THE MANUNGU COLLIERY EXPANSION, DELMAS

BIODIVERSITY ASSESSMENT

Mpumalanga Province

January 2018

REFERENCE

Manungu - Biodiversity

CLIENT

Prepared for:

EIMS (Pty) Ltd
Brian Whitfield
+27 11 789 7170
+27 82 688 9850

Prepared by:

The Biodiversity Company
420 Vale Ave. Ferndale, 2194
Cell: +27 81 319 1225
Fax: +27 86 527 1965
info@thebiodiversitycompany.com
www.thebiodiversitycompany

Report Name	**THE MANUNGU COLLIERY EXPANSION, DELMAS**
Reference	**Manungu - Biodiversity**
Submitted to	**Environmental Impact Management Systems (Pty) Ltd**
Report reviewer (Fauna)	**Peter Kimberg**  Peter Kimberg is Pr Sci Nat registered (400085/15) in the field of aquatic and biological science. Peter is an aquatic and biodiversity specialist with 13 years of experience in the environmental consulting field.
Report contributor (Herpetofauna)	**Michael Adams**  Michael Adams is an experienced natural scientist with a specialisation in herpetofauna. He has over 10 years of experience working with reptiles and amphibians as a consultant and through various conservation initiatives.
Report contributor (Botany and Fauna)	**Martinus Erasmus**  Martinus Erasmus obtained his B-Tech degree in Nature Conservation in 2016 at the Tshwane University of Technology. Martinus has been conducting basic assessments and assisting specialists in field during his studies since 2015.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

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)	An indication of the quality and age of base data used for the specialist report;	Section 6
Appendix 6 (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 12
Appendix 6 (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 10
Appendix 6 (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5
Appendix 6 (f)	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;	Section 11
Appendix 6 (g)	An identification of any areas to be avoided, including buffers;	Section 11
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;	Section 11
Appendix 6 (i)	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4
Appendix 6 (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity **[including identified alternatives on the environment]** or activities;	Section 12
Appendix 6 (k)	Any mitigation measures for inclusion in the EMPr;	Section 13.5
Appendix 6 (l)	Any conditions for inclusion in the environmental authorisation;	Section 13.6
Appendix 6 (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 13.6
Appendix 6 (n)	A reasoned opinion— i. **[as to]** whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities 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;	Section 15
Appendix 6 (o)	A description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3

GNR 326 April 2017	Description	Section in the Report
Appendix 6 (p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 3
Appendix 6 (q)	Any other information requested by the competent authority.	None

EXECUTIVE SUMMARY

It is clear from the regional ecological overview, as well as the baseline data collected to date that the project area has been altered (historically and currently) predominantly by agricultural land use. It is further evident that the remaining natural habitats have been impacted on as a result of poor grazing practices. The development of the general area, and the increase in mining operations and supporting activities have also contributed to the altered ecological status and functioning of the systems.

However, despite these impacts the remaining natural *Highveld grassland* habitats (including grassland and wetland habitats) exhibited a fairly healthy balance between various common grassland associated herbaceous plants.

The ecological integrity, importance and functioning of the natural grassland and wetland systems within the larger Project area is furthermore reflected in the diverse community structures. This diversity is indicative of the importance of these systems to collectively provide refugia, food and corridors for dispersal in and through the Project area. The preservation of these systems, albeit the majority are modified to some extent, is the most important aspect to consider for the consideration of the proposed mining project.

The impacts associated with the proposed underground mining method are considerably less significant when compared to the proposed opencast mining methods. This compounded with the placement of new infrastructure, access routes and mining activities will have a significant impact on the local environment and ecological processes. Careful consideration must be afforded each of the recommendations provided herein. In the event that environmental authorisation is issued for this project, proven ecological (or environmental) controls and mitigation measures must be entrenched in the management framework. It is strongly recommended that a comprehensive biodiversity action plan be compiled prior to the issuing of any environmental authorisation.

