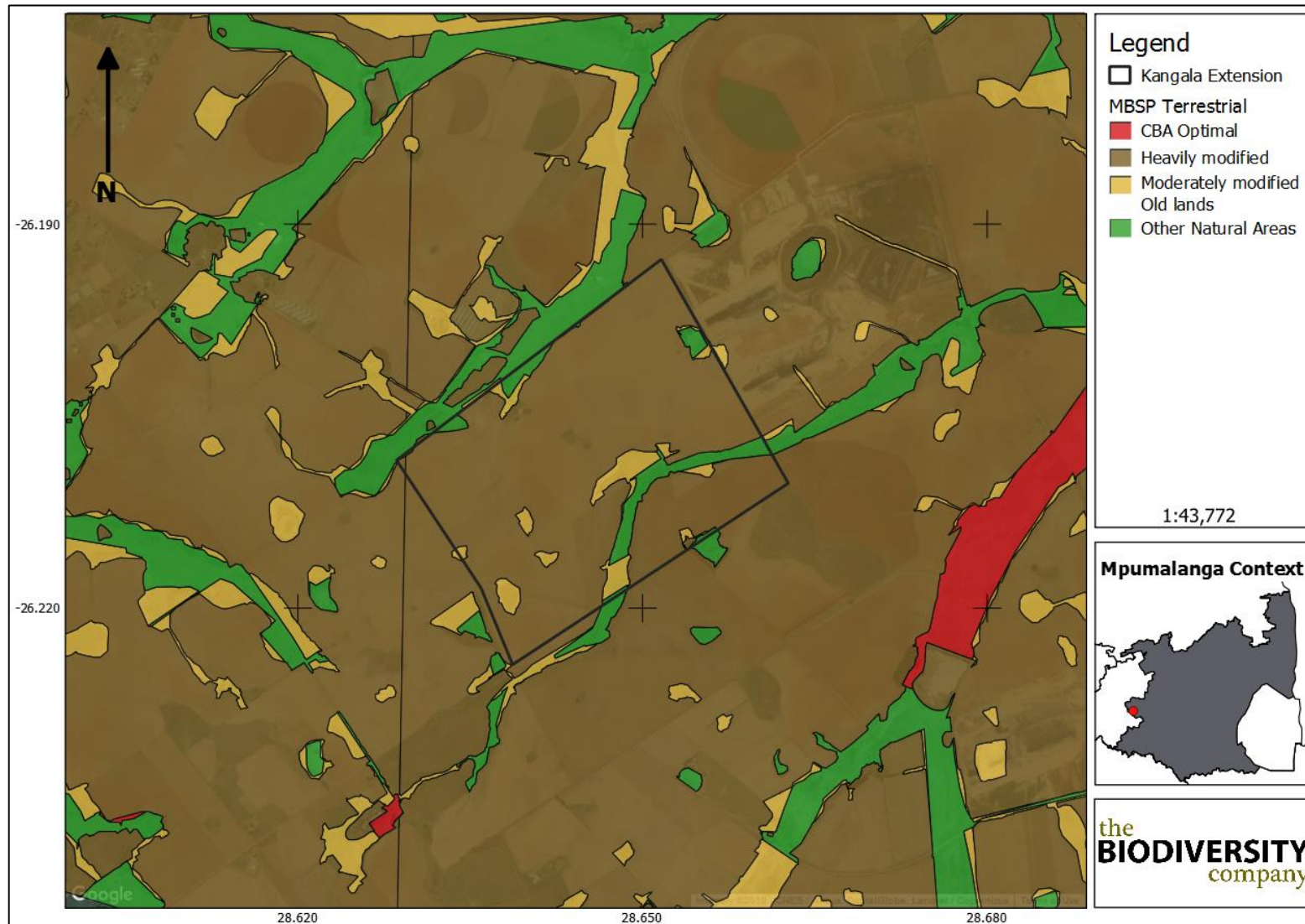


Figure 3: Kangala project area superimposed on the MBSP Terrestrial Critical Biodiversity Areas (CBA) map (MBSP, 2014)



### 6.3 Project Area in Relation to the NBA

The recently completed National Biodiversity Assessment 2011 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.

Information from the NBA can be used to:

- Streamline environmental decision-making, including environmental impact assessments (EIAs), by providing upfront information about threatened ecosystems and biodiversity priority areas that can be integrated early on in the process to improve the quality and efficiency of decision making at the site scale.
- Strengthen land-use planning, including through provincial and municipal Spatial Development Frameworks which set out desired future patterns of land-use, taking into account the priorities and requirements of a range of sectors.
- Strengthen national development planning and other strategic planning processes, through provision of clear spatial inputs to enable optimal development decisions for South Africa's future. This should happen at the national and landscape scale through scenario planning, enabling strategic trade-offs where necessary, for example between minerals development, energy security and water security.
- Identify priorities for management and restoration of ecosystems, which provides opportunities for ecosystem-based job creation and supports the provision of ecosystem services.
- Provide initial identification of threatened ecosystems, for listing in terms of the Biodiversity Act.
- Highlight areas where more detailed assessment and planning is required, for example the need for a national coastal biodiversity plan to identify coastal ecosystem priority areas.

The NBA also provides standard national spatial data layers that can be used in other national, provincial and local planning projects, and an agreed set of national biodiversity targets. In the NBA 2011 these include the first national map of coastal and marine habitat types, and the first national spatial demarcation of the estuarine functional zone.

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 project area was superimposed on the terrestrial ecosystem threat status (Figure 4). As seen in this figure the project area, on a regional context, overlaps entirely with ecosystems that are listed as Vulnerable (VU). The project area is also within a few kilometres of ecosystems which are regionally listed as Critically Endangered (CR) (Figure 4). However, on a local scale a large portion of the proposed study area and its immediate surroundings is highly modified or transformed by agricultural activities as well as existing mining operations from a desktop point of view (Figure 2)





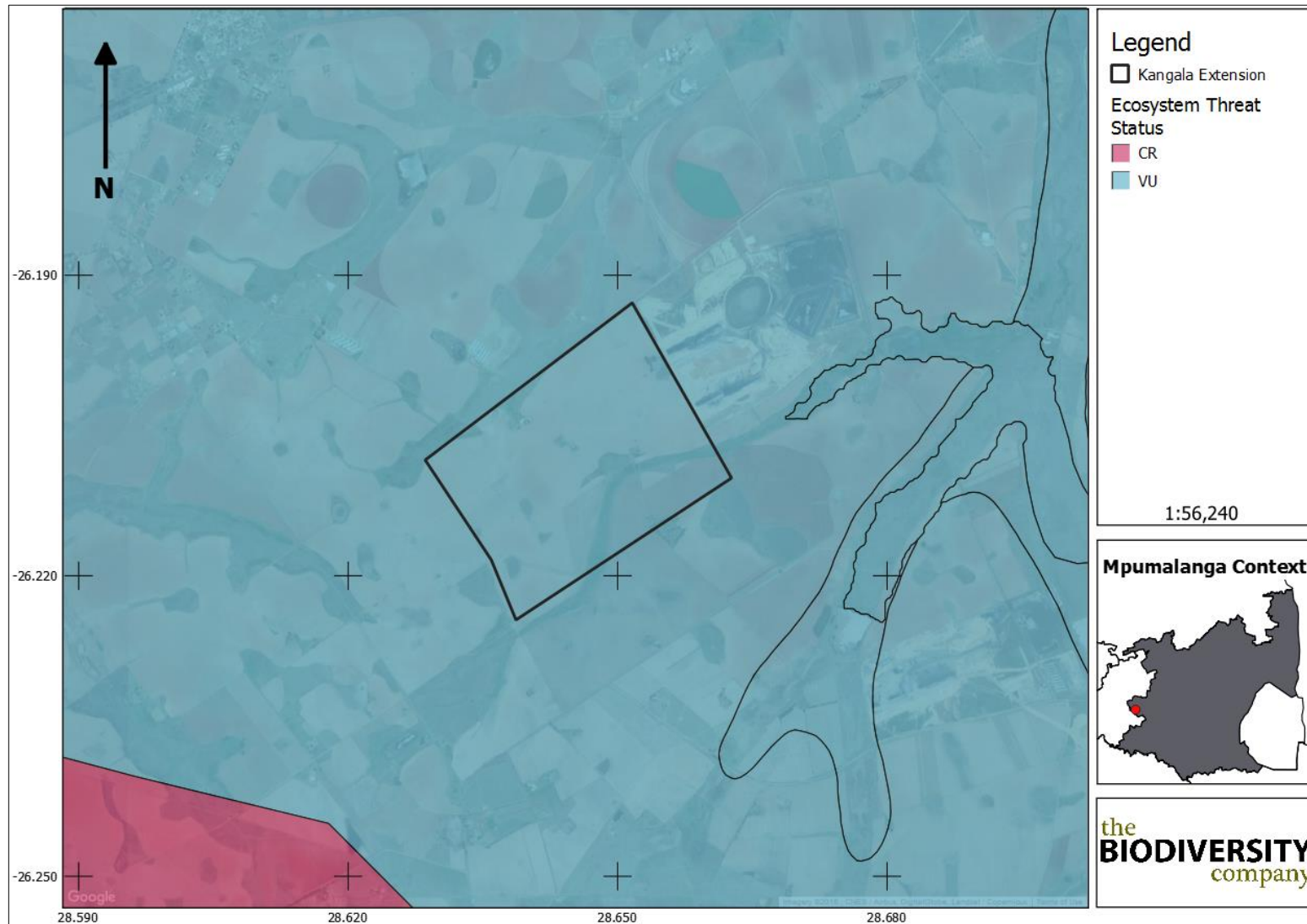


Figure 4: Kangala project area showing the regional ecosystem threat status of the associated terrestrial ecosystems (NBA, 2012)



### 6.3.2 Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver et al., 2011).

The Kangala project area was superimposed on the regional ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 5). Based on Figure 5 the terrestrial ecosystems associated with the development are rated as *not protected*. This means that these ecosystems are not adequately protected in areas such as national parks.



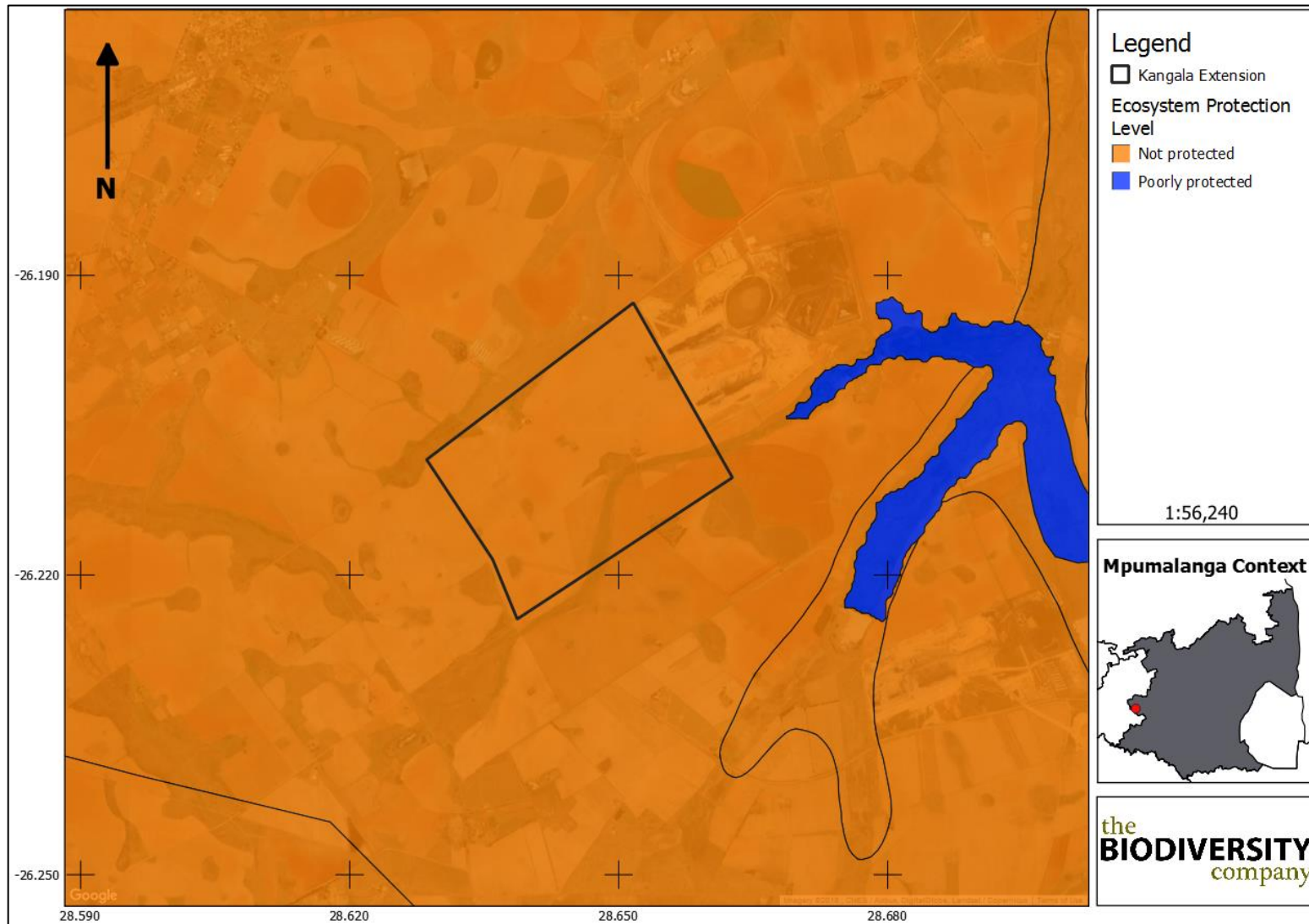


Figure 5: Kangala project area showing the regional level of protection of terrestrial ecosystems (NBA, 2012)

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## 6.4 Project Area in Relation to Protected Areas

Figure 6 shows the location of formally protected areas in relation to the project area. 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 any formally or informally protected area (Figure 6). The closest protected area is the Marievale Bird Sanctuary Provincial Nature Reserve which is situated approximately 17.6 km south-west of the project area.

Based on the above information and the location of the proposed development, the Kangala extension project is not expected to have an impact on any formally or informally protected areas.

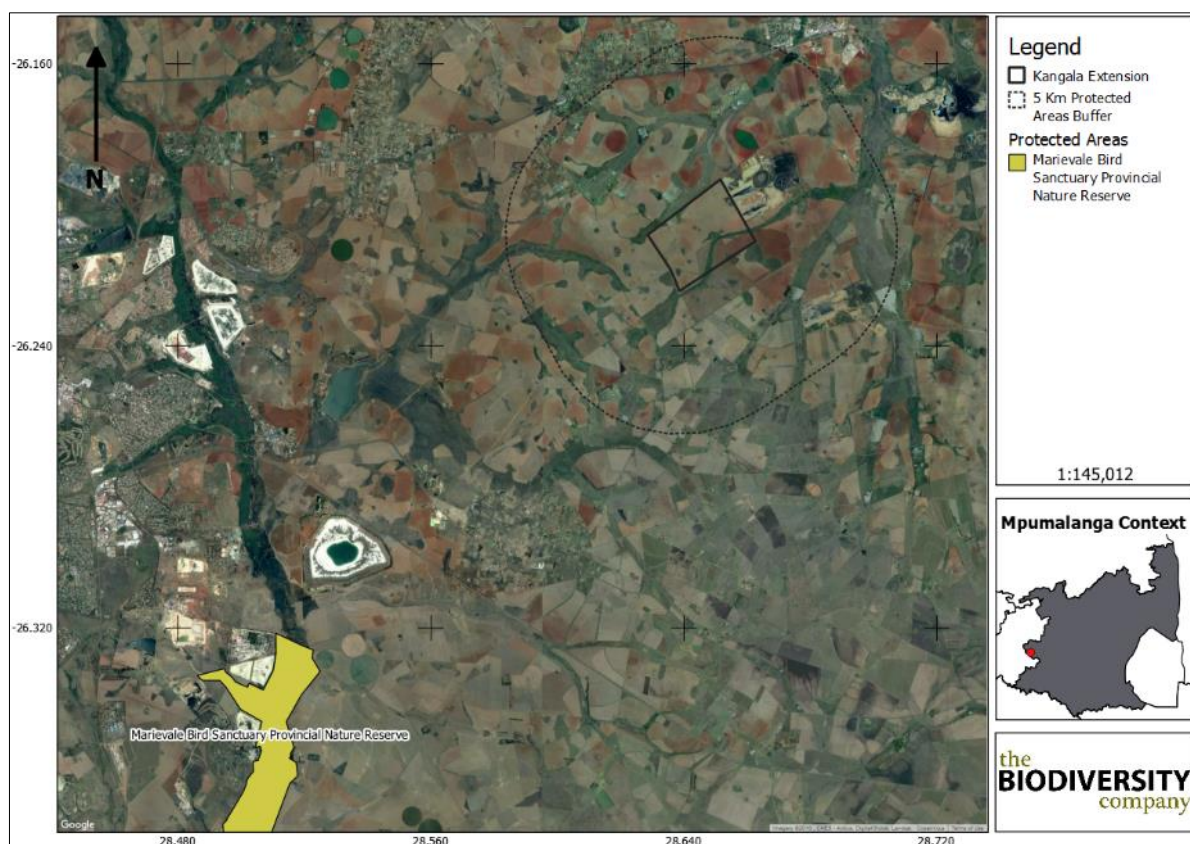


Figure 6: Formally protected areas in relation to the project area (BGIS,2017)

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

In an attempt to better conserve aquatic ecosystems, South Africa has recently categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver et al. 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel et al. 2011).

Figure 7 shows the location of the project area in relation to wetland and river FEPAs. Based on this information, the project area does overlap with certain wetland areas. However, none of these areas are classified as NFEPA wetlands or rivers. One True FEPA wetland does occur to the west of the project area.



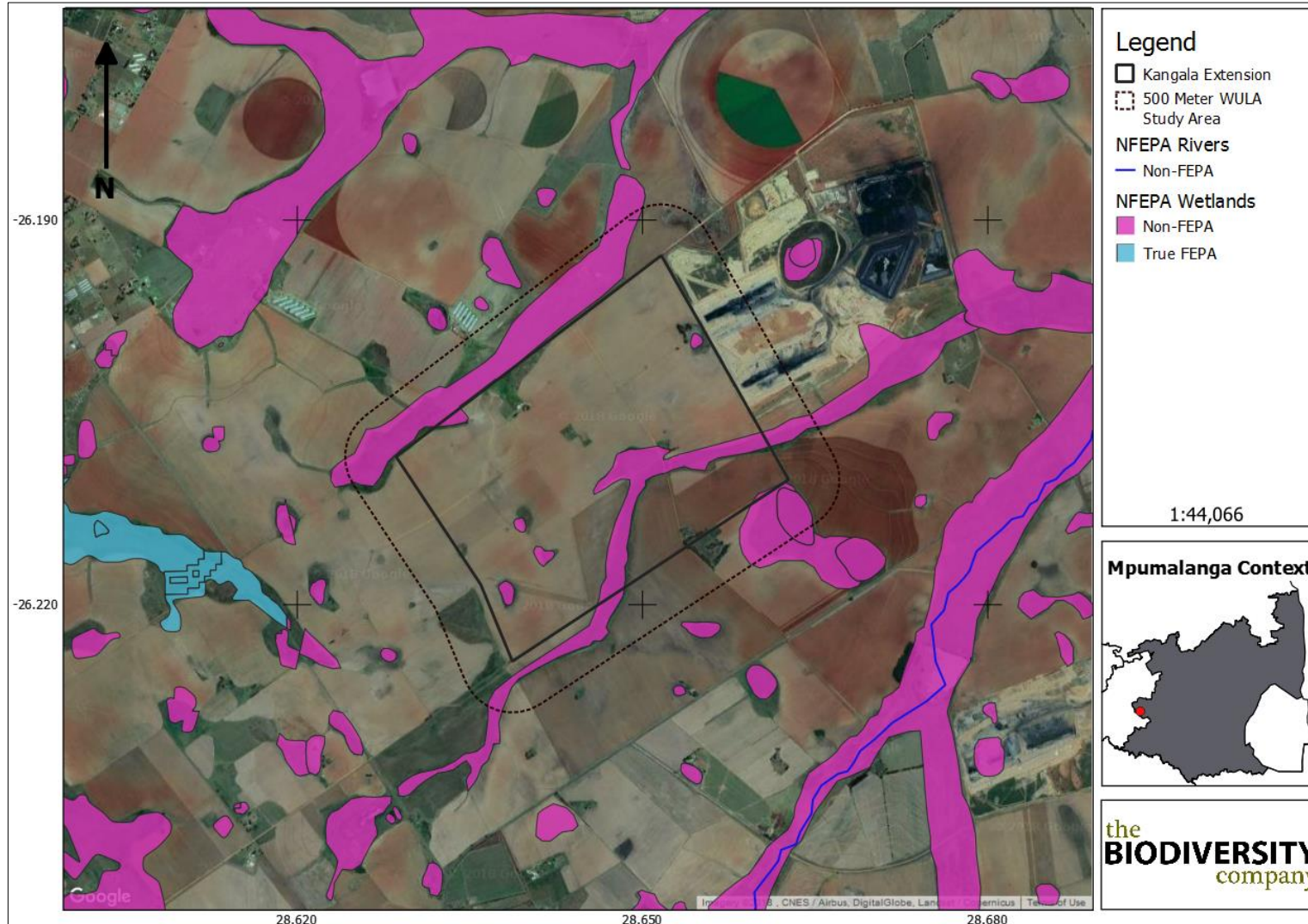


Figure 7: The project area in relation to the National Freshwater Ecosystem Priority Areas

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## 6.6 The MBSP Freshwater Assessment

The MBSP Freshwater Assessment outlines priority areas for freshwater biodiversity in Mpumalanga. The resulting features are predominantly derived from the NFEPA products, layers include CBA Rivers (based on FEPA and free-flowing rivers), CBA Wetlands (based on FEPA wetlands), CBA Aquatic species (Odonata & crab taxa of conservation concern only), ESA Wetland Clusters (FEPA wetland clusters), and ESA Wetlands (all other non-FEPA wetlands). The MTPA created an updated land-cover using SPOT 2010 imagery. This data, together with high-resolution aerial imagery, was used to update and clean some of the features (MTPA et al., Freshwater Assessment, 2011).