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

- Much of the Project area is identified as being heavily modified, although a portion of the south-western Project area overlaps with a CBA: Optimal and a few other areas area classified as ONAs;
- Based on the National Biodiversity Assessment (NBA, 2012) the Project area was overlaps entirely with ecosystems that are listed as Vulnerable (VU). The Project area is also within a few kilometres of ecosystems which are listed as Critically Endangered;
- The majority of the terrestrial ecosystems associated with the development are rated as *not protected*;
- 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;
- The Project area does overlap with certain wetland areas, and two perennial rivers. However, none of these areas are classified as NFEPA wetlands or rivers;

- The Project area, in relation to the MBSP Freshwater Assessment, overlaps with Ecological Support Area (ESA) – Wetlands, Heavily Modified Areas, Dams and Other Natural Areas (ONAs);
- The Project area is situated across two different vegetation types; the Eastern Highveld Grassland (GM12) and the Soweto Highveld Grassland (GM8) vegetation types, according to Mucina & Rutherford (2006). Both of these vegetation types are classified as *Endangered*;
- Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 393 plant species are expected to occur in the Project area. Of the 393-plant species, five (5) species are listed as being Species of Conservation Concern (SCC);
- Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 288 bird species are expected to occur in the vicinity of the project area. Of the expected bird species, twenty-four (24) species are listed as SCC either on a regional (21) or global scale (15);
- The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that could be expected to occur within the project area. Of these, twelve (12) (17.4%) are listed as being of conservation concern on a regional or global basis;
- Nine (9) category 1b species were recorded at the site and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act;
- Seventy-six (76) bird species were recorded in the project area during the January 2018 survey;
- Overall, mammal diversity in the project area was considered high, with eighteen (18) mammal species being recorded during the January 2018 survey based on either direct observation, camera trap photographs or the presence of visual tracks & signs;
- Three (3) mammal SCC were recorded in the project area. Serval (*Leptailurus serval*) were encountered on a number of occasions during the survey, and it appears that a healthy population of these threatened mammals occur within the project area. Similarly, there seems to be healthy populations of Cape Clawless Otters (*Aonyx capensis*) along the wetland areas and in the dams within the project area and adjacent to it; and
- Six (6) reptile species were recorded in the project area during the January 2018 survey. One near-endemic snake and one endemic snake species were recorded in the project area.
- Potential impacts on the Critical Biodiversity Areas and wetland areas was rated as highly significant prior to mitigation. Although some of the wetlands have been impacted upon due to existing impacts such as grazing by cattle, most of the wetlands were in good condition and were given a high sensitivity rating;
- The presence of various species of conservation concern also increased the habitat sensitivities of the wetland and grasslands areas;

- Potential impacts on the vegetation community were rated as highly significant prior to mitigation. Implementation of mitigation measures reduced the significance of impacts to moderate levels;
- The primary mitigation measure recommended for the project area is for there to be no development in or adjacent to the high-sensitivity wetlands or grassland areas, especially in the south-western, western and eastern portions of the project area where species of conservation concern occur. Based on the sensitivity map in this report, it is recommended that no mining or associated acitivities take place within 100m of any of the sensitive areas defined; and
- Over and above the mititgation measures include in this report, it is further recommended that the placement of the entrance of the underground mining facilities and associated offices be revised and alternative options for its placement be investigated. At the present location it is considered far too close to sensitive critical biodiversity areas as well as to close to wetland areas were species of conservation of concern occur.

IMPACT STATEMENT

An impact statement is required as per the NEMA regulations with regards to the proposed development.

Considering the above-mentioned conclusions, it is the opinion of the specialist that the project be favourably considered but that the mitigation measures and recommendations should be strictly adhered to and enforced. Importantly, this means that the areas marked as sensitive according the results from the field survey must be not be impacted upon during, or post, development and that a 100m buffer must be maintained as specificed. These wetland and grassland areas were marked as highly sensitive due to the high biodiversity values assigned to them as well as the presence of species of conservation concern.

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

30th January 2018

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Tables

Figures

1 Introduction

The Biodiversity Company 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 expansion of the Manungu Colliery near Delmas in Mpumalanga. The proposed project will include a combination of open pit and underground operations.

EIMS has been appointed to undertake relevant authorisation applications and amendment applications to existing authorisations and/or licences pertaining to the Manungu Colliery including:

- New Integrated Environmental Authorisation (Scoping and Environmental Impact Report (S&EIR)) for:
    - Construction of a wash plant and associated infrastructure to complement the existing coal beneficiation plant;
    - Disposal of wash plant waste (requiring Waste Management Licence) for the duration of the 30-year Life of Mine (LOM);
    - New residue deposits and/or residue stockpiles (requiring Waste Management Licence); and
    - Various mining related activities including the primary processing of a mineral resource related to the 30-year LOM which fall outside of the existing approved mining area (refer to locality map).
- New Integrated Water Use Licence (IWUL) for:
    - Discard (wash plant waste) disposal;
    - Two new abstraction boreholes;
    - A new French drain system; and
    - Evaporation sprays at the existing pollution control dam (PCD).
- Amendments to existing Environmental Authorisation and Environmental Management Plan for inter alia:
    - Stockpile vegetation requirements; and
    - Tree screen requirements.

A wet season terrestrial biodiversity survey was conducted in January 2018. The survey was conducted by two terrestrial ecologists over a period of four days. The survey was focused primarily on those areas which were most likely to be impacted upon by the proposed development. Furthermore, identification and description of any sensitive receptors were recorded across the Project area, and the manner in which these sensitive receptors may be affected by the activity was also investigated.

The purpose of the specialist study is to provide relevant input into the EIA process and to provide an EIA/EMPR Report for the proposed activities associated with Manungu Colliery and ancillary activities proposed to take place on site.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

2 Project area

The Manungu Colliery is located approximately 7 km south 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 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 expansion of the Manungu 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.

Based on maps provided by EIMS, the following supporting infrastructure will be built:

- Offices, workshops, change houses, storehouses, warehouses, including a new contractors camp;
- Internal roads and haul roads, fuel storage facilities;
- Open pits, underground sections, crushing circuits, a wash plant, conveyors;
- Water supply networks, storm water networks, pollution control dams; and
- Topsoil stockpiles, discard dumps, and Run of Mine (ROM) stockpiles.

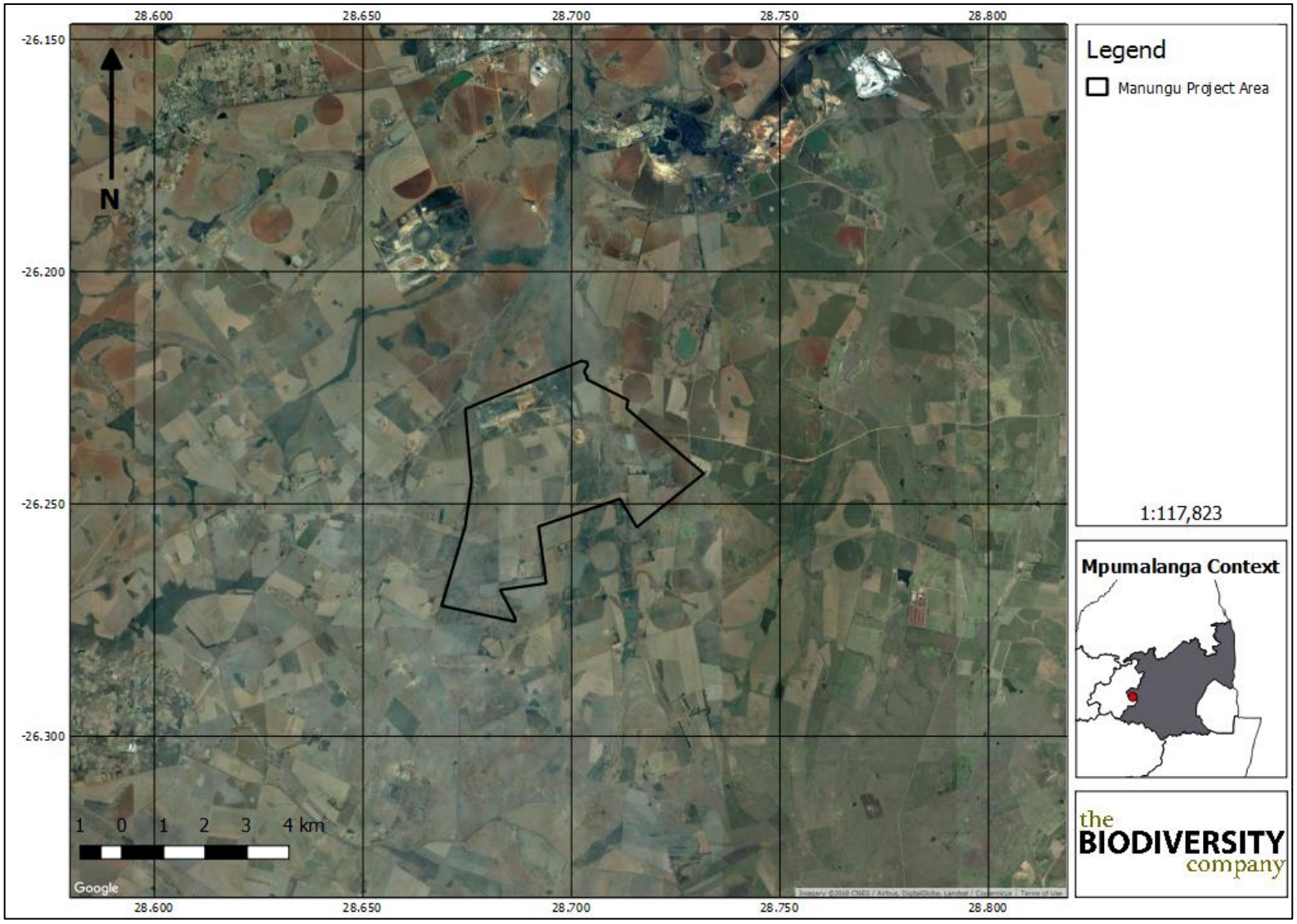

Figure 1: The proposed Manungu Project area

3 Scope of Work

The Biodiversity Company was commissioned by EIMS to conduct a biodiversity baseline (terrestrial, aquatic and wetland ecosystems) and impact assessment for the proposed Manungu Colliery expansion. The Terms of Reference (ToR) included the following:

- Desktop description of the baseline receiving environment specific to the field of expertise (general surrounding as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity, wetlands and soils) that occur in the study area, and the manner in which these sensitive receptors may be affected by the activity;
- Site visit to verify desktop information;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application;
- Provide a map identifying sensitive receptors in the study area, based on available maps, database information & site visit verification; and
- Compile summary specialist reports to feed into the EIA reports, including the following:
    - Botany;
    - Fauna (mammals and avifauna);
    - Herpetology (reptiles and amphibians);
    - Wetland ecosystems (including hydropedology); and
    - Aquatic ecology.

4 Limitations

The following limitations should be noted for the study:

- As per the scope of work, the fieldwork component of the assessment comprised one assessment only, that was conducted during the wet season. This study has not assessed any temporal trends for the respective seasons;
- The scope of work for the project did not include blasting as a potential impact during the construction or operational phase. However, if such action is to be taken the authors of this report must be contacted in order to consult on further mitigation measures which will need to be taken to prevent undue disturbance to fauna in the area;
- The assessments were conducted on those portions of the Project area as originally defined by the client, any changes in the project boundary subsequent to this may negatively impact the robustness of this report;