The project area in relation to the MBSP Freshwater Assessment overlaps with the following areas; Ecological Support Area (ESA) – Wetlands, Heavily Modified Areas and Other Natural Areas (ONAs) (Figure 8).



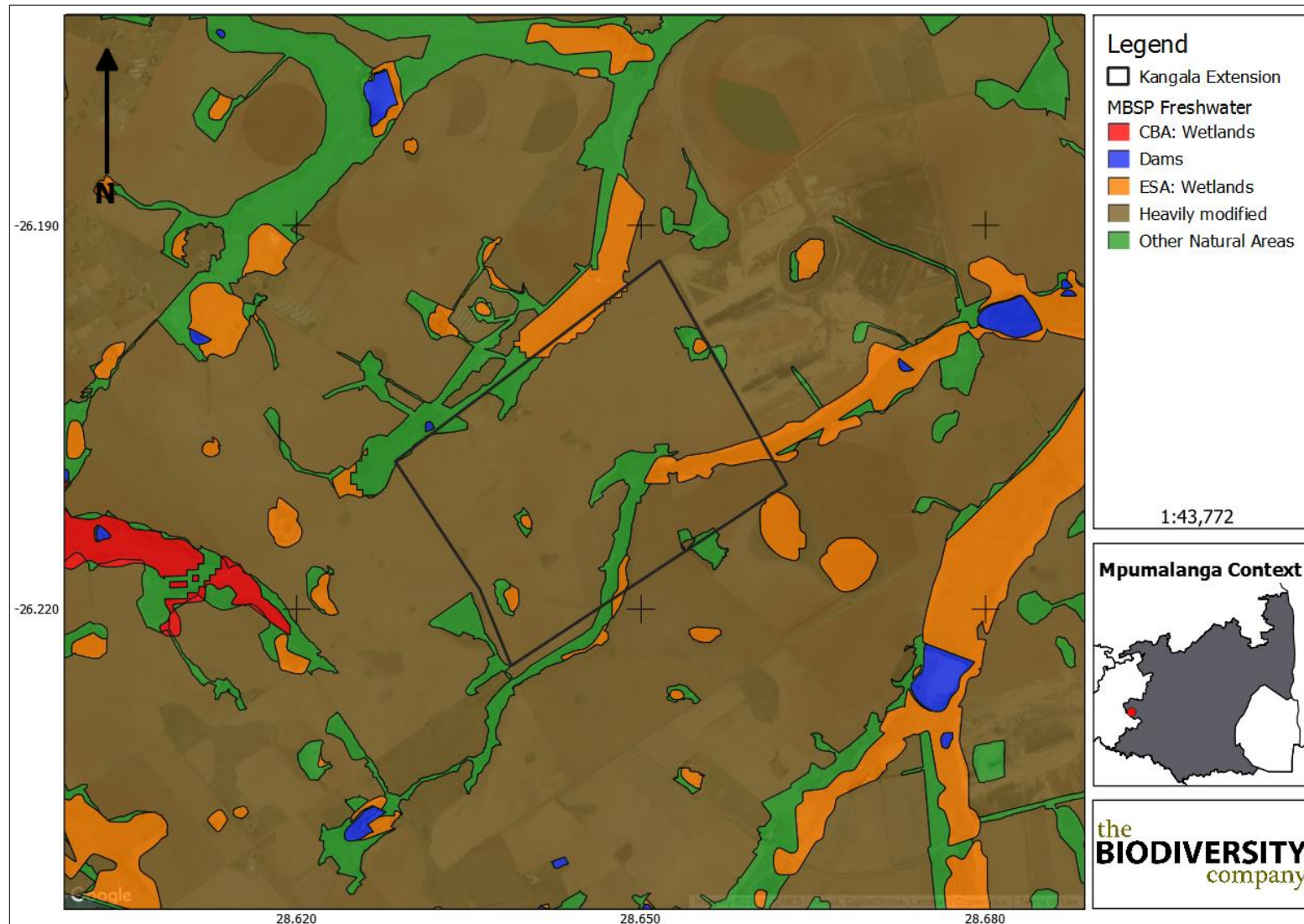


Figure 8: The Kangala project area in relation to the MBSP Freshwater Assessment

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## 6.7 Mpumalanga Highveld Wetlands

The purpose of the Mpumalanga Highveld Wetlands project was to:

- Ground-truth and refine the current data layers of the extent, distribution, condition and type of freshwater ecosystems in the Mpumalanga Highveld coal belt, to support informed and consistent decision-making by regulators in relation to the water-biodiversity-energy nexus;
- To incorporate these revised data layers into the atlas of high-risk freshwater ecosystems and guidelines for wetland offsets, currently being developed by SANBI, to improve the scientific robustness of these tools; and
- To support the uptake, and development of the necessary capacity to apply the data, atlas and guidelines by regulators and the coal mining industry in their planning and decision-making processes” (SANBI, 2012).

The Mpumalanga Highveld Wetlands data also classifies NFEPA land cover based on the defined condition of each area. These are known as the NFEPA wetland conditions categories. The categories are listed in Figure 9 and are represented in relation to the project area in Figure 10.

Description of NFEPA wetland conditions categories.			
PES equivalent provides a description of the condition category that is broadly equivalent to that used by the Department of Water Affairs to describe Present Ecological State. Percentage of total area in each condition category is also provided.			
PES equivalent	NFEPA condition	Description	% of total wetland area*
Natural or Good	AB	Percentage natural land cover $\geq$ 75%	47
Moderately modified	C	Percentage natural land cover 25-75%	18
Heavily to critically modified	DEF	Riverine wetland associated with a D, E, F or Z ecological category river	2
	Z1	Wetland overlaps with a 1:50,000 "artificial" inland water body from the Department of Land Affairs: Chief Directorate of Surveys and Mapping (2005-2007)	7
	Z2	Majority of the wetland unit is classified as "artificial" in the wetland delineation GIS layer	4
	Z3	Percentage natural land cover < 25%	20

\* This percentage excludes the unmapped wetlands that have been irreversibly lost due to draining, ploughing and concreting

Figure 9: A breakdown of the NFEPA wetland condition categories as defined by the MHW dataset

Figure 10 shows the project area in relation to the Mpumalanga Highveld Wetlands data as provided by SANBI. Two notable wetland areas occur on the northern boundary and across the southern portion of the project area. Both these wetlands are classified as having an NFEPA condition of 'C', which means that these wetlands are moderately modified from their natural condition. Small patches of other wetlands classed as 'Z' or heavily modified, occur in the south-western corner of the project area.



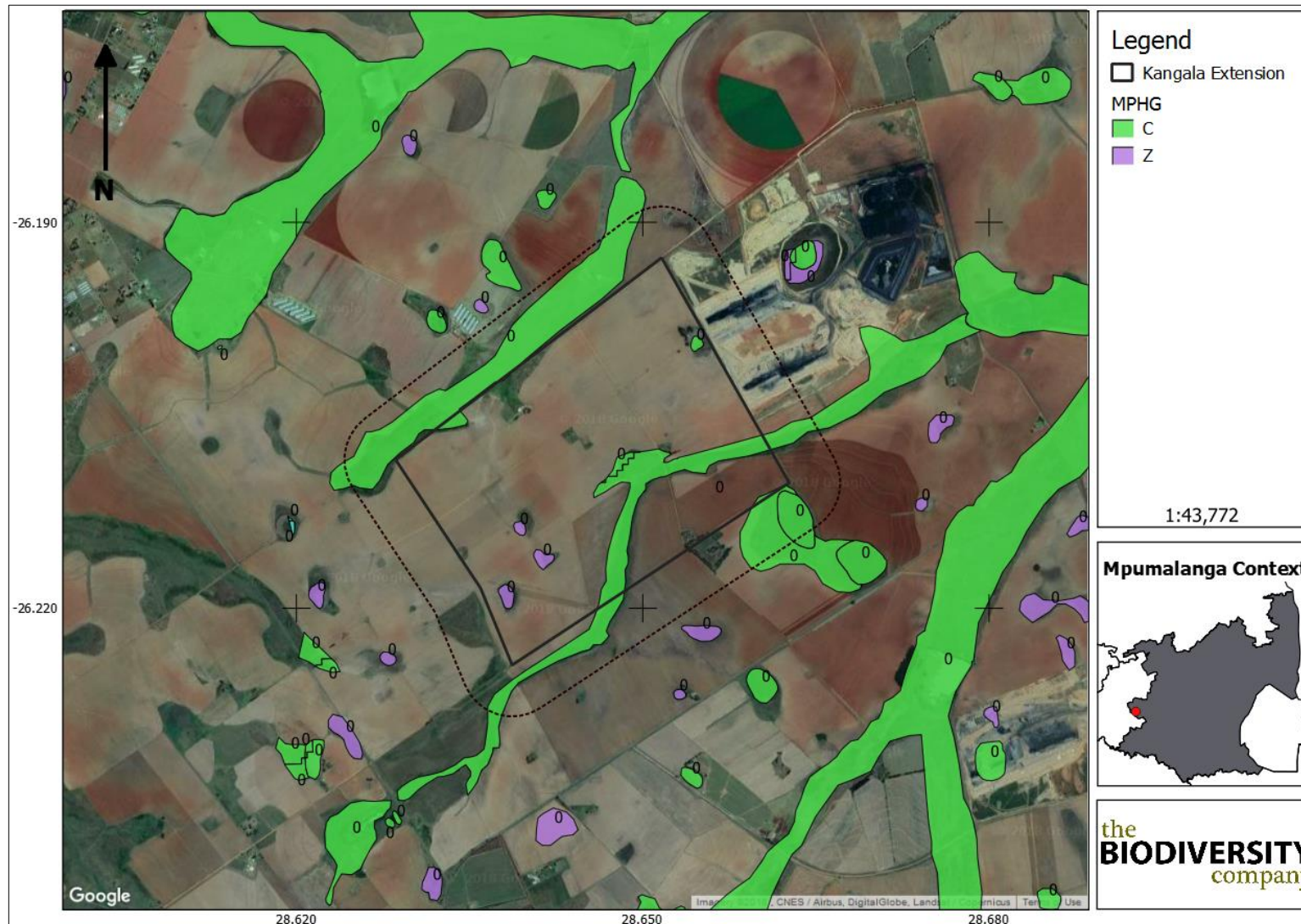


Figure 10: Shows the overall project area in relation to the Mpumalanga Highveld Wetlands (SANBI, 2012)



### 6.7.1 Buffer Assessment

The DWS buffer tool recommends at a desktop level that the required buffer for open cast mining be 180 m. A minimum buffer zone of 175 m is recommended for the wetlands with regards to a mining operation (Macfarlane DM, *et.al*, 2009). These minimum buffer widths (to protect core wetland habitat and aquatic functioning) are calculated based on a simple classification of wetland types and land use categories, broadly grouped as riverine and palustrine systems. Ecological and landscape characteristic are then assessed to establish the need to increase the buffer width, if at all.

The MBSP has been used to identify biodiversity/environmentally sensitive areas (indicated above). In accordance with the National Biodiversity Act, the MBSP translates the FEPAs into freshwater Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs).

- In terms of the MBSP and NFEPA implementation guidelines, no mining should occur within 1 km of any FEPA (CBA) wetland or river.

### 6.8 Project Area in Relation to Freshwater Resources

The proposed extension is located in the Olifants Water Management Area (WMA) within the B20A quaternary catchment. The project area is drained to the north and south by two unnamed tributaries of the B20A-1308 Sub Quaternary Reach (SQR) a reach of the Bronkhorstspuit.

### 6.9 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 1 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.

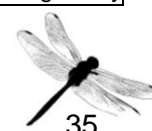
Good practice environmental management is followed, and monitoring and compliance enforcement is ensured.

*Table 1: The mining and biodiversity guidelines categories*

Category	Biodiversity priority areas	Risk for mining	Implications for mining
<b>A. Legally protected</b>	<ul style="list-style-type: none"> <li>• Protected areas (including National Parks, Nature Reserves, World Heritage Sites, Protected Environments, Nature Reserves)</li> <li>• Areas declared under Section 49 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002)</li> </ul>	<b>Mining prohibited</b>	<p>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.</p> <p>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.</p>
<b>B. Highest biodiversity importance</b>	<ul style="list-style-type: none"> <li>• Critically endangered and endangered ecosystems</li> <li>• Critical Biodiversity</li> </ul>	<b>Highest risk for mining</b>	<p>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</p>

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	<p>Areas (or equivalent areas) from provincial spatial biodiversity plans</p> <ul style="list-style-type: none"> <li>• River and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs</li> <li>• Ramsar Sites</li> </ul>		<p>decision-making for mining, water use licenses, and environmental authorisations.</p> <p>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.</p> <p>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.</p>
<p><b>C. High biodiversity importance</b></p>	<ul style="list-style-type: none"> <li>• Protected area buffers (including buffers around National Parks, World Heritage Sites* and Nature Reserves)</li> <li>• Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas)</li> <li>• Other identified priorities from provincial spatial biodiversity plans</li> <li>• High water yield areas</li> <li>• Coastal Protection Zone</li> <li>• Estuarine functional zone</li> </ul>	<p><b>High risk for mining</b></p>	<p>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.</p> <p>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.</p> <p>Mining options may be limited in these areas, and limitations for mining projects are possible.</p> <p>Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.</p>
<p><b>D. Moderate biodiversity importance</b></p>	<ul style="list-style-type: none"> <li>• Ecological support areas</li> <li>• Vulnerable ecosystems</li> <li>• Focus areas for protected area expansion (land-based and offshore protection)</li> </ul>	<p><b>Moderate risk for mining</b></p>	<p>These areas are of moderate biodiversity value. EIA's 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.</p> <p>Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.</p>



According to the Mining and Biodiversity Guidelines spatial dataset (2013), the majority of the Kangala Extension project area is considered to be of low biodiversity importance and there is therefore a correlating low risk for mining. However, various portions of the project area mostly related to wetlands are classified as having a moderate biodiversity importance and these represent a moderate risk to mining (Figure 11).



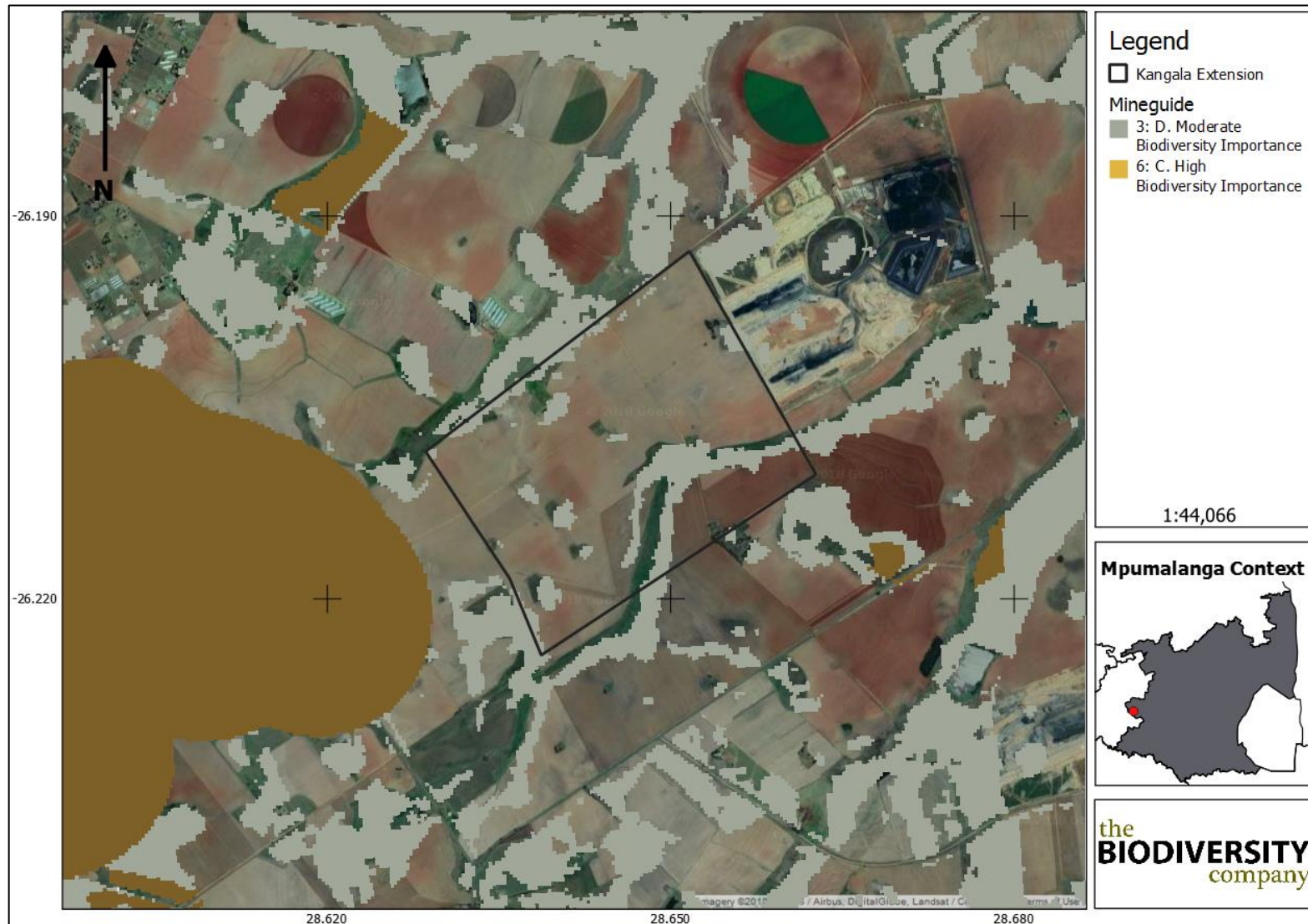


Figure 11: The Kangala extension project area superimposed on the Mining and Biodiversity Guidelines spatial dataset (2013)



## 7 Results & Discussion

### 7.1 Desktop Assessment

#### 7.1.1 Regional Vegetation Assessment

The Kangala extension 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 mainly 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 Regional Vegetation Types

The grassland biome comprises many different vegetation types. The project area is situated within one vegetation type; namely the Eastern Highveld Grassland (GM12) according to Mucina & Rutherford (2006) (Figure 12).