- No detailed activity list for the proposed project was provided and therefore the risk assessment has been completed based on presumptions for standard mining operations;

- Wetland systems identified at desktop level within 500 m of the Project area were considered for the identification and desktop delineation, with wetland areas within the Project area being the focus for ground truthing;
- The impact assessment was completed for the proposed mining areas and supporting infrastructure for the Project area. The impact assessment has considered these layouts to be final, and have not considered the No Go alternative; and
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

5 Methodologies

5.1 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);
- Herpetology (reptiles and amphibians);
- Wetland ecosystems (including hydropedology); and
- Aquatic ecology.

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

5.2 Botanical Assessment

The botanical study encompassed an assessment of all the vegetation units and habitat types within the Project area. The focus was on 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:

- Braun Blanquet (if applicable) phytosociological and quantification assessment and delineation of habitats; and
- Timed meanders; and
- Sensitivity analysis based on structural and species diversity; and
- Identification of floral red-data species.

5.2.1 Literature study

A literature review was conducted as part of the desktop study to identify the potential habitats present within the Project area. The SANBI provides an electronic database system, namely the Botanical Database of Southern Africa (BODATSA), to access distribution records on southern African plants. This is a new database which replaces the old Plants of Southern Africa (POSA) database. The POSA database provided distribution data of flora at the quarter degree square (QDS) resolution.

The Red List of South African Plants website (SANBI, 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, 2014);
- Medicinal Plants of South Africa (Van Wyk et al., 2013);
- Freshwater Life: A field guide to the plants and animals of southern Africa (Griffiths & Day, 2016); and
- Identification guide to southern African grasses. An identification manual with keys, descriptions and distributions. (Fish et al., 2015).

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

- The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford, 2011);
- Grassland Ecosystem Guidelines: landscape interpretation for planners and managers (SANBI, 2013); and
- Red List of South African Plants (Raimondo et al., 2009; SANBI, 2016).

5.3 Wet Season Fieldwork

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

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

5.4 Faunal Assessment (Mammals & Avifauna)

The faunal desktop assessment included the following:

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

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

- Camera trapping (Figure 2);
- Visual observations;
- Small mammal trapping (Figure 2);
- Identification of tracks and signs; and
- Utilization of local knowledge.

Site selection for trapping focussed on the representative habitats within the Project area. Sites were selected on the basis of GIS mapping and Google Earth imagery and then final selection was confirmed through ground truthing during the surveys. Habitat types sampled included pristine, disturbed and semi-disturbed zones, drainage lines and wetlands.

Figure 2: A) Terrestrial ecologist photographing a rodent captured in a Sherman trap; and B) One of the motion-activated camera traps deployed in the Manungu Project area

5.5 Herpetology (Reptiles & Amphibians)

A herpetofauna assessment of the Project area was 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 were 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. the open cast areas).

The herpetological field survey comprised the following techniques:

- Diurnal hand searches - are used for reptile species that shelter in or under particular microhabitats (typically rocks, exfoliating rock outcrops, fallen timber, leaf litter, bark etc.);
- Visual searches - typically undertaken for species whose behaviour involves surface activity or for species that are difficult to detect by hand-searches or pitfall trapping. May include walking transects or using binoculars to view 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.

6 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 1198): 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:

6.1 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.

6.2 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.

6.3 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.

6.4 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.

6.5 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 (MBCP). 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 MBCP provided a spatial framework that supported land-use planning and helped to streamline and monitor environmental decision-making (Ferrar & Lotter, 2007).

Since 2007 several technical advances and land use changes necessitated the need for an update of the MBCP. The updated product is called the Mpumalanga Biodiversity Sector Plan (MBSP) and builds on the successes of the MBCP 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).

6.6 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).

6.7 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.

7 EIA Study Approach

This draft Environmental Impact Assessment report (EIAR) has been compiled in accordance with the accepted Plan of Study and incorporates the findings and recommendations from other specialist studies conducted for the project.

In addition, this draft EIAR is being compiled according to the guidelines provided in GNR 326 of the EIA Regulations (2017).

All specialist studies were initiated on the basis of the conceptual layout plan indicating the proposed mining areas and mine infrastructure associated with the Manungu expansion project, as provided by EIMS.

8 Project area

General Land Use

The dominant land use of the surrounding area is cultivated land/agriculture, predominately maize cropping and to a lesser extent other crop plants such as Soya. Natural vegetation is utilized for livestock grazing predominately by cattle. Subsistence farming also occurs on site, with cattle grazing across various portions of the Project area, including wetland areas. 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;
- Farm dams and at least one large man-made dam;
- Power lines – especially large Eskom powerlines transecting the proposed southern UG portion of the Project area;
- Telephone lines;
- Agricultural homesteads; and
- Dwellings.

Description of the Project area

The nearest sizeable town is Delmas, which is approximately 7km to the north of the Project area. The project will be an expansion of the existing Manungu colliery which is situated adjacent to the proposed expansion area. The proposed project will be a combination of open pit and underground operations.

8.1 The Mpumalanga Biodiversity Sector Plan (MBSP)

The key output of a 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.

8.2 Project area in Relation to the MBSP

Figure 3 shows the Manungu Project superimposed on the MBSP Terrestrial CBA map. Based on this, the proposed mining areas will overlap with:

- Critical Biodiversity Areas: Optimal (CBA: Optimal);
- 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-western Project area overlaps with a CBA: Optimal and a few other areas area classified as ONAs (Figure 3). The data used for this analysis is often captured remotely and therefore an important aspect of this study was to ground-truth the boundaries of these areas.