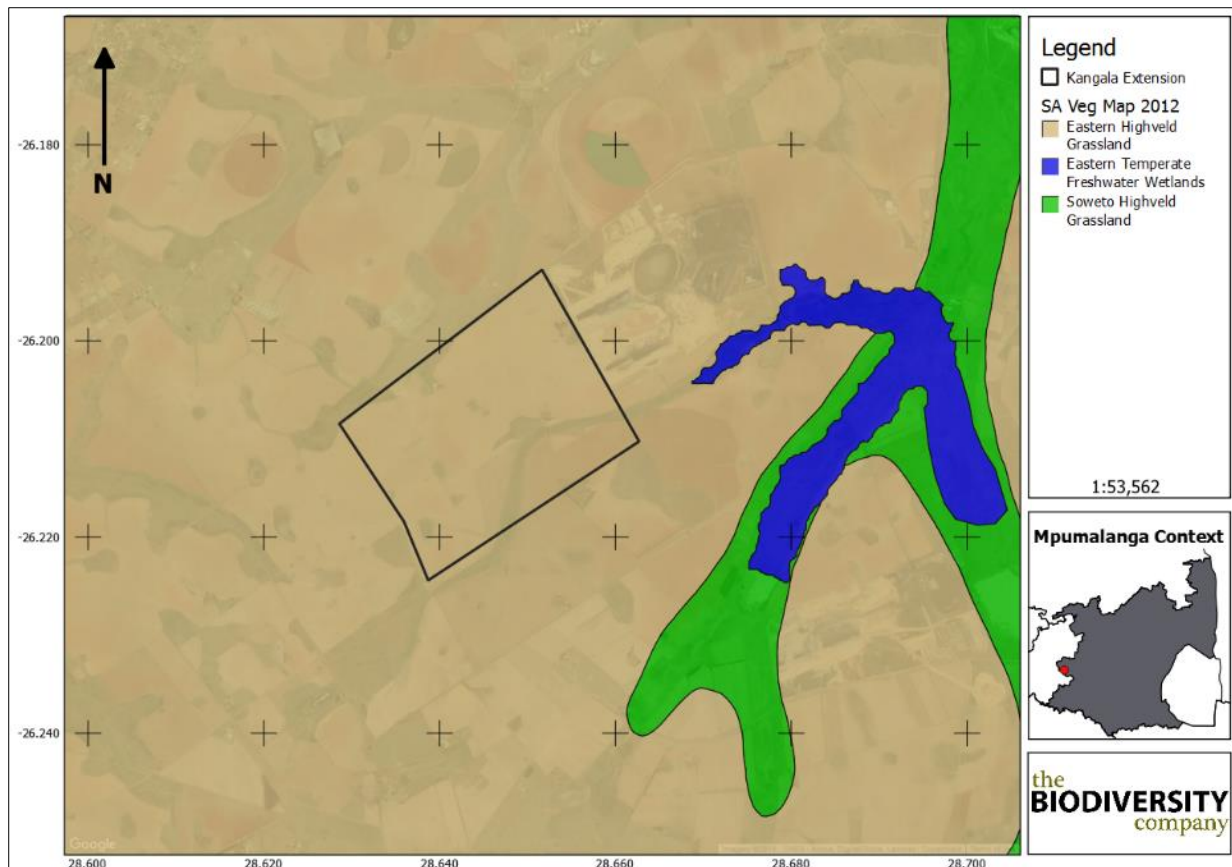


Figure 12: The Kangala project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS,2017)

### 7.1.1.2 Eastern Highveld Grassland

This vegetation type occurs on slightly to moderately undulating planes, including some low hills and pan depressions. The vegetation is a short dense grass land dominated by the usual highveld grass composition (*Aristida*, *Digitaria*, *Erafrostsis*, *Themeda*, *Tristachya* etc.) with small scattered rocky outcrops with, wiry sour grasses and some woody species. Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. No serious alien invasions are reported (Mucina & Rutherford, 2006).

### 7.1.1.3 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 **Eastern Highveld Grassland** vegetation type:

**Graminoids:** *Aristida aequiglumis*, *A. congesta*, *A. junciformis* subsp. *Galpinii*, *Brachiaria serrata*, *Cynodon dactylon*, *Digitaria monodactyla*, *D. tricholaenoides*, *Elionurus muticus*, *Eragrostis chloromelas*, *E. curvula*, *E. plana*, *E. racemosa*, *E. sclerantha*, *Heteropogon contortus*, *Loudetia simplex*, *Microchloa caffra*, *Monocymbium cerasiiforme*, *Setaria sphacelata*, *Sporobolus africanus*, *S. pectinatus*, *Themeda triandra*, *Trachypogon spicatus*, *Tristachya leucothrix*, *T. rehmanni*, *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon*



*appendiculatus*, *A schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplectens*, *Eragrostis capensis*, *E. gummiflua*, *E. patentissima*, *Harpochoa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*;

**Herbs:** *Berkheya setifera*, *Haplocarpha scaposa*, *Justicia anagalloides*, *Acalypha angusta*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii*, *E. transvalensis* subsp. *setilobus*, *Helichrysum aureonitens*, *H caespititium*, *H. callicomum*, *H. oreophilum*, *H. caespititium*, *H. oreophilum*, *H rugulosum*, *ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Vernonia oligocephala*, *Wahlenbergia undulata*;

**Geophytic herbs:** *Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*;

**Succulent herb:** *Aloe ecklonis*; and

**Low shrubs:** *Anthospermum rigidum* subsp. *pumilum*, *Stoebe plumosa*.

#### 7.1.1.4 Regional Conservation Status

##### 7.1.1.4.1 Eastern Highveld Grassland

According to Mucina & Rutherford (2006), this 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 Nooitgedacht Dam and Jericho Dam Nature Reserves and in private reserves (Holkransse, Kransbank, Morgenstond).

Some 44% of this vegetation type has however, already been transformed including at the proposed project area primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but *Acacia mearnsii* can become dominant in disturbed sites. Erosion is very low.

##### 7.1.1.5 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 393 plant species have the potential to occur in the area (Figure 13). The list of potential plant species to occur within the project area region is provided in Appendix A.

Of the 393-plant species associated with this region, five (5) species are listed as being Species of Conservation Concern (SCC) (Table 2).

On a local scale, however, the project area and its vicinity is highly transformed by agricultural activities and existing mining operations and thus no indigenous flora of conservation concern is likely to remain on site.



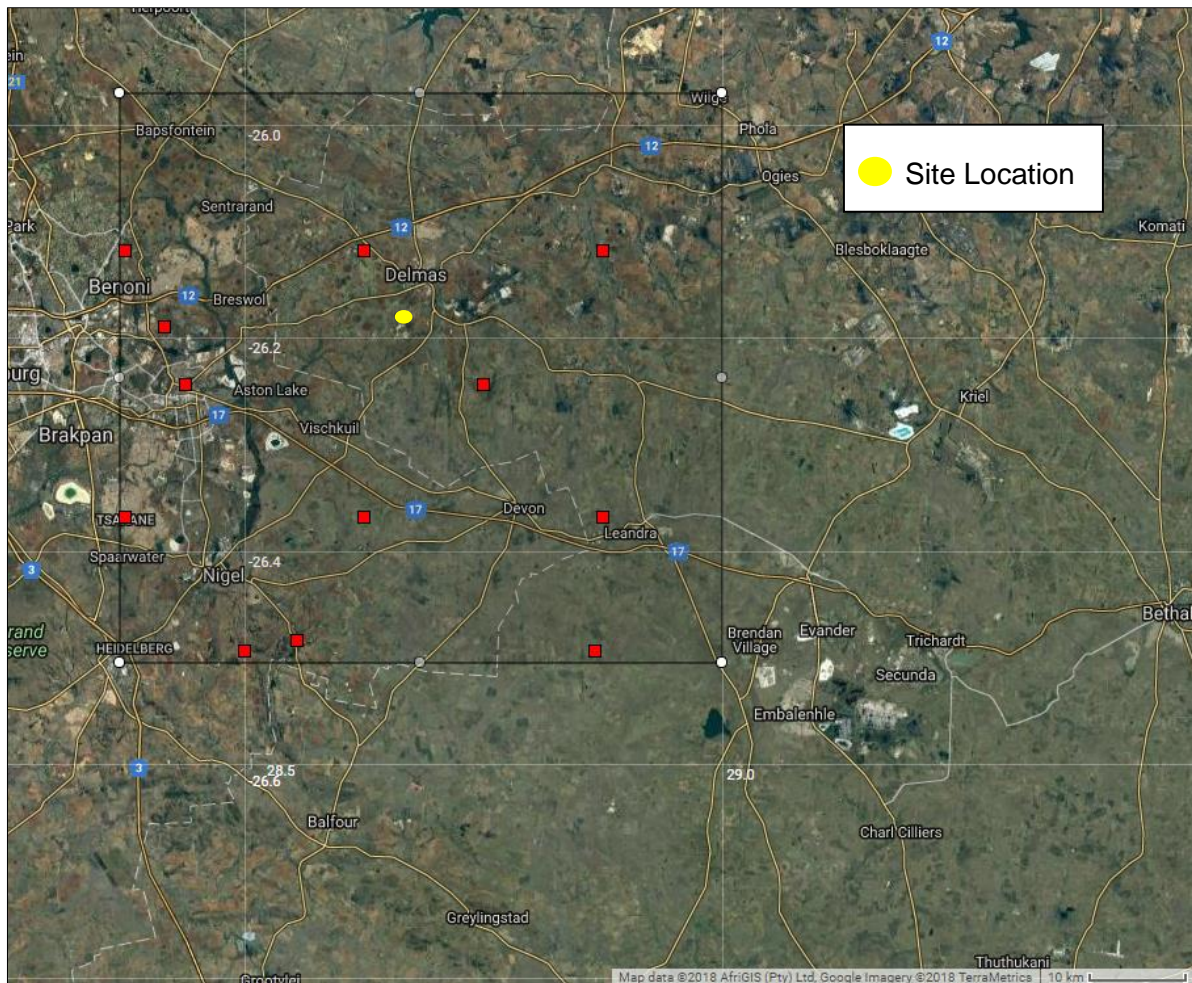


Figure 13: Map showing the regional grid drawn in order to compile an expected species list (BODATSA-POSA, 2016)

Table 2: Plant Species of Conservation Concern (SCC) expected to occur within the region of the project area (BODATSA-POSA, 2016)

Family	Scientific Name	Author	SANBI listing (2017)	Ecology
Aizoaceae	<i>Khadia beswickii</i>	(L.Bolus) N.E.Br.	VU	Indigenous; Endemic
Fabaceae	<i>Indigofera hybrida</i>	N.E.Br.	VU	Indigenous; Endemic
Apocynaceae	<i>Pachycarpus suaveolens</i>	(Schltr.) Nicholas & Goyder	VU	Indigenous
Aizoaceae	<i>Delosperma leendertziae</i>	N.E.Br.	NT	Indigenous; Endemic
Orchidaceae	<i>Habenaria bicolor</i>	Conrath & Kraenzl.	NT	Indigenous

*Khadia beswickii* is listed as Vulnerable (VU) according to the Red List of South African Plants (SANBI, 2017) and can be found in open shallow soil over rocks in grassland. The major threats to this species habitat loss, invasive alien species (direct effects) and harvesting [gathering] (Victor *et al*, 2005).



*Indigofera hybrida* is listed as Vulnerable (VU) according to the Red List of South African Plants (SANBI,2017) and can be found in the Wakkerstroom Montane Grassland, KaNgwane Montane Grassland, Eastern Highveld Grassland Veld types in dry highveld grassland habitat). Habitat has been transformed to forestry plantations and agriculture (Burrows et al, 2006).

*Pachycarpus suaveolens* is listed as Near-Threatened (NT) according to the Red List of South African Plants (SANBI,2017) and can be found in the Veld types Lydenburg Montane Grassland, Eastern Highveld Grassland, Soweto Highveld Grassland. It may be present in short or annually burnt grasslands, 1400-2000 m. The Grassland habitat is extensively transformed by urban development, crop cultivation, mining and invasive alien plants (Lötter et al, 2007).

*Delosperma leendertziae* is listed as Near-Threatened (NT) according to the Red List of South African Plants (SANBI,2017) and can be found in the Savanna Veld type, and prefers steep, south-facing slopes of quartzite in mountain grassland. Major threats are due to habitat quality at more than 10 existing locations is declining due to soil erosion, alien plant invasion and inappropriate fire management (Victor et al, 2005).

*Habenaria bicolor* is listed as Near-Threatened (NT) according to the Red List of South African Plants (SANBI,2017) and can be found in Grassland where there are well-drained grasslands at around 1600 m in South Africa. Urban expansion, habitat transformation, degradation and destruction are severe threats in Gauteng and are causing ongoing declines (Victor et al, 2007).

## 7.1.2 Regional Faunal Assessment

### 7.1.2.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 288 bird species have the potential to occur within the vicinity of the project area (pentads 2605\_2835, 2605\_2480, 2605\_2845, 2610\_2835, 2610\_2840, 2610\_2845, 2615\_2835, 2615\_2840,2615\_2845). The full list of potential bird species is provided in Appendix B.

Of the potential bird species to occur within this region, twenty-four (24) species (8.3%) are listed as SCC either on a regional (21) or global scale (15) (Table 3).

The potential SCC include the following:

- Three (3) species that are listed as Endangered (EN) on a regional basis;
- Seven (7) species that are listed as Vulnerable (VU) on a regional basis; and
- Twelve (11) species that are listed as Near Threatened (NT) on a regional basis;

On a global scale, four (4) species are listed as VU and ten (10) species as NT (Table 3).



Table 3: List of bird species of regional or global conservation importance that are expected to occur in pentads 2605\_2835, 2605\_2480, 2605\_2845, 2610\_2835, 2610\_2840, 2610\_2845, 2615\_2835, 2615\_2840, 2615\_2845 (SABAP2, 2017, ESKOM, 2014; IUCN, 2017)

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Alcedo semitorquata</i>	Kingfisher, Half-collared	NT	LC	Moderate
<i>Anthropoides paradiseus</i>	Crane, Blue	NT	VU	High
<i>Calidris ferruginea</i>	Sandpiper, Curlew	LC	NT	Moderate
<i>Charadrius pallidus</i>	Plover, Chestnut-banded	NT	NT	Moderate
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC	High
<i>Circus macrourus</i>	Harrier, Pallid	NT	NT	Moderate
<i>Circus maurus</i>	Harrier, Black	EN	VU	Moderate
<i>Circus ranivorus</i>	Marsh-harrier, African	EN	LC	High
<i>Coracias garrulus</i>	Roller, European	NT	LC	Moderate
<i>Eupodotis caerulescens</i>	Korhaan, Blue	LC	NT	Moderate
<i>Eupodotis senegalensis</i>	Korhaan, White-bellied	VU	LC	Moderate
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC	High
<i>Falco vespertinus</i>	Falcon, Red-footed	NT	NT	High
<i>Geronticus calvus</i>	Ibis, Southern Bald	VU	VU	High
<i>Glareola nordmanni</i>	Pratincole, Black-winged	NT	NT	Moderate
<i>Mirafra cheniana</i>	Lark, Melodious	LC	NT	Moderate
<i>Mycteria ibis</i>	Stork, Yellow-billed	EN	LC	High
<i>Neotis denhami</i>	Bustard, Denham's	VU	NT	Moderate
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT	High
<i>Phoeniconaias minor</i>	Flamingo, Lesser	NT	NT	High
<i>Phoenicopterus ruber</i>	Flamingo, Greater	NT	LC	High
<i>Podica senegalensis</i>	Finfoot, African	VU	LC	Moderate
<i>Sagittarius serpentarius</i>	Secretarybird	VU	VU	High
<i>Tyto capensis</i>	Grass-owl, African	VU	LC	High

Some of the expected bird SCC from are discussed below.

*Alcedo semitorquata* (Half-collared Kingfisher) is listed as Near Threatened (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 moderate due to the fact that there are some farm dams in the project area, and there are various wetland areas nearby, both of which could provide suitable habitat for this species.



*Anthropoides paradiseus* (Blue Crane) is listed as Near Threatened (NT) on a regional scale. The species is near-endemic to South Africa and although populations have increased in the south and south-western Western Cape and KwaZulu-Natal Provinces, the national population has decreased by half since the 1970s, with dramatic declines in many former strongholds (IUCN, 2017). Populations of all three crane species in South Africa 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. Based on the presence of suitable habitat, especially open grasslands and wetlands, as well as the proximity of maize fields in which this species often forages, the likelihood of occurrence was rated as high.

*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 salt pans (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 wet areas creates the potential for this species to occur in the area and the likelihood of occurrence was rated as high.

*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 project area as a migratory route or a temporary overwintering location from August to March and as such the likelihood of occurrence is moderate.

*Circus maurus* (Black Harrier) is listed as Endangered (EN) on a local basis and is restricted to southern Africa, where it is mainly found in the fynbos and Karoo of the Western and Eastern Cape. It is also found in the grasslands of Free State, Lesotho and KwaZulu-Natal. Harriers breed close to coastal and upland marshes, damp sites, near vleis or streams with tall shrubs or reeds. South-facing slopes are preferred in mountain areas where temperatures are cooler, and vegetation is taller (IUCN, 2017). During the non-breeding season, they will also be found in dry grassland areas further north and they also visit coastal river floodplains in Namibia. Due to the presence of some suitable habitat in the project area but the lack of any mountainous areas, the likelihood of occurrence is rated as 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 extensive wetlands and marsh areas at the project area and the occurrence of *C. ranivorus* in the project area is therefore considered to be moderate to 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.

*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 (Hockey et al, 2005). It generally prefers tall, dense sour or mixed grassland, either open or lightly wooded, occasionally moving into cultivated or burnt land, which are present in the project area thus likelihood of occurrence was rated as moderate.

*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 occurrence for 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.

*Geronticus calvus* (Southern Bald Ibis) is listed as Vulnerable (VU) on a regional basis and prefers high rainfall (>700 mm p.a.), sour and alpine grasslands, with an absence of trees and a short, dense grass sward and also occurs in lightly wooded and relatively arid country. It forages on recently burned ground, also using unburnt natural grassland, cultivated pastures, reaped maize fields and ploughed areas. It has a varied diet, mainly consisting of insects and other terrestrial invertebrates (IUCN, 2017). It has high nesting success on safe, undisturbed cliffs. The likelihood of the species foraging within the project area is high due to plentiful suitable habitat.

*Mycteria ibis* (Yellow-billed Stork) is listed as EN on a regional scale and Least Concern (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 water bodies within the project area creates a high possibility that this species may occur in the project area.



*Neotis denhami* (Denham's Bustard) is listed as VU on a regional scale and NT on a global scale. It occurs in flat, arid, mostly open country such as grassland, Karoo, bushveld, thornveld, scrubland and savanna but also including modified habitats such as wheat fields and firebreaks. Collisions with power lines may be a significant threat in parts of the range, particularly South Africa (IUCN, 2007). The habitat at the project area does provide marginally suitable habitat for this species and therefore its likelihood of occurrence is rated as moderate.

*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 high due to the wetland systems present as well as the vegetated dams which this species prefers.

*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 low.

*Podica senegalensis* (African Finfoot) occurs in forest and wooded savanna along permanent streams with thick growths of *Syzygium guineense*, along secluded reaches of thickly wooded rivers and on the edges of pools, lakes and dams with well-vegetated banks on the edges of dense papyrus beds far from the shore. It is rarely found away from shoreline vegetation and generally avoids stagnant or fast-flowing water (IUCN, 2017). There is some habitat for this species in the project area in the forms of dams and as such the likelihood of occurrence is rated as moderate.

*Sagittarius serpentarius* (Secretarybird) 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 wetland areas present in the project area, as well as the agricultural areas present in which this species may forage.

*Tyto capensis* (African Grass-owl) is rated as Vulnerable (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 present in the project area. Furthermore, this species specifically has a preference for nesting in dense stands of the grass species *Imperata cylindrica*. Extensive areas of this grass species are evident within the project area and as such the likelihood of occurrence is rated as high.

### 7.1.2.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that have the potential to occur within the project area (Appendix C). Of these species, 12 are medium to large





conservation dependant species, such *Ceratotherium simum* (Southern White Rhinoceros) and *Tragelaphus oryx* (Common Eland) 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 (highlighted in red) in Appendix C.