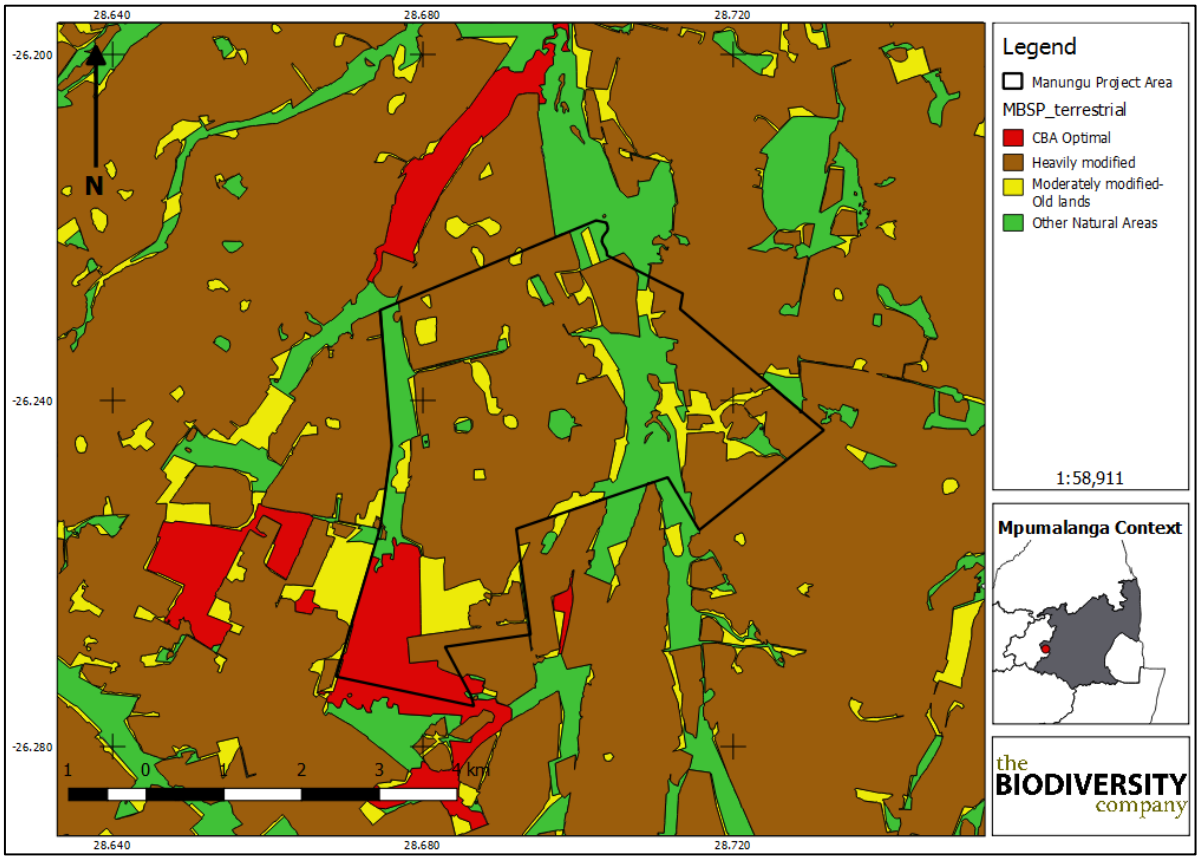

Figure 3: Manungu Project area superimposed on the MBSP Terrestrial Critical Biodiversity Areas (CBA) map (MBSP, 2014)

8.3 Project area in Relation to the NBA

The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level (Driver at al., 2012).

8.3.1 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 at al., 2012).

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 at al., 2012).

The Project area was superimposed on the terrestrial ecosystem threat status (Figure 4). As seen in Figure 4 the Project area overlaps entirely with ecosystems that are listed as Vulnerable (VU). The Project area is also within a few kilometres of ecosystems which are listed as Critically Endangered (CR) (Figure 4).

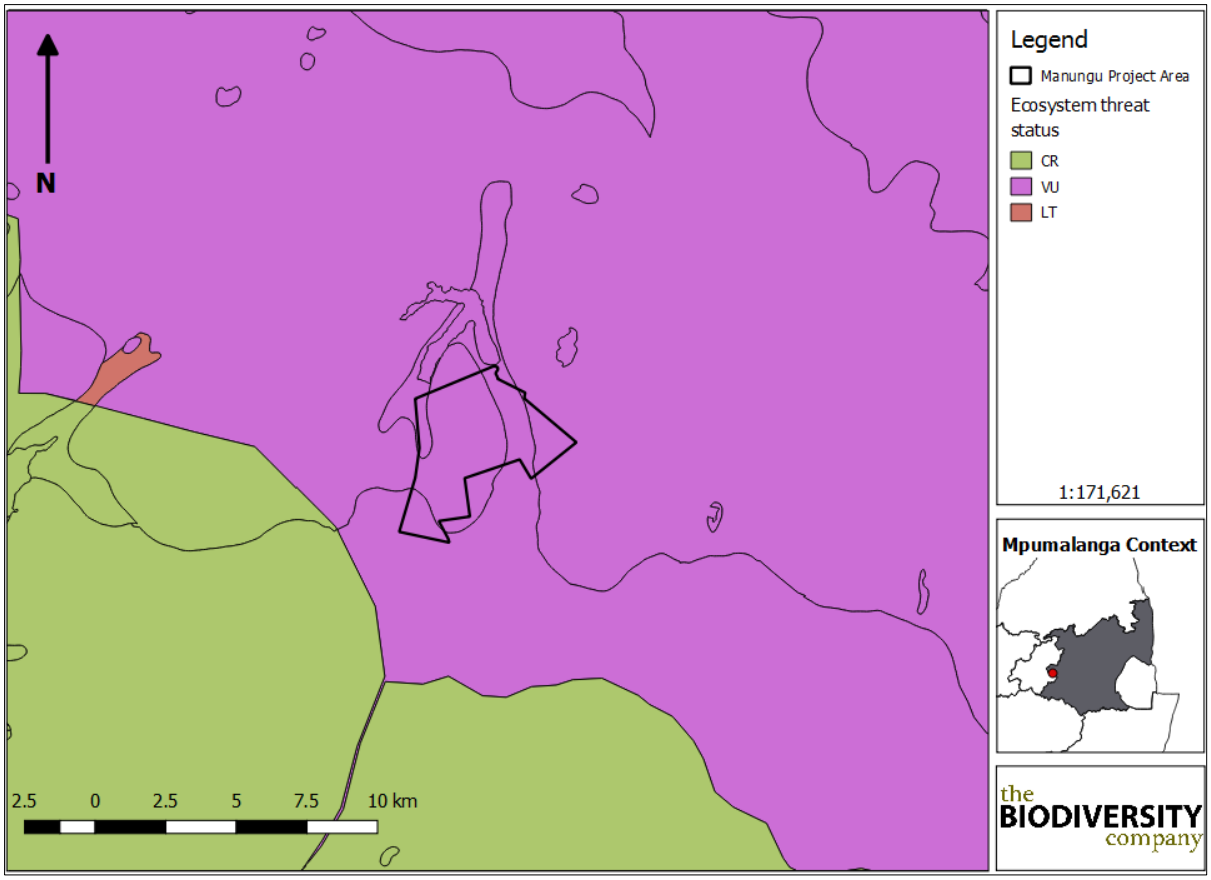

Figure 4: Manungu Project area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2012)

8.3.2 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 at al., 2012).

The Manungu Project was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 5). Based on Figure 5 the majority of the terrestrial ecosystems associated with the development are rated as not protected and a small portion on the northern boundary of the Project area is rated as poorly protected.