Of the remaining 73 small to medium sized mammal species, twelve (12) (17.4%) are listed as being of conservation concern on a regional or global basis (Table 4).

The list of potential species includes:

- Two (2) that are listed as Endangered (EN) on a regional basis;
- Three (3) that are listed as Vulnerable (VU) on a regional basis; and
- Eight (8) that are listed as Near Threatened (NT) on a regional scale (Table 4).

On a global scale, 1 species is listed as EN, 2 are listed as VU and 2 as NT (Table 4).

*Table 4: 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	
		Regional (SANBI, 2016)	IUCN (2017)
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT
<i>Atelerix frontalis</i>	South Africa Hedgehog	NT	LC
<i>Cloeotis percivali</i>	Short-eared Trident Bat	EN	LC
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	NT	LC
<i>Felis nigripes</i>	Black-footed Cat	VU	VU
<i>Leptailurus serval</i>	Serval	NT	LC
<i>Panthera pardus</i>	Leopard	VU	VU
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT
<i>Pelea capreolus</i>	Grey Rhebok	NT	LC
<i>Poecilogale albinucha</i>	African Striped Weasel	NT	LC
<i>Redunca fulvorufula</i>	Mountain Reedbuck	EN	LC
<i>Smutsia temminckii</i>	Temminck's Ground Pangolin	VU	VU

Some of the expected mammal SCC are discussed below.

*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 a non-perennial stream within the project area and small wetlands, the likelihood of occurrence of this species occurring in the project area is considered to be moderate.

*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 the likelihood of occurrence is rated as moderate.

*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. Based on the proximity of the various wetlands the likelihood of occurrence of this species was rated as moderate.

*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 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 various grassland and wetland areas in the project area the likelihood of occurrence for this species within the project area is rated as high.

*Ourebia ourebi* (Oribi) has a patchy distribution throughout Africa and is known to occur in South Africa. Populations are becoming more fragmented as it is gradually eliminated from moderately to densely settled areas (IUCN, 2017). Although suitable habitat exists within the project area, the likelihood of occurrence is rated as low due to the relatively small size of the patches of natural vegetation that remain within the project area.

*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 and the likelihood of occurrence in an area in close proximity to various mining and agricultural activities in the area and where they are likely to be persecuted is regarded as low.

*Pelea capreolus* (Grey Rhebok) is endemic to a small region in southern Africa, inhabiting montane and plateau grasslands of South Africa, Swaziland, and Lesotho. In South Africa, their distribution is irregular and patchy, and they no longer occur north of the Orange River in the Northern Cape, or in parts of the North-West Province (IUCN, 2017). Grey Rhebok can be found in suitable habitat which has rocky hills, grassy mountain slopes, and montane and plateau grasslands in southern Africa. They are predominantly browsers, and largely water independent, obtaining most of their water requirements from their food. Based on the lack of



their favoured habitat at the project area, the likelihood of occurrence of this species is rated as low.

*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 moderate.

*Redunca fulvorufula* (Mountain Reedbuck) is listed as EN both regionally and globally. The South African population has undergone a decline of 61-73% in the last three generations (15 years) (IUCN, 2017). Mountain Reedbuck live on ridges and hillsides in broken rocky country and high-altitude grasslands (often with some tree or bush cover). Due to the lack of this habitat at the project area, the likelihood of occurrence of this species is rated as low.

### 7.1.2.3 Herpetofauna (Reptiles & Amphibians)

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2017) 17 reptile species have the potential to occur in the project area (Appendix D). Of these reptile species, only one (1) is regarded as a SCC, namely *Crocodylus niloticus* (Nile Crocodile) which is listed as Near Threatened (NT) regionally (Table 5). Although this species is listed as expected to occur within the project area, the lack of very large water bodies or rivers which this species requires, and the lack of recent records for the surrounding area, suggests that the likelihood of occurrence is low (Table 5).

Table 5: List of reptile species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; Bates et al., 2014)

Species	Common name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
<i>Crocodylus niloticus</i>	Nile Crocodile	VU	LC	Low

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2017), 17 amphibian species have the potential to occur within the project area (Appendix E). No amphibian species of conservation concern should be present in the project area, however, according to the above-mentioned sources but *in situ* confirmation is required.

### 7.1.3 Riverine Ecology Assessment

Desktop information for the SQR was obtained from Department of Water and Sanitation (DWS) (2018). The Bronkhorstspuit SQR B20A-1308 of a tributary of the Bronkhorstspuit River. The Present Ecological Status (PES) category of the reach was classed as largely modified (class D). The largely modified state of the reach was attributed to moderate to large impacts to instream habitat, wetland and riparian zone continuity, flow modifications and serious impacts on physico-chemical conditions (water quality). The attainable ecological management class for the Bronkhorstspuit project area is class C or moderately modified (DWS, 2018).



Table 6: The desktop information pertaining to the B20A-1308 Sub Quaternary Reach (DWS, 2018)

Component/Catchment	B20A-1308 (Bronkhorstspuit)
Present Ecological Status	class D (largely modified)
Ecological Importance Class	Moderate
Ecological Sensitivity	Moderate
Default Ecological Category	class C (moderately modified)

The list of potential fish species is presented in Table 7 (Skelton, 2001; DWS, 2018). Five (5) fish species have the potential to occur in the project area. It should be noted that these species lists are compiled on an SQR basis and not on a site-specific basis. It is therefore, unlikely that all the expected species will be present at every site in the SQR, with habitat type and availability being a major driver of species diversity. Therefore, Table 7 should be viewed as a list of potential species rather than an expected species list. Fish species richness within the SQR is low, and the expected species are considered to be tolerant to modified physico-chemical conditions (DAAF, 2013).

Table 7: Potential indigenous species list for project area

Scientific name	Common name	IUCN Status
<i>Clarias gariepinus</i>	Sharptooth Catfish	LC
<i>Enteromius anoplus</i>	Chubbyhead Barb	LC
<i>Enteromius paludinosus</i>	Straightfin Barb	LC
<i>Pseudocrenilabrus philander</i>	Southern Mouth Brooder	LC
<i>Tilapia sparrmanii</i>	Banded Tilapia	LC
<b>Total number of expected species</b>		<b>5</b>
IUCN - International Union for Conservation of Nature; LC - Least Concern		

### 7.1.3.1 Presence of Species of Conservation Concern

The conservation status of the indigenous fish species was assessed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species (IUCN, 2017). Based on this assessment, no species of concern occur in the Bronkhorstspuit SQR.

## 8 Potential Impacts 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 ecosystem services. Depending on the mining methods adopted, mining activities can cause environmental degradation. These disturbances have direct, indirect, short- and long-term potentially adverse effects on the landscape and nearby human communities.

The impact of open-cast mining is the conversion of land use, most likely from undeveloped or agricultural land use. This impact is accompanied by loss of habitat, noise, dust, blasting effects, erosion, sedimentation, and changes to the visual scene (Langer *et al.*, 2002).

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Key impacts commonly associated with open cast mining activities on biodiversity are discussed below. The listed activities are 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 (EIA phase) as more information becomes available. The significance (quantification) of potential environmental impacts will be assessed in terms of the Guideline Documentation on EIA Regulation; Department of Environmental Affairs and Tourism, 2014 (Impact Assessment Methodology, Appendix 6) in the final impact assessment report.

## 8.1 Impact Assessment Considerations

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 may provide possible habitat and shelter to a number of endemic and protected faunal 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, 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. It should be noted however, that a large portion of the proposed project area and its surroundings is highly modified or transformed and thus is unlikely to contain such species.

Some risks associated with open cast mining methods are as follows:

- Open cast coal mining alters 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; and
- Open cast coal mining causes dust and noise pollution when topsoil is disrupted with heavy machinery and coal dust is created in mines.

### 8.1.1 Scoping Assessment Impacts

The scoping assessment impact table is presented in Table 8 where the potential impacts have been rated before and after mitigation.



Table 8: Scoping assessment potential impacts before and after mitigation.

Impact	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence
Further loss and fragmentation of the vegetation community as well the destruction of a portion of a Vulnerable vegetation type.	-1	2	4	4	4	5	-17,5	1	1	3	2	2	2	4	High
Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)	-1	2	5	4	4	5	-18,75	1	1	3	2	2	2	4	High
Loss of movement corridor that animals use to migrate between fragmented habitats.	-1	3	5	5	4	4	-17	1	2	3	2	2	2	4.5	High



### 8.1.2 Mitigation Measures Objectives

A number of general mitigation measures are recommended for the project as a whole, while more specific measures are detailed in the following sections which relate to impacts to fauna and flora specifically. The mitigation measures supplied below must be read with, and implemented, in conjunction with those mitigation measures recommended in the specialist wetland and aquatics reports. The general focus of mitigation measures must be to reduce the significance of potential impacts (as defined above) associated with the development and thereby to:

- Prevent the further loss and fragmentation of this vegetation community (listed as Vulnerable) and ONAs in the vicinity of the project site;
- Prevent the loss of the faunal community associated with this vegetation community and with sensitive wetland environments;
- Prevent the loss of expected species of conservation concern which are known to occur within the project area; and
- Limiting the construction area to the defined project areas and only impacting those areas where it is unavoidable to do so otherwise.

### 8.1.3 Mitigation Measures for Impacts

Recommended mitigation for the scoping assessment measures include the following:

- As far as possible, the proposed discard stockpiles for hards, softs and topsoil should be placed in areas that have already been disturbed, the ONA's / Moderate biodiversity importance areas that are present should be avoided;
- It is recommended that areas to be developed be specifically demarcated so that during the construction phase and operational phase, only the demarcated areas be impacted upon. All mining and stockpile areas, and access roads must be clearly demarcated from surrounding natural areas and entrance into these areas should be closely monitored;
- It should be made an offence for any staff to bring any plant species into any portion of the project site. No plant species whether indigenous or exotic should be brought into the project area, to prevent the spread of exotic or invasive species;
- 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 are found during construction (this includes all species of flora and fauna);
- Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species;
- Any topsoil that is removed during construction must be appropriately removed and stored according to the national and provincial guidelines, specifically the Department of Environmental Affairs and Forestry, 2005 (DWAf, 2005) This includes on-going



maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation;

- A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site. Alternatively, the mine may undertake or contract the disposal of contaminated soil at a licenced and registered facility if necessary;
- Compilation of and implementation of an alien vegetation management plan for the entire site, including the surrounding project area and especially the wetland areas;
- A site-specific walk-through survey prior to commencement of activity informed by the findings from the detailed EIA phase assessment;
  - Demarcate the stockpiles in previously disturbed areas and / or habitats with lower sensitivity;
  - Obtain permits for any listed/protected species found on site;
  - Search and rescue, where appropriate.
- Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during the construction process. The intentional killing of any animals including snakes, lizards, birds or other animals should be strictly prohibited;
- The areas rated as highly sensitive in the project area as defined in this report, should be avoided as far as possible during the construction and operational phases. All efforts must be made to minimise access to this area from construction workers and machinery including locating activities on the boundaries of existing disturbances and using existing access roads as much as possible;
- All livestock must be kept out of the wetland and grassland areas in order to prevent overgrazing of potential SCC avifauna habitat; and
- No domestic animals are to be allowed in to the project area under any circumstances, especially any dogs and cats. Any and all feral cats which may enter the project area must be removed immediately.

## 8.2 Riverine Impact Assessment Considerations

The proposed project activities were determined to have two primary potential impacts to the associated riverine ecology. The first was determined to be related to the conditions within the physical make-up of the considered river reaches. This includes the riverine substrates, banks, riparian vegetation and water column. These physical components of a water course determine the quality of the aquatic habitats. Therefore, modification of these physical components would result in a habitat quality impact. The second impact was determined to be related to the chemical properties of water. Considering aquatic biota have requirements for habitat, as well as sensitivity to changes in water chemistry, a change to water quality is anticipated to have negative impacts to local aquatic biota.





The central anticipated impacts associated with the proposed project are related to increased suspended solids and sedimentation. The proposed open pit mining methods, without mitigation, will strip vegetation resulting in increased runoff velocities and subsequent erosion, sedimentation and increased suspended solids. This may have an impact to aquatic habitat and to fine sediment sensitive instream aquatic ecology. The proposed project has the potential to alter the topography of the catchment feeding the considered SQR and can result in the alteration of the hydrology within the considered river reach.

It can be anticipated that salt's and metal's content within the mineral resources will become exposed to further weathering via the active mining process. This subsequently may result in the increase of dissolved solid content downstream of the proposed project should runoff/seepage from the mineral resources enter into the watercourse.

Following the completion of the mining project and closure of the open pit areas, there is potential for acid mine drainage to develop and emanate from the rehabilitated pit. This however requires further confirmation.

## 9 Scoping Phase Conclusion

From an ecological perspective the development is situated primarily in an area which has been extensively modified due to agricultural activities and little natural or pristine vegetation persists. However, various wetland areas do occur throughout the project area, most notably across the southern portion of the proposed development footprint. Although somewhat disturbed, it is believed these areas may support various faunal species and there is a moderate likelihood that SCC (such as Serval) may occur there. These wetland areas may also act as important corridors that allow for the movement of faunal species. Upcoming field surveys will increase the robustness of these preliminary results.

The proposed development is associated with mining activities, namely open cast coal mining. The proposed activities have the potential to result in direct loss and destruction of habitats (including a Vulnerable vegetation type), direct mortalities and displacement of fauna and flora. The removal of any remaining natural vegetation to accommodate mining will reduce the habitat available for fauna species and may reduce animal populations and species compositions within the area.

The level of disturbance emphasises the need to recommend relevant mitigation measures (including adhering to any potential recommended buffer zones) to limit the impact significance rating to such an extent that final recommendations can be made to inform and guide the environmental impact practitioner and regulatory authorities. This will enable these parties to make informed decisions as to the ecological viability of the proposed project. A detailed risk and impact matrix will be completed to fully determine the significance and likelihood of all associated impacts.

The following conclusions were defined based on the scoping phase information analysed for this report:

- According to the MBSP spatial data, the Kangala extension project area overlaps with the following land types:
  - Heavily Modified Areas (HMA);  
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- Moderately Modified Areas (Old Lands); and
- Other Natural Areas (ONAs).
- Based on this desktop information, much of the project area is identified as being heavily modified, although a portion of the south-eastern project area overlaps with an ONA (Figure 2);
- According to the NBA terrestrial ecosystem threat status (Figure 3), on a regional context the project area overlaps entirely with ecosystems that are listed as Vulnerable (VU) and as *not protected* although locally much of the project area is already transformed or modified by agricultural activities and existing mining operations;
- The Kangala extension project is not expected to have an impact on any formally or informally protected areas;
- The project area does overlap with certain wetland areas according to various spatial datasets analysed for this report. However, none of these areas are classified as NFEPA wetlands or rivers. One True FEPA wetland does occur to the east of the project area;
- According to the Mining and Biodiversity Guidelines spatial dataset (2013), the majority of the Kangala project area is considered to be of low biodiversity importance and there is therefore a correlating low risk for mining. However, various portions of the project area are classified as having a moderate biodiversity importance and these represent a moderate risk to mining (Figure 10);
- The project area is situated within the Eastern Highveld Grassland (GM12) vegetation type. According to Mucina & Rutherford (2006), this vegetation type is classified as Endangered in its natural condition; and
- According to various biodiversity datasets analysed, the following number of threatened or protected faunal species (SCC) have the potential to occur within the project area:
  - Of the expected bird species, twenty-four (24) species (8.3%) are listed as SCC either on a regional (21) or global scale (15); and
  - Of the expected mammal species, twelve (12) (17.4%) are listed as being of conservation concern on a regional or global basis.

## 10 Terms of Reference

### 10.1 Terrestrial Studies

Fauna (Mammals, birds, reptiles & amphibians) and flora will include the following:

#### 10.1.1 Desktop

- Compilation of an expected species list;
- Identify expected Red Data or listed species potentially occurring in the area;



- A proximity assessment to any protected or ecologically important areas;
- Potential impact assessment.

### 10.1.2 Field Study

The field survey for fauna will be undertaken concurrently with vegetation surveys. All animals observed in the area will be noted. Ecological indicators, such as calls, tracks and dung will be noted and regarded as indicative of the presence of that particular animal.

A detailed fauna lists will be compiled and discussed in relation to the floristic survey findings. The probability of occurrence for species not observed during field surveys will be considered if applicable regarding available habitats. Protected and endemic species will be the focus of discussion. Faunal composition of disturbed sites will be compared to the composition of undisturbed areas.

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

- Timed meander (vegetation);
- Camera trapping;
- Active sampling;
- Visual observations;
- Small mammal trapping
- Identification of tracks and signs; and
- Utilization of local knowledge.

The current status of the faunal environment will be determined and an evaluation of the extent of site-related effects in terms of certain ecological indicators, as well as identification of specific important ecological attributes such as rare and endangered species, protected species, sensitive species and endemic species will be made. The habitat will be characterised in relation to biota and the extent of site related effects. Presence of red data and protected species will be indicated on a map. Habitats present will be identified and delineated.

## 10.2 Proposed Riverine Ecology Studies

Standard methods used in the River Ecosystem Monitoring Programme were used to determine the PES of the considered watercourse. The various sections provided below elaborate on the various methods/indexes which were applied for this study.

### 10.2.1 Water Quality

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



## 10.2.2 Aquatic Habitat Integrity and Riparian Zone Delineation

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

The IHIA model was used to assess the integrity of the habitats from a riparian and instream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996). The criteria and ratings utilised in the assessment of habitat integrity in the current study are presented in Table 9 and Table 10.

*Table 9: Criteria used in the assessment of habitat integrity (Kleynhans, 1996)*

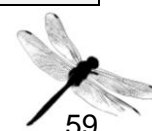
Criterion	Relevance
<b>Water abstraction</b>	Direct impact on habitat type, abundance and size. Also implicated in flow, bed, channel and water quality characteristics. Riparian vegetation may be influenced by a decrease in the supply of water.
<b>Flow modification</b>	Consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow can have an impact on habitat attributes such as an increase in duration of low flow season, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season.
<b>Bed modification</b>	Regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.
<b>Channel modification</b>	May be the result of a change in flow, which may alter channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
<b>Water quality modification</b>	Originates from point and diffuse point sources. Measured directly or alternatively agricultural activities, human settlements and industrial activities may indicate the likelihood of modification. Aggravated by a decrease in the volume of water during low or no flow conditions.
<b>Inundation</b>	Destruction of riffle, rapid and riparian zone habitat. Obstruction to the movement of aquatic fauna and influences water quality and the movement of sediments.
<b>Exotic macrophytes</b>	Alteration of habitat by obstruction of flow and may influence water quality. Dependent upon the species involved and scale of infestation.
<b>Exotic aquatic fauna</b>	The disturbance of the stream bottom during feeding may influence the water quality and increase turbidity. Dependent upon the species involved and their abundance.
<b>Solid waste disposal</b>	A direct anthropogenic impact which may alter habitat structurally. Also, a general indication of the misuse and mismanagement of the river.
<b>Indigenous vegetation removal</b>	Impairment of the buffer the vegetation forms to the movement of sediment and other catchment runoff products into the river. Refers to physical removal for farming, firewood and overgrazing.
<b>Exotic vegetation encroachment</b>	Excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Allochthonous organic matter input will also be changed. Riparian zone habitat diversity is also reduced.
<b>Bank erosion</b>	Decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or exotic vegetation encroachment.

*Table 10: Descriptions used for the ratings of the various habitat criteria*

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

The riparian delineation was completed according to Department of Water Affairs and Forestry (DWAf, 2005). Typical riparian cross sections and structures are provided in Figure 14. Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. One metre contour data obtained from topography spatial data was also utilised to support the infield assessment.

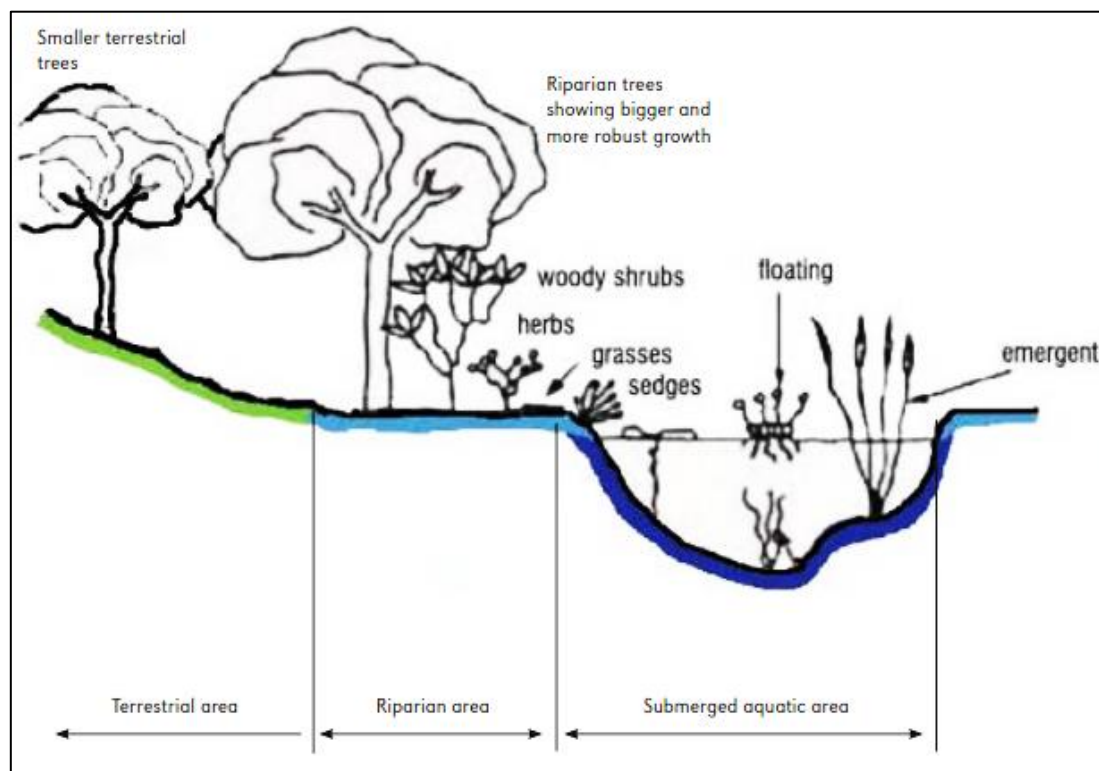


Figure 14: Riparian Habitat Delineations (DWAf, 2005)

### 10.3 Aquatic Macroinvertebrate Assessment

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al.*, 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong



information for interpreting cumulative effects (Barbour *et al.*, 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

### 10.3.1 South African Scoring System

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

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

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the North Eastern Coastal Belt - upper ecoregion (Figure 15). This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database.

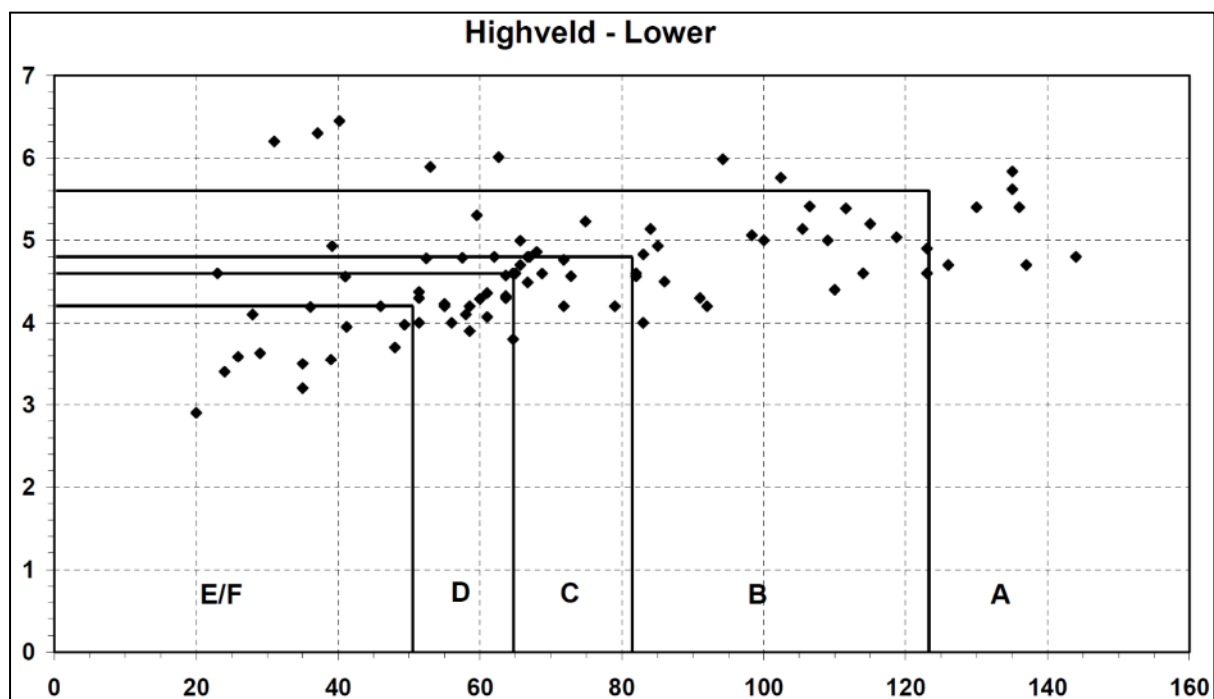


Figure 15: Biological Bands for the Highveld Lower Ecoregion (Dallas, 2007)

The assessment of the watercourse was completed using standard invertebrate sampling methods which have been adapted to suit the nature of the considered watercourse. In the case of this study, the wide and deep nature of the Vaal River system has presented poor invertebrate biotopes. In order to compensate for this and provide a high level assessment of the current conditions, an adapted overall statistical analysis was conducted in this study. This



involved the selection of four sampling points which represented a single site. Standard SASS5 sampling methods were completed at a total of four sites which represent the larger macro site. This data will be presented in the final report.

### **10.3.2 Macroinvertebrate Response Assessment Index**

The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the SQR. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality;
- Energy inputs from the watershed; and
- Riparian vegetation assessment.

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the PES.

### **10.4 Fish Community Assessment**

A standard qualitative fish assessment will be completed for this study. Electrofishing techniques, fyke and cast netting methods were applied to determine the reach based fish community during the survey for comparative purposes and interpretation. The Fish Response Assessment Index will be applied for this study.

### **10.5 Present Ecological Status**

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For the purpose of this study ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river ecoclassification manual by Kleynhans and Louw (2007).



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

Family	Scientific Name	Author	SANBI listing (2017)	Ecology
Malvaceae	<i>Abutilon sonneratianum</i>	(Cav.) Sweet	LC	Indigenous
Euphorbiaceae	<i>Acalypha angustata</i>	Sond.	LC	Indigenous
Euphorbiaceae	<i>Acalypha caperonioides</i> var. <i>caperonioides</i>	Baill.	DD	Indigenous
Asteraceae	<i>Acanthospermum glabratum</i>	(DC.) Wild		Not Indigenous; Naturalised
Asteraceae	<i>Achillea millefolium</i>	L.		Not Indigenous; Naturalised
Amaranthaceae	<i>Achyranthes aspera</i> var. <i>aspera</i>	L.		Not Indigenous; Naturalised
Crassulaceae	<i>Adromischus umbraticola</i> subsp. <i>umbraticola</i>	C.A.Sm.		Indigenous; Endemic
Fabaceae	<i>Aeschynomene rehmannii</i> var. <i>leptobotrya</i>	Schinz	LC	Indigenous
Apiaceae	<i>Afroscidium magalismontanum</i>	(Sond.) P.J.D.Winter	LC	Indigenous
Agapanthaceae	<i>Agapanthus campanulatus</i> subsp. <i>patens</i>	F.M.Leight.	LC	Indigenous
Poaceae	<i>Agrostis continuata</i>	Stapf	LC	Indigenous
Poaceae	<i>Agrostis lachnantha</i> var. <i>lachnantha</i>	Nees	LC	Indigenous
Hyacinthaceae	<i>Albuca baurii</i>	Baker		Indigenous
Hyacinthaceae	<i>Albuca fastigiata</i> var. <i>fastigiata</i>	Dryand.		Indigenous
Hyacinthaceae	<i>Albuca setosa</i>	Jacq.		Indigenous
Hyacinthaceae	<i>Albuca shawii</i>	Baker		Indigenous
Apiaceae	<i>Alepidea peduncularis</i>	Steud. ex A.Rich.	DD	Indigenous
Poaceae	<i>Alloteropsis semialata</i> subsp. <i>semialata</i>	(R.Br.) Hitchc.	LC	Indigenous
Asphodelaceae	<i>Aloe jeppeae</i>	Klopper & Gideon F.Sm.	LC	Indigenous
Asphodelaceae	<i>Aloe subspicata</i>	(Baker) Boatwr. & J.C.Manning		Indigenous
Cyatheaceae	<i>Alsophila dregei</i>	(Kunze) R.M.Tryon	LC	Indigenous
Amaranthaceae	<i>Alternanthera pungens</i>	Kunth		Not Indigenous; Naturalised



Amaranthaceae	<i>Amaranthus thunbergii</i>	Moq.	LC	Indigenous
Lythraceae	<i>Ammannia baccifera subsp. baccifera</i>	L.		Not Indigenous; Naturalised
Apiaceae	<i>Ammi majus var. glaucifolium</i>	L.		Not Indigenous; Naturalised
Apocynaceae	<i>Ancylobotrys capensis</i>	(Oliv.) Pichon	LC	Indigenous
Poaceae	<i>Andropogon appendiculatus</i>	Nees	LC	Indigenous
Poaceae	<i>Andropogon schirensis</i>	Hochst. ex A.Rich.	LC	Indigenous
Aponogetonaceae	<i>Aponogeton junceus</i>	Lehm.	LC	Indigenous
Asteraceae	<i>Arctotis arctotoides</i>	(L.f.) O.Hoffm.	LC	Indigenous
Fabaceae	<i>Argyrolobium harveyanum</i>	Oliv.	LC	Indigenous
Fabaceae	<i>Argyrolobium speciosum</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Argyrolobium tuberosum</i>	Eckl. & Zeyh.	LC	Indigenous
Iridaceae	<i>Aristea torulosa</i>	Klatt	LC	Indigenous
Poaceae	<i>Aristida bipartita</i>	(Nees) Trin. & Rupr.	LC	Indigenous
Poaceae	<i>Aristida congesta subsp. congesta</i>	Roem. & Schult.	LC	Indigenous
Poaceae	<i>Aristida diffusa subsp. burkei</i>	Trin.	LC	Indigenous
Poaceae	<i>Aristida junciformis subsp. junciformis</i>	Trin. & Rupr.	LC	Indigenous
Asteraceae	<i>Artemisia afra var. afra</i>	Jacq. ex Willd.	LC	Indigenous
Poaceae	<i>Arundinella nepalensis</i>	Trin.	LC	Indigenous
Apocynaceae	<i>Asclepias adscendens</i>	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias albens</i>	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias aurea</i>	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias brevipes</i>	(Schltr.) Schltr.	LC	Indigenous; Endemic
Apocynaceae	<i>Asclepias crispa var. crispa</i>	P.J.Bergius	LC	Indigenous; Endemic
Apocynaceae	<i>Asclepias eminens</i>	(Harv.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias fallax</i>	(Schltr.) Schltr.	LC	Indigenous; Endemic
Apocynaceae	<i>Asclepias gibba var. gibba</i>	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias gibba var. media</i>	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias multicaulis</i>	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	<i>Asclepias stellifera</i>	Schltr.	LC	Indigenous



Apocynaceae	<i>Aspidoglossum biflorum</i>	E.Mey.	LC	Indigenous
Apocynaceae	<i>Aspidoglossum glabrescens</i>	(Schltr.) Kupicha	LC	Indigenous; Endemic
Apocynaceae	<i>Aspidoglossum interruptum</i>	(E.Mey.) Bullock	LC	Indigenous
Apocynaceae	<i>Aspidoglossum lamellatum</i>	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	<i>Aspidoglossum ovalifolium</i>	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	<i>Aspidoglossum restioides</i>	(Schltr.) Kupicha	LC	Indigenous; Endemic
Aspleniaceae	<i>Asplenium cordatum</i>	(Thunb.) Sw.	LC	Indigenous
Amaranthaceae	<i>Atriplex suberecta</i>	I.Verd.	LC	Indigenous
Rhamnaceae	<i>Berchemia zeyheri</i>	(Sond.) Grubov		Indigenous
Elatinaceae	<i>Bergia decumbens</i>	Planch. ex Harv.	LC	Indigenous
Asteraceae	<i>Berkheya pinnatifida subsp. ingrata</i>	(Thunb.) Thell.	LC	Indigenous; Endemic
Asteraceae	<i>Berkheya radula</i>	(Harv.) De Wild.	LC	Indigenous
Asteraceae	<i>Berkheya seminivea</i>	Harv. & Sond.	LC	Indigenous; Endemic
Asteraceae	<i>Berkheya setifera</i>	DC.	LC	Indigenous
Asteraceae	<i>Berkheya zeyheri subsp. zeyheri</i>	Oliv. & Hiern	LC	Indigenous
Poaceae	<i>Bewsia biflora</i>	(Hack.) Gooss.	LC	Indigenous
Asteraceae	<i>Bidens pilosa</i>	L.		Not Indigenous; Naturalised
Poaceae	<i>Brachiaria advena</i>	Vickery	NE	Not Indigenous; Naturalised
Poaceae	<i>Brachiaria serrata</i>	(Thunb.) Stapf	LC	Indigenous
Apocynaceae	<i>Brachystelma chloranthum</i>	(Schltr.) Peckover	LC	Indigenous
Scrophulariaceae	<i>Buddleja saligna</i>	Willd.	LC	Indigenous
Scrophulariaceae	<i>Buddleja salviifolia</i>	(L.) Lam.	LC	Indigenous
Asteraceae	<i>Callilepis leptophylla</i>	Harv.	LC	Indigenous
Poaceae	<i>Catalepis gracilis</i>	Stapf & Stent	LC	Indigenous
Cannabaceae	<i>Celtis africana</i>	Burm.f.	LC	Indigenous
Caryophyllaceae	<i>Cerastium arabis</i>	E.Mey. ex Fenzl		Indigenous
Caryophyllaceae	<i>Cerastium capense</i>	Sond.		Indigenous



Pteridaceae	<i>Cheilanthes hirta</i> var. <i>brevipilosa</i>	Sw.	LC	Indigenous; Endemic
Pteridaceae	<i>Cheilanthes multifida</i> subsp. <i>lacerata</i>	(Sw.) Sw.	LC	Indigenous
Amaranthaceae	<i>Chenopodium glaucum</i>	L.		Not Indigenous; Naturalised
Amaranthaceae	<i>Chenopodium phillipsianum</i>	Aellen		Indigenous
Gentianaceae	<i>Chironia palustris</i> subsp. <i>palustris</i>	Burch.	LC	Indigenous
Gentianaceae	<i>Chironia purpurascens</i> subsp. <i>humilis</i>	(E.Mey.) Benth. & Hook.f.	LC	Indigenous
Asteraceae	<i>Cirsium vulgare</i>	(Savi) Ten.		Not Indigenous; Naturalised; Invasive
Cleomaceae	<i>Cleome maculata</i>	(Sond.) Szyszyl.	LC	Indigenous
Cleomaceae	<i>Cleome monophylla</i>	L.	LC	Indigenous
Euphorbiaceae	<i>Clutia hirsuta</i> var. <i>hirsuta</i>	(Sond.) Müll.Arg.	LC	Indigenous
Euphorbiaceae	<i>Clutia pulchella</i> var. <i>pulchella</i>	L.	LC	Indigenous
Combretaceae	<i>Combretum apiculatum</i> subsp. <i>apiculatum</i>	Sond.	LC	Indigenous
Apocynaceae	<i>Cordylogyne globosa</i>	E.Mey.	LC	Indigenous
Caryophyllaceae	<i>Corrigiola litoralis</i> subsp. <i>litoralis</i>	L.		Indigenous
Crassulaceae	<i>Cotyledon orbiculata</i> var. <i>oblonga</i>	L.	LC	Indigenous
Crassulaceae	<i>Crassula alba</i> var. <i>alba</i>	Forssk.		Indigenous
Crassulaceae	<i>Crassula capitella</i> subsp. <i>nodulosa</i>	Thunb.		Indigenous
Crassulaceae	<i>Crassula lanceolata</i> subsp. <i>lanceolata</i>	(Eckl. & Zeyh.) Endl. ex Walp.		Indigenous; Endemic
Crassulaceae	<i>Crassula natans</i> var. <i>natans</i>	Thunb.		Indigenous; Endemic
Crassulaceae	<i>Crassula setulosa</i> var. <i>setulosa</i>	Harv.	NE	Indigenous
Asteraceae	<i>Crepis hypochaeridea</i>	(DC.) Thell.		Not Indigenous; Naturalised
Fabaceae	<i>Crotalaria distans</i> subsp. <i>distans</i>	Benth.	LC	Indigenous
Fabaceae	<i>Crotalaria globifera</i>	E.Mey.	LC	Indigenous
Araliaceae	<i>Cussonia paniculata</i> subsp. <i>sinuata</i>	Eckl. & Zeyh.		Indigenous
Amaranthaceae	<i>Cyathula cylindrica</i> var. <i>cylindrica</i>	Moq.	LC	Indigenous





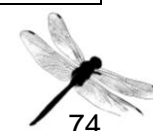
Amaranthaceae	<i>Cyathula uncinulata</i>	(Schrad.) Schinz	LC	Indigenous
Poaceae	<i>Cymbopogon caesius</i>	(Hook. & Arn.) Stapf	LC	Indigenous
Poaceae	<i>Cymbopogon pospischilii</i>	(K.Schum.) C.E.Hubb.	NE	Indigenous
Aizoaceae	<i>Delosperma leendertziae</i>	N.E.Br.	NT	Indigenous; Endemic
Caryophyllaceae	<i>Dianthus micropetalus</i>	Ser.		Indigenous
Caryophyllaceae	<i>Dianthus mooiensis subsp. kirkii</i>	F.N.Williams		Indigenous
Caryophyllaceae	<i>Dianthus zeyheri subsp. zeyheri</i>	Sond.		Indigenous; Endemic
Fabaceae	<i>Dichilus gracilis</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Dichilus lebeckioides</i>	DC.	LC	Indigenous
Fabaceae	<i>Dichilus pilosus</i>	Conrath ex Schinz	LC	Indigenous; Endemic
Fabaceae	<i>Dichilus strictus</i>	E.Mey.	LC	Indigenous
Asteraceae	<i>Dicoma anomala subsp. anomala</i>	Sond.	LC	Indigenous
Poaceae	<i>Digitaria diagonalis var. diagonalis</i>	(Nees) Stapf	LC	Indigenous
Poaceae	<i>Digitaria eriantha</i>	Steud.	LC	Indigenous
Poaceae	<i>Digitaria monodactyla</i>	(Nees) Stapf	LC	Indigenous
Poaceae	<i>Digitaria tricholaenoides</i>	Stapf	LC	Indigenous
Poaceae	<i>Diheteropogon amplexens var. amplexens</i>	(Nees) Clayton	LC	Indigenous
Poaceae	<i>Diheteropogon filifolius</i>	(Nees) Clayton	LC	Indigenous
Asteraceae	<i>Dimorphotheca caulescens</i>	Harv.	LC	Indigenous
Asteraceae	<i>Dimorphotheca spectabilis</i>	Schltr.	LC	Indigenous
Ebenaceae	<i>Diospyros austro-africana var. microphylla</i>	De Winter		Indigenous
Ebenaceae	<i>Diospyros lycioides subsp. guerkei</i>	Desf.		Indigenous
Ebenaceae	<i>Diospyros whyteana</i>	(Hiern) F.White		Indigenous
Hyacinthaceae	<i>Dipcadi gracillimum</i>	Baker		Indigenous
Hyacinthaceae	<i>Dipcadi marlothii</i>	Engl.		Indigenous
Hyacinthaceae	<i>Dipcadi viride</i>	(L.) Moench		Indigenous
Malvaceae	<i>Dombeya rotundifolia var. rotundifolia</i>	(Hochst.) Planch.	LC	Indigenous
Hyacinthaceae	<i>Drimia calcarata</i>	(Baker) Stedje		Indigenous



Hyacinthaceae	<i>Drimia depressa</i>	(Baker) Jessop		Indigenous
Hyacinthaceae	<i>Drimia elata</i>	Jacq.		Indigenous
Hyacinthaceae	<i>Drimia multisetosa</i>	(Baker) Jessop		Indigenous
Droseraceae	<i>Drosera burkeana</i>	Planch.	LC	Indigenous
Droseraceae	<i>Drosera madagascariensis</i>	DC.	LC	Indigenous
Poaceae	<i>Echinochloa jubata</i>	Stapf	LC	Indigenous
Fabaceae	<i>Elephantorrhiza elephantina</i>	(Burch.) Skeels	LC	Indigenous
Poaceae	<i>Eleusine coracana</i>	(L.) Gaertn.		Indigenous
Poaceae	<i>Eleusine coracana subsp. africana</i>	(L.) Gaertn.	LC	Indigenous
Poaceae	<i>Eleusine multiflora</i>	A.Rich.	NE	Not Indigenous; Naturalised
Poaceae	<i>Elionurus muticus</i>	(Spreng.) Kunth	LC	Indigenous
Polygonaceae	<i>Emex australis</i>	Steinh.	LC	Indigenous
Poaceae	<i>Eragrostis capensis</i>	(Thunb.) Trin.	LC	Indigenous
Poaceae	<i>Eragrostis chloromelas</i>	Steud.	LC	Indigenous
Poaceae	<i>Eragrostis cilianensis</i>	(All.) Vignolo ex Janch.	LC	Indigenous
Poaceae	<i>Eragrostis curvula</i>	(Schrad.) Nees	LC	Indigenous
Poaceae	<i>Eragrostis micrantha</i>	Hack.	LC	Indigenous
Poaceae	<i>Eragrostis patentipilosa</i>	Hack.	LC	Indigenous
Poaceae	<i>Eragrostis racemosa</i>	(Thunb.) Steud.	LC	Indigenous
Poaceae	<i>Eragrostis stapfii</i>	De Winter	LC	Indigenous
Poaceae	<i>Eragrostis tef</i>	(Zuccagni) Trotter	NE	Not Indigenous; Naturalised
Fabaceae	<i>Erythrina zeyheri</i>	Harv.	LC	Indigenous
Ebenaceae	<i>Euclea crispa subsp. crispa</i>	(Thunb.) Gürke		Indigenous
Hyacinthaceae	<i>Eucomis autumnalis subsp. clavata</i>	(Mill.) Chitt.	NE	Indigenous
Orchidaceae	<i>Eulophia cooperi</i>	Rchb.f.	LC	Indigenous; Endemic
Orchidaceae	<i>Eulophia hians var. hians</i>	Spreng.	LC	Indigenous
Orchidaceae	<i>Eulophia hians var. nutans</i>	Spreng.	LC	Indigenous
Orchidaceae	<i>Eulophia ovalis var. bainesii</i>	Lindl.	LC	Indigenous



Orchidaceae	<i>Eulophia ovalis var. ovalis</i>	Lindl.	LC	Indigenous
Euphorbiaceae	<i>Euphorbia epicyparissias</i>	E.Mey. ex Boiss.	LC	Indigenous
Euphorbiaceae	<i>Euphorbia prostrata</i>	Aiton	NE	Not Indigenous; Naturalised
Asteraceae	<i>Euryops transvaalensis subsp. transvaalensis</i>	Klatt	LC	Indigenous
Polygonaceae	<i>Fallopia convolvulus</i>	(L.) Holub		Not Indigenous; Naturalised
Poaceae	<i>Festuca scabra</i>	Vahl	LC	Indigenous
Poaceae	<i>Fingerhuthia africana</i>	Lehm.	LC	Indigenous
Poaceae	<i>Fingerhuthia sesleriiformis</i>	Nees	LC	Indigenous
Asteraceae	<i>Gazania krebsiana subsp. serrulata</i>	Less.	LC	Indigenous
Asteraceae	<i>Gerbera ambigua</i>	(Cass.) Sch.Bip.	LC	Indigenous
Asteraceae	<i>Gerbera piloselloides</i>	(L.) Cass.	LC	Indigenous
Thymelaeaceae	<i>Gnidia gymnostachya</i>	(C.A.Mey.) Gilg	LC	Indigenous
Thymelaeaceae	<i>Gnidia nodiflora</i>	Meisn.	LC	Indigenous
Apocynaceae	<i>Gomphocarpus fruticosus subsp. decipiens</i>	(L.) Aiton f.	LC	Indigenous
Apocynaceae	<i>Gomphocarpus fruticosus subsp. fruticosus</i>	(L.) Aiton f.	LC	Indigenous
Amaranthaceae	<i>Gomphrena celosioides</i>	Mart.		Not Indigenous; Naturalised
Malvaceae	<i>Grewia flava</i>	DC.	LC	Indigenous
Malvaceae	<i>Grewia occidentalis var. occidentalis</i>	L.	LC	Indigenous
Orchidaceae	<i>Habenaria bicolor</i>	Conrath & Kraenzl.	NT	Indigenous
Orchidaceae	<i>Habenaria epipactidea</i>	Rchb.f.	LC	Indigenous
Asteraceae	<i>Haplocarpha scaposa</i>	Harv.	LC	Indigenous
Asteraceae	<i>Helichrysum argyrosphaerum</i>	DC.	LC	Indigenous
Asteraceae	<i>Helichrysum aureonitens</i>	Sch.Bip.	LC	Indigenous
Asteraceae	<i>Helichrysum caespitium</i>	(DC.) Harv.	LC	Indigenous
Asteraceae	<i>Helichrysum cephaloideum</i>	DC.	LC	Indigenous
Asteraceae	<i>Helichrysum chionosphaerum</i>	DC.	LC	Indigenous
Asteraceae	<i>Helichrysum difficile</i>	Hilliard	LC	Indigenous
Asteraceae	<i>Helichrysum lepidissimum</i>	S.Moore	LC	Indigenous



Asteraceae	<i>Helichrysum lineare</i>	DC.	LC	Indigenous
Asteraceae	<i>Helichrysum setosum</i>	Harv.	LC	Indigenous
Brassicaceae	<i>Heliophila carnosa</i>	(Thunb.) Steud.	LC	Indigenous
Brassicaceae	<i>Heliophila rigidiuscula</i>	Sond.	LC	Indigenous
Malvaceae	<i>Hermannia cordata</i>	(E.Mey. ex E.Phillips) De Winter	LC	Indigenous; Endemic
Malvaceae	<i>Hermannia depressa</i>	N.E.Br.	LC	Indigenous
Malvaceae	<i>Hermannia grandistipula</i>	(Buchinger ex Hochst.) K.Schum.	LC	Indigenous
Malvaceae	<i>Hermannia lancifolia</i>	Szyszl.	LC	Indigenous; Endemic
Malvaceae	<i>Hermannia oblongifolia</i>	(Harv.) Hochr.	LC	Indigenous; Endemic
Apiaceae	<i>Heteromorpha arborescens</i> var. <i>abyssinica</i>	(Spreng.) Cham. & Schltdl.	LC	Indigenous
Poaceae	<i>Heteropogon contortus</i>	(L.) Roem. & Schult.	LC	Indigenous
Malvaceae	<i>Hibiscus engleri</i>	K.Schum.	LC	Indigenous
Malvaceae	<i>Hibiscus microcarpus</i>	Garcke	LC	Indigenous
Malvaceae	<i>Hibiscus sabdariffa</i>	L.		Not Indigenous; Naturalised
Malvaceae	<i>Hibiscus trionum</i>	L.		Not Indigenous; Naturalised
Asteraceae	<i>Hilliardiella aristata</i>	(DC.) H.Rob.	LC	Indigenous
Asteraceae	<i>Hilliardiella hirsuta</i>	(DC.) H.Rob.	LC	Indigenous
Asteraceae	<i>Hilliardiella oligocephala</i>	(DC.) H.Rob.	LC	Indigenous
Poaceae	<i>Hyparrhenia anamesa</i>	Clayton	LC	Indigenous
Poaceae	<i>Hyparrhenia hirta</i>	(L.) Stapf	LC	Indigenous
Poaceae	<i>Hyparrhenia poecilotracha</i>	(Hack.) Stapf	LC	Indigenous
Hypericaceae	<i>Hypericum aethiopicum</i> subsp. <i>sonderi</i>	Thunb.	LC	Indigenous
Hypericaceae	<i>Hypericum lalandii</i>	Choisy	LC	Indigenous
Hypoxidaceae	<i>Hypoxis multiceps</i>	Buchinger ex Baker	LC	Indigenous
Hypoxidaceae	<i>Hypoxis rigidula</i> var. <i>rigidula</i>	Baker	LC	Indigenous
Poaceae	<i>Imperata cylindrica</i>	(L.) Raeusch.	LC	Indigenous
Fabaceae	<i>Indigofera confusa</i>	Prain & Baker f.	LC	Indigenous



Fabaceae	<i>Indigofera hedyantha</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Indigofera hiliaris var. hiliaris</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Indigofera hybrida</i>	N.E.Br.	VU	Indigenous; Endemic
Fabaceae	<i>Indigofera obscura</i>	N.E.Br.	LC	Indigenous
Fabaceae	<i>Indigofera setiflora</i>	Baker	LC	Indigenous
Poaceae	<i>Ischaemum fasciculatum</i>	Brongn.	LC	Indigenous
Crassulaceae	<i>Kalanchoe paniculata</i>	Harv.		Indigenous
Crassulaceae	<i>Kalanchoe rotundifolia</i>	(Haw.) Haw.		Indigenous
Aizoaceae	<i>Khadia acutipetala</i>	(N.E.Br.) N.E.Br.	LC	Indigenous; Endemic
Aizoaceae	<i>Khadia beswickii</i>	(L.Bolus) N.E.Br.	VU	Indigenous; Endemic
Achariaceae	<i>Kiggelaria africana</i>	L.	LC	Indigenous
Poaceae	<i>Koeleria capensis</i>	(Steud.) Nees	LC	Indigenous
Asteraceae	<i>Lactuca inermis</i>	Forssk.	LC	Indigenous
Hydrocharitaceae	<i>Lagarosiphon muscoides</i>	Harv.	LC	Indigenous
Thymelaeaceae	<i>Lasiosiphon canoargenteus</i>	C.H.Wright	LC	Indigenous; Endemic
Thymelaeaceae	<i>Lasiosiphon kraussianus</i>	(Meisn.) Meisn.		Indigenous
Thymelaeaceae	<i>Lasiosiphon microcephalus</i>	(Meisn.) J.C.Manning & Magee		Indigenous
Asteraceae	<i>Launaea rarifolia var. rarifolia</i>	(Oliv. & Hiern) Boulos	LC	Indigenous
Hyacinthaceae	<i>Ledebouria luteola</i>	Jessop	LC	Indigenous
Hyacinthaceae	<i>Ledebouria marginata</i>	(Baker) Jessop	LC	Indigenous
Hyacinthaceae	<i>Ledebouria ovatifolia</i>	(Baker) Jessop		Indigenous; Endemic
Hyacinthaceae	<i>Ledebouria revoluta</i>	(L.f.) Jessop	LC	Indigenous
Poaceae	<i>Leersia hexandra</i>	Sw.	LC	Indigenous
Fabaceae	<i>Leobordea arida</i>	(Dümmer) B.- E.van Wyk & Boatwr.	LC	Indigenous; Endemic
Fabaceae	<i>Leobordea divaricata</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Leobordea eriantha</i>	(Benth.) B.- E.van Wyk & Boatwr.	LC	Indigenous



Fabaceae	<i>Leobordea mucronata</i>	(Conrath) B.- E. van Wyk & Boatwr.		Indigenous
Brassicaceae	<i>Lepidium bonariense</i>	L.		Not Indigenous; Naturalised
Brassicaceae	<i>Lepidium transvaalense</i>	Marais	LC	Indigenous
Poaceae	<i>Leptochloa fusca</i>	(L.) Kunth	LC	Indigenous
Fabaceae	<i>Lessertia prostrata</i>	DC.	LC	Indigenous
Limeaceae	<i>Limeum viscosum subsp. viscosum</i>	(J.Gay) Fenzl	NE	Indigenous
Linaceae	<i>Linum thunbergii</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Listia heterophylla</i>	E.Mey.	LC	Indigenous
Lobeliaceae	<i>Lobelia erinus</i>	L.	LC	Indigenous
Lobeliaceae	<i>Lobelia flaccida subsp. flaccida</i>	(C.Presl) A.DC.	LC	Indigenous
Lobeliaceae	<i>Lobelia sonderiana</i>	(Kuntze) Lammers	LC	Indigenous
Poaceae	<i>Lolium perenne</i>	L.	NE	Not Indigenous; Naturalised
Asteraceae	<i>Lopholaena coriifolia</i>	(Sond.) E.Phillips & C.A.Sm.	LC	Indigenous
Fabaceae	<i>Lotononis laxa</i>	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	<i>Lotus discolor subsp. discolor</i>	E.Mey.	LC	Indigenous
Poaceae	<i>Loudetia simplex</i>	(Nees) C.E.Hubb.	LC	Indigenous
Onagraceae	<i>Ludwigia palustris</i>	(L.) Elliott		Not Indigenous; Naturalised
Capparaceae	<i>Maerua cafra</i>	(DC.) Pax	LC	Indigenous
Poaceae	<i>Melinis repens subsp. repens</i>	(Willd.) Zizka	LC	Indigenous
Fabaceae	<i>Melolobium wilmsii</i>	Harms	LC	Indigenous; Endemic
Poaceae	<i>Microchloa cafra</i>	Nees	LC	Indigenous
Lobeliaceae	<i>Monopsis decipiens</i>	(Sond.) Thulin	LC	Indigenous
Iridaceae	<i>Moraea natalensis</i>	Baker	LC	Indigenous
Iridaceae	<i>Moraea pallida</i>	(Baker) Goldblatt	LC	Indigenous
Iridaceae	<i>Moraea simulans</i>	Baker	LC	Indigenous
Iridaceae	<i>Moraea stricta</i>	Baker	LC	Indigenous
Myrothamnaceae	<i>Myrothamnus flabellifolius</i>	Welw.	DD	Indigenous
Myrsinaceae	<i>Myrsine africana</i>	L.	LC	Indigenous



Celastraceae	<i>Mystroxydon aethiopicum</i> subsp. <i>aethiopicum</i>	(Thunb.) Loes.	LC	Indigenous; Endemic
Lythraceae	<i>Nesaea sagittifolia</i> var. <i>sagittifolia</i>	(Sond.) Koehne		Indigenous
Lythraceae	<i>Nesaea schinzii</i>	Koehne		Indigenous
Stilbaceae	<i>Nuxia congesta</i>	R.Br. ex Fresen.	LC	Indigenous
Onagraceae	<i>Oenothera rosea</i>	L'Hér. ex Aiton		Not Indigenous; Naturalised
Onagraceae	<i>Oenothera stricta</i> subsp. <i>stricta</i>	Ledeb. ex Link		Not Indigenous; Naturalised
Onagraceae	<i>Oenothera tetraptera</i>	Cav.		Not Indigenous; Naturalised
Asteraceae	<i>Oncosiphon piluliferus</i>	(L.f.) Källersjö	LC	Indigenous
Asteraceae	<i>Oncosiphon suffruticosus</i>	(L.) Källersjö	LC	Indigenous
Asteraceae	<i>Osteospermum moniliferum</i> subsp. <i>canescens</i>	L.	LC	Indigenous
Asteraceae	<i>Osteospermum scariosum</i> var. <i>scariosum</i>	DC.	NE	Indigenous
Santalaceae	<i>Osyris lanceolata</i>	Hochst. & Steud.	LC	Indigenous
Fabaceae	<i>Otholobium polystictum</i>	(Benth. ex Harv.) C.H.Stirt.	LC	Indigenous
Fabaceae	<i>Otholobium wilmsii</i>	(Harms) C.H.Stirt.	LC	Indigenous
Asteraceae	<i>Othonna natalensis</i>	Sch.Bip.	LC	Indigenous
Polygonaceae	<i>Oxygonum dregeanum</i> subsp. <i>canescens</i>	Meisn.	NE	Indigenous
Apocynaceae	<i>Pachycarpus rigidus</i>	E.Mey.	LC	Indigenous
Apocynaceae	<i>Pachycarpus schinzianus</i>	(Schltr.) N.E.Br.	LC	Indigenous
Apocynaceae	<i>Pachycarpus suaveolens</i>	(Schltr.) Nicholas & Goyder	VU	Indigenous
Poaceae	<i>Panicum natalense</i>	Hochst.	LC	Indigenous
Poaceae	<i>Panicum schinzii</i>	Hack.	LC	Indigenous
Poaceae	<i>Panicum stapfianum</i>	Fourc.	LC	Indigenous
Papaveraceae	<i>Papaver aculeatum</i>	Thunb.	LC	Indigenous
Apocynaceae	<i>Parapodium costatum</i>	E.Mey.	LC	Indigenous
Poaceae	<i>Paspalum distichum</i>	L.	LC	Indigenous



Malvaceae	<i>Pavonia burchellii</i>	(DC.) R.A.Dyer	LC	Indigenous
Fabaceae	<i>Pearsonia cajanifolia</i> subsp. <i>cajanifolia</i>	(Harv.) Polhill	LC	Indigenous; Endemic
Fabaceae	<i>Pearsonia sessilifolia</i> subsp. <i>sessilifolia</i>	(Harv.) Dümmer	LC	Indigenous
Pteridaceae	<i>Pellaea calomelanos</i> var. <i>calomelanos</i>	(Sw.) Link	LC	Indigenous
Poaceae	<i>Pennisetum thunbergii</i>	Kunth	LC	Indigenous
Apocynaceae	<i>Periglossum mackenii</i>	Harv.	LC	Indigenous
Polygonaceae	<i>Persicaria attenuata</i> subsp. <i>africana</i>	(R.Br.) Soják	LC	Indigenous
Pittosporaceae	<i>Pittosporum viridiflorum</i>	Sims	LC	Indigenous
Poaceae	<i>Poa annua</i>	L.	NE	Not Indigenous; Naturalised
Poaceae	<i>Pogonarthria squarrosa</i>	(Roem. & Schult.) Pilg.	LC	Indigenous
Caryophyllaceae	<i>Pollichia campestris</i>	Aiton		Indigenous
Polygalaceae	<i>Polygala gerrardii</i>	Chodat	LC	Indigenous; Endemic
Polygalaceae	<i>Polygala hottentotta</i>	C.Presl	LC	Indigenous
Polygalaceae	<i>Polygala houtboshiana</i>	Chodat	LC	Indigenous
Polygalaceae	<i>Polygala producta</i>	N.E.Br.	LC	Indigenous
Polygalaceae	<i>Polygala uncinata</i>	E.Mey. ex Meisn.	LC	Indigenous
Polygalaceae	<i>Polygala virgata</i> var. <i>decora</i>	Thunb.	LC	Indigenous
Potamogetonaceae	<i>Potamogeton nodosus</i>	Poir.	LC	Indigenous
Potamogetonaceae	<i>Potamogeton pectinatus</i>	L.	LC	Indigenous
Molluginaceae	<i>Psammotropha mucronata</i> var. <i>mucronata</i>	(Thunb.) Fenzl	LC	Indigenous
Molluginaceae	<i>Psammotropha myriantha</i>	Sond.	LC	Indigenous
Amaranthaceae	<i>Pupalia lappacea</i> var. <i>lappacea</i>	(L.) A.Juss.	LC	Indigenous
Ranunculaceae	<i>Ranunculus multifidus</i>	Forssk.	LC	Indigenous
Apocynaceae	<i>Raphionacme hirsuta</i>	(E.Mey.) R.A.Dyer	LC	Indigenous
Apocynaceae	<i>Raphionacme velutina</i>	Schltr.	LC	Indigenous
Vitaceae	<i>Rhoicissus tridentata</i> subsp. <i>cuneifolia</i>	(L.f.) Wild & R.B.Drumm.		Indigenous
Apocynaceae	<i>Riocreuxia polyantha</i>	Schltr.	LC	Indigenous
Lythraceae	<i>Rotala filiformis</i>	(Bellardi) Hiern	LC	Indigenous





Polygonaceae	<i>Rumex acetosella</i> subsp. <i>angiocarpus</i>	L.		Not Indigenous; Naturalised
Polygonaceae	<i>Rumex crispus</i>	L.		Not Indigenous; Naturalised; Invasive
Polygonaceae	<i>Rumex lanceolatus</i>	Thunb.	LC	Indigenous
Lamiaceae	<i>Salvia repens</i> var. <i>transvaalensis</i>	Burch. ex Benth.	LC	Indigenous
Asteraceae	<i>Schistostephium crataegifolium</i>	(DC.) Fenzl ex Harv.	LC	Indigenous
Asteraceae	<i>Schkuhria pinnata</i>	(Lam.) Kuntze ex Thell.		Not Indigenous; Naturalised
Anacardiaceae	<i>Searsia discolor</i>	(E.Mey. ex Sond.) Moffett		Indigenous
Anacardiaceae	<i>Searsia magalismontana</i> subsp. <i>magalismontana</i>	(Sond.) Moffett		Indigenous
Anacardiaceae	<i>Searsia pyroides</i> var. <i>gracilis</i>	(Burch.) Moffett		Indigenous
Anacardiaceae	<i>Searsia pyroides</i> var. <i>pyroides</i>	(Burch.) Moffett		Indigenous
Anacardiaceae	<i>Searsia rigida</i> var. <i>margaretae</i>	(Mill.) F.A.Barkley		Indigenous
Gentianaceae	<i>Sebaea exigua</i>	(Oliv.) Schinz	LC	Indigenous
Gentianaceae	<i>Sebaea leiostyla</i>	Gilg	LC	Indigenous
Selaginellaceae	<i>Selaginella dregei</i>	(C.Presl) Hieron.		Indigenous
Scrophulariaceae	<i>Selago capitellata</i>	Schltr.	LC	Indigenous; Endemic
Asteraceae	<i>Senecio asperulus</i>	DC.	LC	Indigenous
Asteraceae	<i>Senecio burchellii</i>	DC.	LC	Indigenous; Endemic
Asteraceae	<i>Senecio consanguineus</i>	DC.	LC	Indigenous
Asteraceae	<i>Senecio coronatus</i>	(Thunb.) Harv.	LC	Indigenous
Asteraceae	<i>Senecio erubescens</i> var. <i>erubescens</i>	Aiton	NE	Indigenous; Endemic
Asteraceae	<i>Senecio inornatus</i>	DC.	LC	Indigenous
Asteraceae	<i>Senecio isatideus</i>	DC.	LC	Indigenous
Asteraceae	<i>Senecio laevigatus</i> var. <i>laevigatus</i>	Thunb.	LC	Indigenous; Endemic
Asteraceae	<i>Senecio lydenburgensis</i>	Hutch. & Burt Davy	LC	Indigenous
Asteraceae	<i>Senecio othonniflorus</i>	DC.	LC	Indigenous
Asteraceae	<i>Senecio oxyriifolius</i> subsp. <i>oxyriifolius</i>	DC.	LC	Indigenous



Asteraceae	<i>Senecio venosus</i>	Harv.	LC	Indigenous
Asteraceae	<i>Seriphium plumosum</i>	L.		Indigenous
Poaceae	<i>Setaria incrassata</i>	(Hochst.) Hack.	LC	Indigenous
Poaceae	<i>Setaria nigrirostris</i>	(Nees) T.Durand & Schinz	LC	Indigenous
Poaceae	<i>Setaria sphacelata var. torta</i>	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous
Malvaceae	<i>Sida dregei</i>	Burt Davy	LC	Indigenous
Malvaceae	<i>Sida rhombifolia subsp. rhombifolia</i>	L.	LC	Indigenous
Caryophyllaceae	<i>Silene burchellii subsp. pilosellifolia</i>	Otth		Indigenous
Caryophyllaceae	<i>Silene undulata</i>	Aiton		Indigenous
Apocynaceae	<i>Sisyranthus randii</i>	S.Moore	LC	Indigenous
Asteraceae	<i>Sonchus nanus</i>	Sond. ex Harv.	LC	Indigenous
Asteraceae	<i>Sonchus oleraceus</i>	L.		Not Indigenous; Naturalised; Invasive
Malpighiaceae	<i>Sphedamnocarpus pruriens subsp. galphimiifolius</i>	(A.Juss.) Szyszyl.	LC	Indigenous
Poaceae	<i>Sporobolus discosporus</i>	Nees	LC	Indigenous
Poaceae	<i>Sporobolus pectinatus</i>	Hack.	LC	Indigenous; Endemic
Apocynaceae	<i>Stapelia leendertziae</i>	N.E.Br.	LC	Indigenous
Poaceae	<i>Stiburus conrathii</i>	Hack.	LC	Indigenous
Asteraceae	<i>Tagetes minuta</i>	L.		Not Indigenous; Naturalised; Invasive
Portulacaceae	<i>Talinum cafferum</i>	(Thunb.) Eckl. & Zeyh.		Indigenous
Fabaceae	<i>Tephrosia capensis var. acutifolia</i>	(Jacq.) Pers.	LC	Indigenous; Endemic
Fabaceae	<i>Tephrosia capensis var. capensis</i>	(Jacq.) Pers.	LC	Indigenous
Fabaceae	<i>Tephrosia elongata var. elongata</i>	E.Mey.	LC	Indigenous
Fabaceae	<i>Tephrosia semiglabra</i>	Sond.	LC	Indigenous
Santalaceae	<i>Thesium hirsutum</i>	A.W.Hill	LC	Indigenous; Endemic
Santalaceae	<i>Thesium pallidum</i>	A.DC.	LC	Indigenous
Santalaceae	<i>Thesium transvaalense</i>	Schltr.	LC	Indigenous; Endemic



Santalaceae	<i>Thesium utile</i>	A.W.Hill	LC	Indigenous
Asteraceae	<i>Tolpis capensis</i>	(L.) Sch.Bip.	LC	Indigenous
Fabaceae	<i>Trifolium africanum var. africanum</i>	Ser.	NE	Indigenous
Fabaceae	<i>Trifolium africanum var. lydenburgense</i>	Ser.	NE	Indigenous
Poaceae	<i>Tristachya rehmannii</i>	Hack.	LC	Indigenous
Malvaceae	<i>Triumfetta pilosa var. tomentosa</i>	Roth	NE	Indigenous
Alliaceae	<i>Tulbaghia acutiloba</i>	Harv.	LC	Indigenous; Endemic
Alliaceae	<i>Tulbaghia leucantha</i>	Baker	LC	Indigenous
Asteraceae	<i>Ursinia nana subsp. leptophylla</i>	DC.	LC	Indigenous
Caryophyllaceae	<i>Vaccaria hispanica var. hispanica</i>	(Mill.) Rauschert		Not Indigenous; Naturalised
Campanulaceae	<i>Wahlenbergia undulata</i>	(L.f.) A.DC.	LC	Indigenous
Apocynaceae	<i>Xysmalobium brownianum</i>	S.Moore	LC	Indigenous
Apocynaceae	<i>Xysmalobium undulatum var. undulatum</i>	(L.) Aiton f.	LC	Indigenous
Potamogetonaceae	<i>Zannichellia palustris</i>	L.	LC	Indigenous
Rutaceae	<i>Zanthoxylum capense</i>	(Thunb.) Harv.	LC	Indigenous
Rhamnaceae	<i>Ziziphus mucronata subsp. mucronata</i>	Willd.		Indigenous
Rhamnaceae	<i>Ziziphus zeyheriana</i>	Sond.		Indigenous
Fabaceae	<i>Zornia capensis subsp. capensis</i>	Pers.	LC	Indigenous
Fabaceae	<i>Zornia linearis</i>	E.Mey.	LC	Indigenous
Fabaceae	<i>Zornia milneana</i>	Mohlenbr.	LC	Indigenous



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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
<i>Accipiter minullus</i>	Sparrowhawk, Little	Unlisted	LC
<i>Accipiter ovampensis</i>	Sparrowhawk, Ovambo	Unlisted	LC
<i>Acridotheres tristis</i>	Myna, Common	Unlisted	LC
<i>Acrocephalus arundinaceus</i>	Reed-warbler, Great	Unlisted	LC
<i>Acrocephalus baeticatus</i>	Reed-warbler, African	Unlisted	Unlisted
<i>Acrocephalus gracilirostris</i>	Swamp-warbler, Lesser	Unlisted	LC
<i>Acrocephalus palustris</i>	Warbler, Marsh	Unlisted	LC
<i>Acrocephalus schoenobaenus</i>	Warbler, Sedge	Unlisted	LC
<i>Actitis hypoleucos</i>	Sandpiper, Common	Unlisted	LC
<i>Actophilornis africanus</i>	Jacana, African	Unlisted	LC
<i>Afrotis afraoides</i>	Korhaan, Northern Black	Unlisted	LC
<i>Alcedo cristata</i>	Kingfisher, Malachite	Unlisted	Unlisted
<i>Alcedo semitorquata</i>	Kingfisher, Half-collared	NT	LC
<i>Alopochen aegyptiacus</i>	Goose, Egyptian	Unlisted	LC
<i>Amadina erythrocephala</i>	Finch, Red-headed	Unlisted	LC
<i>Amandava subflava</i>	Waxbill, Orange-breasted	Unlisted	Unlisted
<i>Amaurornis flavirostris</i>	Crake, Black	Unlisted	LC
<i>Amblyospiza albifrons</i>	Weaver, Thick-billed	Unlisted	LC
<i>Anas capensis</i>	Teal, Cape	Unlisted	LC
<i>Anas erythrorhyncha</i>	Teal, Red-billed	Unlisted	LC
<i>Anas hottentota</i>	Teal, Hottentot	Unlisted	LC
<i>Anas smithii</i>	Shoveler, Cape	Unlisted	LC
<i>Anas sparsa</i>	Duck, African Black	Unlisted	LC
<i>Anas undulata</i>	Duck, Yellow-billed	Unlisted	LC
<i>Andropadus importunus</i>	Greenbul, Sombre	Unlisted	LC
<i>Anhinga rufa</i>	Darter, African	Unlisted	LC
<i>Anomalospiza imberbis</i>	Finch, Cuckoo	Unlisted	LC
<i>Anthropoides paradiseus</i>	Crane, Blue	NT	VU
<i>Anthus cinnamomeus</i>	Pipit, African	Unlisted	LC
<i>Anthus leucophrys</i>	Pipit, Plain-backed	Unlisted	LC
<i>Anthus lineiventris</i>	Pipit, Striped	Unlisted	LC
<i>Anthus similis</i>	Pipit, Long-billed	Unlisted	LC
<i>Anthus vaalensis</i>	Pipit, Buffy	Unlisted	LC
<i>Apalis thoracica</i>	Apalis, Bar-throated	Unlisted	LC
<i>Apus affinis</i>	Swift, Little	Unlisted	LC
<i>Apus apus</i>	Swift, Common	Unlisted	LC
<i>Apus barbatus</i>	Swift, African Black	Unlisted	LC
<i>Apus caffer</i>	Swift, White-rumped	Unlisted	LC
<i>Apus horus</i>	Swift, Horus	Unlisted	LC
<i>Aquila pennatus</i>	Eagle, Booted	Unlisted	LC



<i>Ardea cinerea</i>	Heron, Grey	Unlisted	LC
<i>Ardea goliath</i>	Heron, Goliath	Unlisted	LC
<i>Ardea melanocephala</i>	Heron, Black-headed	Unlisted	LC
<i>Ardea purpurea</i>	Heron, Purple	Unlisted	LC
<i>Ardeola ralloides</i>	Heron, Squacco	Unlisted	LC
<i>Asio capensis</i>	Owl, Marsh	Unlisted	LC
<i>Bostrychia hagedash</i>	Ibis, Hadedda	Unlisted	LC
<i>Botaurus stellaris</i>	Bittern, Eurasian	Unlisted	LC
<i>Bradypterus baboecala</i>	Rush-warbler, Little	Unlisted	LC
<i>Bubo africanus</i>	Eagle-owl, Spotted	Unlisted	LC
<i>Bubulcus ibis</i>	Egret, Cattle	Unlisted	LC
<i>Burhinus capensis</i>	Thick-knee, Spotted	Unlisted	LC
<i>Burhinus vermiculatus</i>	Thick-knee, Water	Unlisted	LC
<i>Buteo rufoscus</i>	Buzzard, Jackal	Unlisted	LC
<i>Buteo vulpinus</i>	Buzzard, Common	Unlisted	Unlisted
<i>Butorides striata</i>	Heron, Green-backed	Unlisted	LC
<i>Calandrella cinerea</i>	Lark, Red-capped	Unlisted	LC
<i>Calendulauda sabota</i>	Lark, Sabota	Unlisted	LC
<i>Calidris ferruginea</i>	Sandpiper, Curlew	LC	NT
<i>Calidris minuta</i>	Stint, Little	LC	LC
<i>Centropus burchellii</i>	Coucal, Burchell's	Unlisted	Unlisted
<i>Centropus superciliosus</i>	Coucal, White-browed	Unlisted	LC
<i>Cercomela familiaris</i>	Chat, Familiar	Unlisted	LC
<i>Certhilauda benguelensis</i>	Lark, Benguela Long-billed	Unlisted	Unlisted
<i>Certhilauda curvirostris</i>	Lark, Cape Long-billed	Unlisted	LC
<i>Certhilauda semitorquata</i>	Lark, Eastern Long-billed	Unlisted	LC
<i>Certhilauda subcoronata</i>	Lark, Karoo Long-billed	Unlisted	LC
<i>Ceryle rudis</i>	Kingfisher, Pied	Unlisted	LC
<i>Chalcomitra amethystina</i>	Sunbird, Amethyst	Unlisted	LC
<i>Charadrius hiaticula</i>	Plover, Common Ringed	Unlisted	LC
<i>Charadrius pallidus</i>	Plover, Chestnut-banded	NT	NT
<i>Charadrius pecuarius</i>	Plover, Kittlitz's	Unlisted	LC
<i>Charadrius tricollaris</i>	Plover, Three-banded	Unlisted	LC
<i>Chersomanes albofasciata</i>	Lark, Spike-heeled	Unlisted	LC
<i>Chlidonias hybrida</i>	Tern, Whiskered	Unlisted	LC
<i>Chlidonias leucopterus</i>	Tern, White-winged	Unlisted	LC
<i>Chrysococcyx caprius</i>	Cuckoo, Diderick	Unlisted	LC
<i>Ciconia abdimii</i>	Stork, Abdim's	NT	LC
<i>Ciconia ciconia</i>	Stork, White	Unlisted	LC
<i>Cinnyricinclus leucogaster</i>	Starling, Violet-backed	Unlisted	LC
<i>Cinnyris talatala</i>	Sunbird, White-bellied	Unlisted	LC
<i>Circaetus pectoralis</i>	Snake-eagle, Black-chested	Unlisted	LC
<i>Circus aeruginosus</i>	Marsh-harrier, Western	Unlisted	LC
<i>Circus macrourus</i>	Harrier, Pallid	NT	NT



<i>Circus maurus</i>	Harrier, Black	EN	VU
<i>Circus pygargus</i>	Harrier, Montagu's	Unlisted	LC
<i>Circus ranivorus</i>	Marsh-harrier, African	EN	LC
<i>Cisticola aridulus</i>	Cisticola, Desert	Unlisted	LC
<i>Cisticola ayresii</i>	Cisticola, Wing-snapping	Unlisted	LC
<i>Cisticola cinnamomeus</i>	Cisticola, Pale-crowned	Unlisted	LC
<i>Cisticola fulvicapilla</i>	Neddicky, Neddicky	Unlisted	LC
<i>Cisticola juncidis</i>	Cisticola, Zitting	Unlisted	LC
<i>Cisticola lais</i>	Cisticola, Wailing	Unlisted	LC
<i>Cisticola textrix</i>	Cisticola, Cloud	Unlisted	LC
<i>Cisticola tinniens</i>	Cisticola, Levallant's	Unlisted	LC
<i>Colius striatus</i>	Mousebird, Speckled	Unlisted	LC
<i>Columba arquatrix</i>	Olive-pigeon, African	Unlisted	LC
<i>Columba guinea</i>	Pigeon, Speckled	Unlisted	LC
<i>Columba livia</i>	Dove, Rock	Unlisted	LC
<i>Coracias caudatus</i>	Roller, Lilac-breasted	Unlisted	LC
<i>Coracias garrulus</i>	Roller, European	NT	LC
<i>Corvus albus</i>	Crow, Pied	Unlisted	LC
<i>Corvus capensis</i>	Crow, Cape	Unlisted	LC
<i>Corythaixoides concolor</i>	Go-away-bird, Grey	Unlisted	LC
<i>Cossypha caffra</i>	Robin-chat, Cape	Unlisted	LC
<i>Coturnix coturnix</i>	Quail, Common	Unlisted	LC
<i>Coturnix delegorguei</i>	Quail, Harlequin	Unlisted	LC
<i>Creatophora cinerea</i>	Starling, Wattled	Unlisted	LC
<i>Crecopsis egregia</i>	Crake, African	Unlisted	LC
<i>Crithagra atrogularis</i>	Canary, Black-throated	Unlisted	LC
<i>Crithagra flaviventris</i>	Canary, Yellow	Unlisted	LC
<i>Crithagra gularis</i>	Seedeater, Streaky-headed	Unlisted	LC
<i>Crithagra mozambicus</i>	Canary, Yellow-fronted	Unlisted	LC
<i>Cuculus solitarius</i>	Cuckoo, Red-chested	Unlisted	LC
<i>Cypsiurus parvus</i>	Palm-swift, African	Unlisted	LC
<i>Delichon urbicum</i>	House-martin, Common	Unlisted	LC
<i>Dendrocygna bicolor</i>	Duck, Fulvous	Unlisted	LC
<i>Dendrocygna viduata</i>	Duck, White-faced Whistling	Unlisted	LC
<i>Dendropicos fuscescens</i>	Woodpecker, Cardinal	Unlisted	LC
<i>Dicrurus adsimilis</i>	Drongo, Fork-tailed	Unlisted	LC
<i>Egretta alba</i>	Egret, Great	Unlisted	LC
<i>Egretta ardesiaca</i>	Heron, Black	Unlisted	LC
<i>Egretta garzetta</i>	Egret, Little	Unlisted	LC
<i>Egretta intermedia</i>	Egret, Yellow-billed	Unlisted	LC
<i>Elanus caeruleus</i>	Kite, Black-shouldered	Unlisted	LC
<i>Emberiza capensis</i>	Bunting, Cape	Unlisted	LC
<i>Emberiza tahapisi</i>	Bunting, Cinnamon-breasted	Unlisted	LC
<i>Eremopterix leucotis</i>	Sparrowlark, Chestnut-backed	Unlisted	LC



<i>Estrilda astrild</i>	Waxbill, Common	Unlisted	LC
<i>Estrilda erythronotos</i>	Waxbill, Black-faced	Unlisted	LC
<i>Euplectes afer</i>	Bishop, Yellow-crowned	Unlisted	LC
<i>Euplectes albonotatus</i>	Widowbird, White-winged	Unlisted	LC
<i>Euplectes ardens</i>	Widowbird, Red-collared	Unlisted	LC
<i>Euplectes axillaris</i>	Widowbird, Fan-tailed	Unlisted	LC
<i>Euplectes capensis</i>	Bishop, Yellow	Unlisted	LC
<i>Euplectes orix</i>	Bishop, Southern Red	Unlisted	LC
<i>Euplectes progne</i>	Widowbird, Long-tailed	Unlisted	LC
<i>Eupodotis caerulescens</i>	Korhaan, Blue	LC	NT
<i>Eupodotis senegalensis</i>	Korhaan, White-bellied	VU	LC
<i>Falco amurensis</i>	Falcon, Amur	Unlisted	LC
<i>Falco biarmicus</i>	Falcon, Lanner	VU	LC
<i>Falco naumanni</i>	Kestrel, Lesser	Unlisted	LC
<i>Falco rupicoloides</i>	Kestrel, Greater	Unlisted	LC
<i>Falco rupicolus</i>	Kestrel, Rock	Unlisted	LC
<i>Falco vespertinus</i>	Falcon, Red-footed	NT	NT
<i>Fulica cristata</i>	Coot, Red-knobbed	Unlisted	LC
<i>Gallinago nigripennis</i>	Snipe, African	Unlisted	LC
<i>Gallinula chloropus</i>	Moorhen, Common	Unlisted	LC
<i>Geronticus calvus</i>	Ibis, Southern Bald	VU	VU
<i>Glareola nordmanni</i>	Pratincole, Black-winged	NT	NT
<i>Halcyon albiventris</i>	Kingfisher, Brown-hooded	Unlisted	LC
<i>Haliaeetus vocifer</i>	Fish-eagle, African	Unlisted	LC
<i>Himantopus himantopus</i>	Stilt, Black-winged	Unlisted	LC
<i>Hirundo abyssinica</i>	Swallow, Lesser Striped	Unlisted	LC
<i>Hirundo albigularis</i>	Swallow, White-throated	Unlisted	LC
<i>Hirundo cucullata</i>	Swallow, Greater Striped	Unlisted	LC
<i>Hirundo fuligula</i>	Martin, Rock	Unlisted	Unlisted
<i>Hirundo rustica</i>	Swallow, Barn	Unlisted	LC
<i>Hirundo semirufa</i>	Swallow, Red-breasted	Unlisted	LC
<i>Indicator indicator</i>	Honeyguide, Greater	Unlisted	LC
<i>Ixobrychus minutus</i>	Bittern, Little	Unlisted	LC
<i>Jynx ruficollis</i>	Wryneck, Red-throated	Unlisted	LC
<i>Lamprotornis nitens</i>	Starling, Cape Glossy	Unlisted	LC
<i>Laniarius atrococcineus</i>	Shrike, Crimson-breasted	Unlisted	LC
<i>Laniarius ferrugineus</i>	Boubou, Southern	Unlisted	LC
<i>Lanius collaris</i>	Fiscal, Common (Southern)	Unlisted	LC
<i>Lanius collurio</i>	Shrike, Red-backed	Unlisted	LC
<i>Lanius minor</i>	Shrike, Lesser Grey	Unlisted	LC
<i>Larus fuscus</i>	Gull, Lesser Black-backed	Unlisted	LC
<i>Lophaelix occipitalis</i>	Eagle, Long-crested	Unlisted	LC
<i>Lybius torquatus</i>	Barbet, Black-collared	Unlisted	LC
<i>Macronyx capensis</i>	Longclaw, Cape	Unlisted	LC



<i>Megaceryle maximus</i>	Kingfisher, Giant	Unlisted	Unlisted
<i>Merops apiaster</i>	Bee-eater, European	Unlisted	LC
<i>Merops bullockoides</i>	Bee-eater, White-fronted	Unlisted	LC
<i>Milvus aegyptius</i>	Kite, Yellow-billed	Unlisted	Unlisted
<i>Milvus migrans</i>	Kite, Black	Unlisted	LC
<i>Mirafra africana</i>	Lark, Rufous-naped	Unlisted	LC
<i>Mirafra apiata</i>	Lark, Cape Clapper	Unlisted	LC
<i>Mirafra cheniana</i>	Lark, Melodious	LC	NT
<i>Mirafra fasciolata</i>	Lark, Eastern Clapper	Unlisted	LC
<i>Mirafra marjoriae</i>	Lark, Agulhas Clapper	Unlisted	Unlisted
<i>Monticola explorator</i>	Rock-thrush, Sentinel	Unlisted	LC
<i>Monticola rupestris</i>	Rock-thrush, Cape	Unlisted	LC
<i>Motacilla aguimp</i>	Wagtail, African Pied	Unlisted	LC
<i>Motacilla capensis</i>	Wagtail, Cape	Unlisted	LC
<i>Muscicapa adusta</i>	Flycatcher, African Dusky	Unlisted	LC
<i>Muscicapa striata</i>	Flycatcher, Spotted	Unlisted	LC
<i>Mycteria ibis</i>	Stork, Yellow-billed	EN	LC
<i>Myrmecocichla formicivora</i>	Chat, Anteating	Unlisted	LC
<i>Neotis denhami</i>	Bustard, Denham's	VU	NT
<i>Netta erythrophthalma</i>	Pochard, Southern	Unlisted	LC
<i>Numida meleagris</i>	Guineafowl, Helmeted	Unlisted	LC
<i>Nycticorax nycticorax</i>	Night-Heron, Black-crowned	Unlisted	LC
<i>Oena capensis</i>	Dove, Namaqua	Unlisted	LC
<i>Oenanthe monticola</i>	Wheatear, Mountain	Unlisted	LC
<i>Oenanthe pileata</i>	Wheatear, Capped	Unlisted	LC
<i>Onychognathus morio</i>	Starling, Red-winged	Unlisted	LC
<i>Oriolus larvatus</i>	Oriole, Black-headed	Unlisted	LC
<i>Ortygospiza atricollis</i>	Quailfinch, African	Unlisted	LC
<i>Oxyura maccoa</i>	Duck, Maccoa	NT	NT
<i>Parisoma subcaeruleum</i>	Tit-babbler, Chestnut-vented	Unlisted	Unlisted
<i>Passer diffusus</i>	Sparrow, Southern Grey-headed	Unlisted	LC
<i>Passer domesticus</i>	Sparrow, House	Unlisted	LC
<i>Passer melanurus</i>	Sparrow, Cape	Unlisted	LC
<i>Pernis apivorus</i>	Honey-buzzard, European	Unlisted	LC
<i>Phalacrocorax africanus</i>	Cormorant, Reed	Unlisted	Unlisted
<i>Phalacrocorax lucidus</i>	Cormorant, White-breasted	Unlisted	LC
<i>Philomachus pugnax</i>	Ruff, Ruff	Unlisted	LC
<i>Phoeniconaias minor</i>	Flamingo, Lesser	NT	NT
<i>Phoenicopterus ruber</i>	Flamingo, Greater	NT	LC
<i>Phoeniculus purpureus</i>	Wood-hoopoe, Green	Unlisted	LC
<i>Phylloscopus trochilus</i>	Warbler, Willow	Unlisted	LC
<i>Platalea alba</i>	Spoonbill, African	Unlisted	LC
<i>Plectropterus gambensis</i>	Goose, Spur-winged	Unlisted	LC
<i>Plegadis falcinellus</i>	Ibis, Glossy	Unlisted	LC





<i>Plocepasser mahali</i>	Sparrow-weaver, White-browed	Unlisted	LC
<i>Ploceus capensis</i>	Weaver, Cape	Unlisted	LC
<i>Ploceus cucullatus</i>	Weaver, Village	Unlisted	LC
<i>Ploceus velatus</i>	Southern Masked-weaver, Southern	Unlisted	LC
<i>Podica senegalensis</i>	Finfoot, African	VU	LC
<i>Podiceps cristatus</i>	Grebe, Great Crested	Unlisted	LC
<i>Podiceps nigricollis</i>	Grebe, Black-necked	Unlisted	LC
<i>Polyboroides typus</i>	Harrier-Hawk, African	Unlisted	LC
<i>Porphyrio madagascariensis</i>	Swamphen, African Purple	Unlisted	Unlisted
<i>Porzana porzana</i>	Crake, Spotted	Unlisted	LC
<i>Porzana pusilla</i>	Crake, Baillon's	Unlisted	LC
<i>Prinia flavicans</i>	Prinia, Black-chested	Unlisted	LC
<i>Prinia subflava</i>	Prinia, Tawny-flanked	Unlisted	LC
<i>Pternistis swainsonii</i>	Spurfowl, Swainson's	Unlisted	LC
<i>Pycnonotus nigricans</i>	Bulbul, African Red-eyed	Unlisted	LC
<i>Pycnonotus tricolor</i>	Bulbul, Dark-capped	Unlisted	Unlisted
<i>Pytilia melba</i>	Pytilia, Green-winged	Unlisted	LC
<i>Quelea quelea</i>	Quelea, Red-billed	Unlisted	LC
<i>Rallus caerulescens</i>	Rail, African	Unlisted	LC
<i>Recurvirostra avosetta</i>	Avocet, Pied	Unlisted	LC
<i>Rhinopomastus cyanomelas</i>	Scimitarbill, Common	Unlisted	LC
<i>Riparia cincta</i>	Martin, Banded	Unlisted	LC
<i>Riparia paludicola</i>	Martin, Brown-throated	Unlisted	LC
<i>Riparia riparia</i>	Martin, Sand	Unlisted	LC
<i>Sagittarius serpentarius</i>	Secretarybird, Secretarybird	VU	VU
<i>Sarkidiornis melanotos</i>	Duck, Comb	Unlisted	LC
<i>Sarothrura rufa</i>	Flufftail, Red-chested	Unlisted	LC
<i>Saxicola torquatus</i>	Stonechat, African	Unlisted	LC
<i>Scleroptila levaillantii</i>	Francolin, Red-winged	Unlisted	LC
<i>Scleroptila levaillantoides</i>	Francolin, Orange River	Unlisted	Unlisted
<i>Scopus umbretta</i>	Hamerkop, Hamerkop	Unlisted	LC
<i>Serinus canicollis</i>	Canary, Cape	Unlisted	LC
<i>Sigelus silens</i>	Flycatcher, Fiscal	Unlisted	LC
<i>Spermestes cucullatus</i>	Mannikin, Bronze	Unlisted	Unlisted
<i>Sphenoeacus afer</i>	Grassbird, Cape	Unlisted	LC
<i>Spizocorys conirostris</i>	Lark, Pink-billed	Unlisted	LC
<i>Spreo bicolor</i>	Starling, Pied	Unlisted	Unlisted
<i>Stenostira scita</i>	Flycatcher, Fairy	Unlisted	LC
<i>Streptopelia capicola</i>	Turtle-dove, Cape	Unlisted	LC
<i>Streptopelia semitorquata</i>	Dove, Red-eyed	Unlisted	LC
<i>Streptopelia senegalensis</i>	Dove, Laughing	Unlisted	LC
<i>Struthio camelus</i>	Ostrich, Common	Unlisted	LC
<i>Sylvia borin</i>	Warbler, Garden	Unlisted	LC



<i>Sylvietta rufescens</i>	Crombec, Long-billed	Unlisted	LC
<i>Tachybaptus ruficollis</i>	Grebe, Little	Unlisted	LC
<i>Tachymarptis melba</i>	Swift, Alpine	Unlisted	LC
<i>Tadorna cana</i>	Shelduck, South African	Unlisted	LC
<i>Telophorus zeylonus</i>	Bokmakierie, Bokmakierie	Unlisted	LC
<i>Terpsiphone viridis</i>	Paradise-flycatcher, African	Unlisted	LC
<i>Thalassornis leuconotus</i>	Duck, White-backed	Unlisted	LC
<i>Thamnolaea cinnamomeiventris</i>	Cliff-chat, Mocking	Unlisted	LC
<i>Threskiornis aethiopicus</i>	Ibis, African Sacred	Unlisted	LC
<i>Trachyphonus vaillantii</i>	Barbet, Crested	Unlisted	LC
<i>Tricholaema leucomelas</i>	Barbet, Acacia Pied	Unlisted	LC
<i>Tringa glareola</i>	Sandpiper, Wood	Unlisted	LC
<i>Tringa nebularia</i>	Greenshank, Common	Unlisted	LC
<i>Tringa stagnatilis</i>	Sandpiper, Marsh	Unlisted	LC
<i>Turdoides jardineii</i>	Babbler, Arrow-marked	Unlisted	LC
<i>Turdus libonyanus</i>	Thrush, Kurrichane	Unlisted	Unlisted
<i>Turdus olivaceus</i>	Thrush, Olive	Unlisted	LC
<i>Turdus smithi</i>	Thrush, Karoo	Unlisted	LC
<i>Turtur chalcospilos</i>	Wood-dove, Emerald-spotted	Unlisted	LC
<i>Tyto alba</i>	Owl, Barn	Unlisted	LC
<i>Tyto capensis</i>	Grass-owl, African	VU	LC
<i>Upupa africana</i>	Hoopoe, African	Unlisted	LC
<i>Urocolius indicus</i>	Mousebird, Red-faced	Unlisted	LC
<i>Vanellus armatus</i>	Lapwing, Blacksmith	Unlisted	LC
<i>Vanellus coronatus</i>	Lapwing, Crowned	Unlisted	LC
<i>Vanellus senegallus</i>	Lapwing, African Wattled	Unlisted	LC
<i>Vidua macroura</i>	Whydah, Pin-tailed	Unlisted	LC
<i>Zosterops pallidus</i>	White-eye, Orange River	Unlisted	LC
<i>Zosterops virens</i>	White-eye, Cape	Unlisted	LC



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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
<i>Aethomys ineptus</i>	Tete Veld Rat	LC	LC
<i>Micaelamys namaquensis</i>	Namaqua Rock Mouse	LC	LC
<i>Alcelaphus buselaphus</i>	Red Hartebeest	LC	LC
<i>Antidorcas marsupialis</i>	Springbok	LC	LC
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	NT
<i>Atelerix frontalis</i>	South Africa Hedgehog	NT	LC
<i>Atilax paludinosus</i>	Water Mongoose	LC	LC
<i>Canis mesomelas</i>	Black-backed Jackal	LC	LC
<i>Caracal caracal</i>	Caracal	LC	LC
<i>Ceratotherium simum</i>	White Rhinoceros	NT	NT
<i>Connochaetes gnou</i>	Black Wildebeest	LC	LC
<i>Connochaetes taurinus</i>	Blue Wildebeest	LC	LC
<i>Crocidura cyanea</i>	Reddish-grey Musk Shrew	LC	LC
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	NT	LC
<i>Crocidura silacea</i>	Lesser Grey-brown Musk Shrew	LC	LC
<i>Cryptomys hottentotus</i>	Common Mole-rat	LC	LC
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	LC
<i>Damaliscus pygargus</i>	Blesbok	LC	LC
<i>Dasymys incomtus</i>	African Marsh Rat	NT	LC
<i>Desmodillus auricularis</i>	Short-tailed Gerbil	LC	LC
<i>Diceros bicornis</i>	Black Rhinoceros	EN	CR
<i>Eidolon helvum</i>	African Straw-colored Fruit Bat	LC	NT
<i>Elephantulus brachyrhynchus</i>	Short-snouted Sengi	LC	LC
<i>Elephantulus myurus</i>	Eastern Rock Sengi	LC	LC
<i>Eptesicus hottentotus</i>	Long-tailed Serotine Bat	LC	LC
<i>Equus quagga</i>	Plains Zebra	LC	NT
<i>Felis nigripes</i>	Black-footed Cat	VU	VU
<i>Felis silvestris</i>	African Wildcat	LC	LC
<i>Genetta genetta</i>	Small-spotted Genet	LC	LC
<i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	LC
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	LC
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	LC
<i>Hydricis maculicollis</i>	Spotted-necked Otter	VU	NT
<i>Hystrix africaeaustralis</i>	Cape Porcupine	LC	LC
<i>Ichneumia albicauda</i>	White-tailed Mongoose	LC	LC
<i>Ictonyx striatus</i>	Striped Polecat	LC	LC
<i>Kerivoula lanosa</i>	Lesser Woolly Bat	LC	LC
<i>Leptailurus serval</i>	Serval	NT	LC
<i>Lepus saxatilis</i>	Scrub Hare	LC	LC



<i>Lepus victoriae</i>	African Savanna Hare	LC	LC
<i>Mastomys coucha</i>	Multimammate Mouse	LC	LC
<i>Mastomys natalensis</i>	Natal Multimammate Mouse	LC	LC
<i>Mellivora capensis</i>	Honey Badger	LC	LC
<i>Mungos mungo</i>	Banded Mongoose	LC	LC
<i>Mus musculus</i>	House Mouse	Unlisted	LC
<i>Myotis welwitschii</i>	Welwitsch's Hairy Bat	LC	LC
<i>Mystromys albicaudatus</i>	White-tailed Rat	VU	EN
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	LC
<i>Neoromicia zuluensis</i>	Aloe Bat	LC	LC
<i>Nycteris thebaica</i>	Egyptian Slit-faced Bat	LC	LC
<i>Orycteropus afer</i>	Aardvark	LC	LC
<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC	LC
<i>Otomys irroratus</i>	Vlei Rat (Fynbos type)	LC	LC
<i>Ourebia ourebi</i>	Oribi	EN	LC
<i>Panthera pardus</i>	Leopard	VU	VU
<i>Papio ursinus</i>	Chacma Baboon	LC	LC
<i>Parahyaena brunnea</i>	Brown Hyaena	NT	NT
<i>Pedetes capensis</i>	Springhare	LC	LC
<i>Pelea capreolus</i>	Grey Rhebok	NT	LC
<i>Poecilogale albinucha</i>	African Striped Weasel	NT	LC
<i>Procavia capensis</i>	Rock Hyrax	LC	LC
<i>Pronolagus randensis</i>	Jameson's Red Rock Rabbit	LC	LC
<i>Pronolagus saundersiae</i>	Hewitt's Red Rock Rabbit	LC	LC
<i>Proteles cristata</i>	Aardwolf	LC	LC
<i>Raphicerus campestris</i>	Steenbok	LC	LC
<i>Rattus rattus</i>	House Rat	Exotic	LC
<i>Redunca fulvorufula</i>	Mountain Reedbuck	EN	LC
<i>Rhabdomys pumilio</i>	Xeric Four-striped Mouse	LC	LC
<i>Rhinolophus blasii</i>	Peak-saddle Horseshoe Bat	LC	LC
<i>Rhinolophus clivosus</i>	Geoffroy's Horseshoe Bat	LC	LC
<i>Rhinolophus darlingi</i>	Darling's Horseshoe Bat	LC	LC
<i>Saccostomus campestris</i>	Pouched Mouse	LC	LC
<i>Sauromys petrophilus</i>	Flat-headed Free-tail Bat	LC	LC
<i>Scotophilus dinganii</i>	Yellow House Bat	LC	LC
<i>Steatomys pratensis</i>	Fat Mouse	LC	LC
<i>Suncus varilla</i>	Lesser Dwarf Shrew	LC	LC
<i>Suricata suricatta</i>	Suricate	LC	LC
<i>Sylvicapra grimmia</i>	Common Duiker	LC	LC
<i>Syncerus caffer</i>	African Buffalo	LC	LC
<i>Tadarida aegyptiaca</i>	Egyptian Free-tailed Bat	LC	LC
<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	LC	LC
<i>Thryonomys swinderianus</i>	Greater Cane Rat	LC	LC
<i>Tragelaphus oryx</i>	Common Eland	LC	LC



<i>Vulpes chama</i>	Cape Fox	LC	LC
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APPENDIX D: *Reptile species expected to occur within the project area*

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
<i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC	LC
<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	LC	LC
<i>Crocodylus niloticus</i>	Nile Crocodile	VU	LC
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	LC
<i>Duberria lutrix</i>	South African Slug-eater	LC	LC
<i>Hemachatus haemachatus</i>	Rinkhals	LC	LC
<i>Lamprophis aurora</i>	Aurora House Snake	LC	LC
<i>Lycodonomorphus inornatus</i>	Olive House Snake	LC	LC
<i>Prosymna ambigua</i>	East African Shovel-Snout	LC	LC
<i>Psammophis subtaeniatus</i>	Stripe-bellied Sand Snake	LC	LC
<i>Psammophylax tritaeniatus</i>	Striped Skaapsteker	LC	LC
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC	LC
<i>Agama atra</i>	Southern Rock Agama	LC	LC
<i>Boaedon capensis</i>	Brown House Snake	LC	Unlisted
<i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC	Unlisted
<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	LC	Unlisted
<i>Trachylepis varia</i>	Variable Skink	LC	LC



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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
<i>Amietia angolensis</i>	Angola river frog	LC	LC
<i>Breviceps adspersus</i>	Bushveld Rain Frog	LC	LC
<i>Cacosternum boettgeri</i>	Common Caco	LC	LC
<i>Kassina senegalensis</i>	Bubbling Kassina	LC	LC
<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC	LC
<i>Pyxicephalus adspersus</i>	Giant Bull Frog	LC	LC
<i>Sclerophrys capensis</i>	Raucous Toad	LC	LC
<i>Sclerophrys garmani</i>	Olive Toad	LC	LC
<i>Sclerophrys gutturalis</i>	Guttural Toad	LC	LC
<i>Semnodactylus wealii</i>	Rattling Frog	LC	LC
<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	LC
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	LC	LC
<i>Tomopterna natalensis</i>	Natal Sand Frog	LC	LC
<i>Tomopterna tandyi</i>	Tandy's Sand Frog	LC	LC
<i>Xenopus laevis</i>	Common Platanna	LC	LC
<i>Amietia fuscigula</i>	Cape River Frog	LC	LC
<i>Schismaderma carens</i>	Red Toad	LC	LC