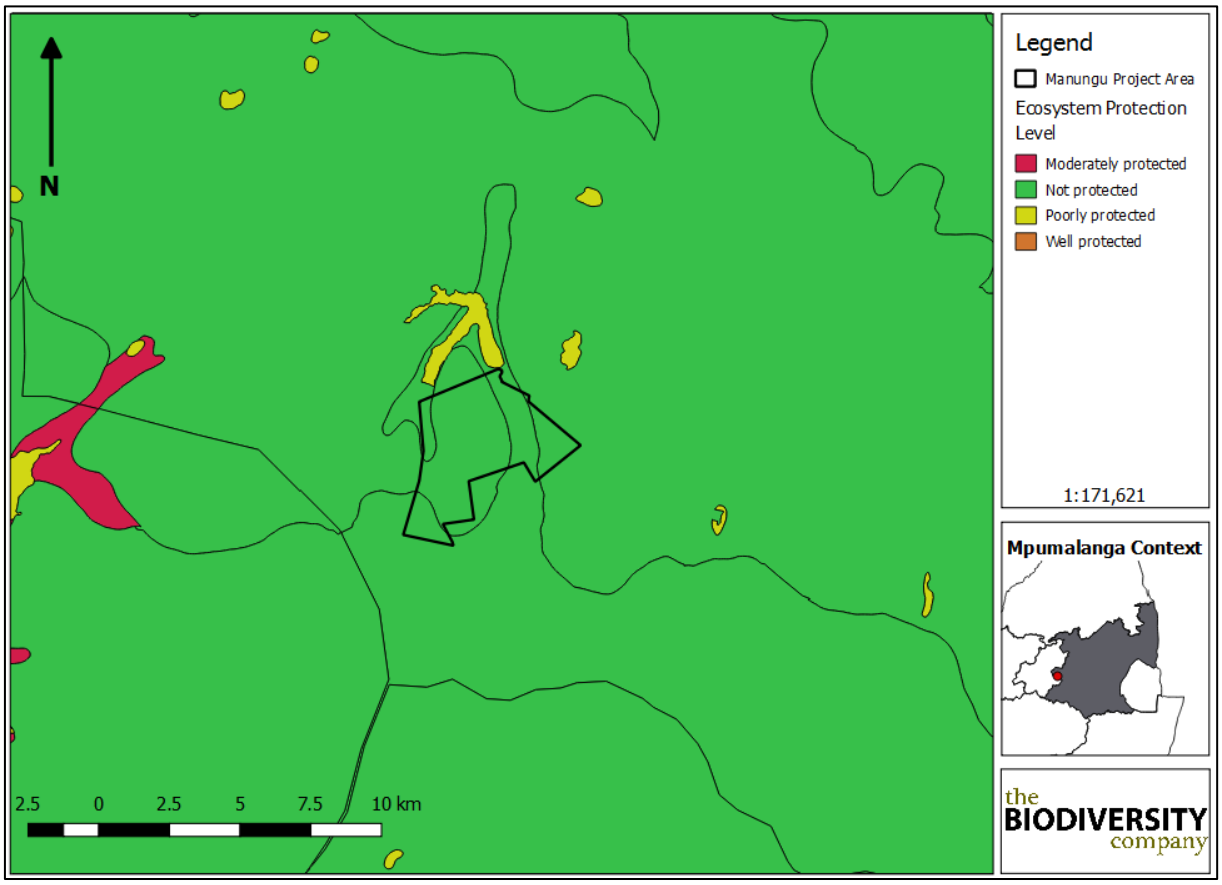

Figure 5: Manungu Project area showing the level of protection of terrestrial ecosystems (NBA, 2012)

8.4 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 (Figure 6).

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

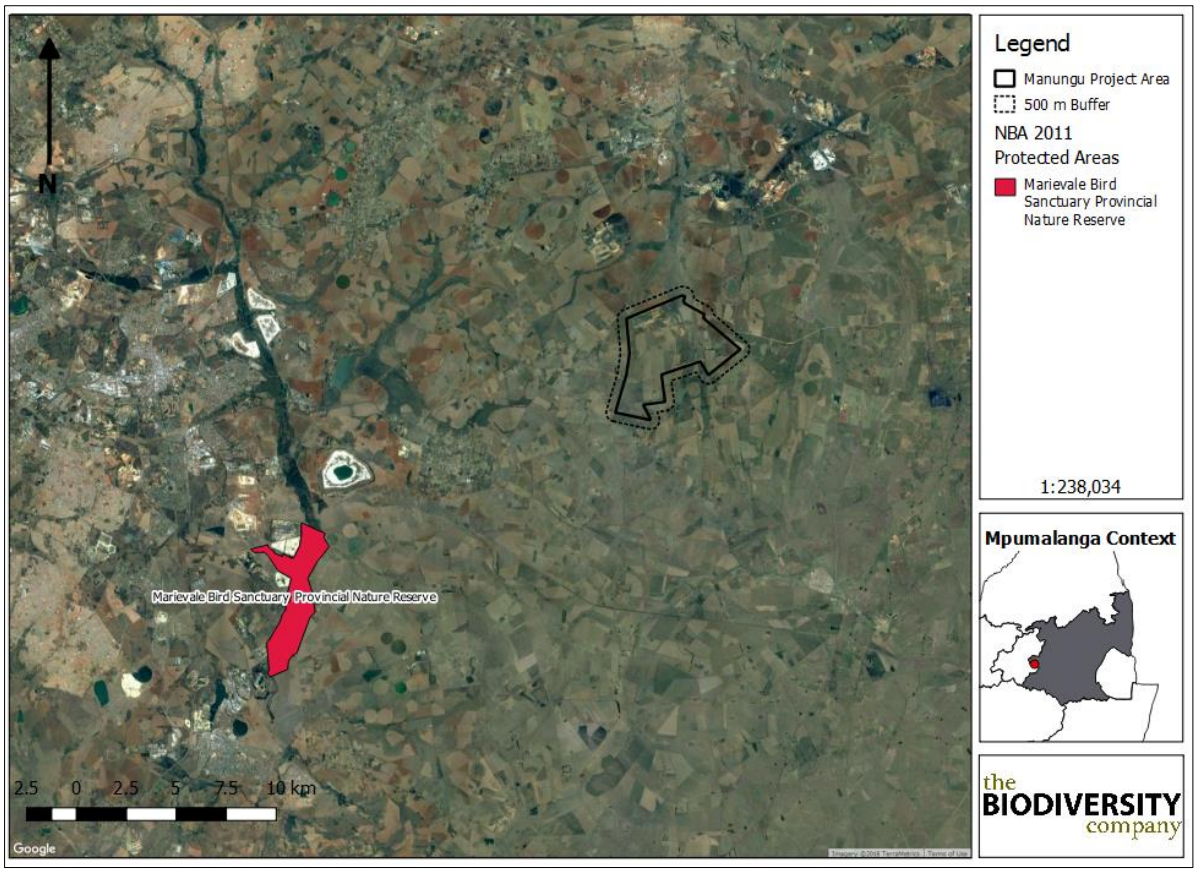

Figure 6: Formally protected areas in relation to the Project area (BGIS,2017)

8.5 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, and two perennial rivers. However, none of these areas are classified as NFEPA wetlands or rivers.

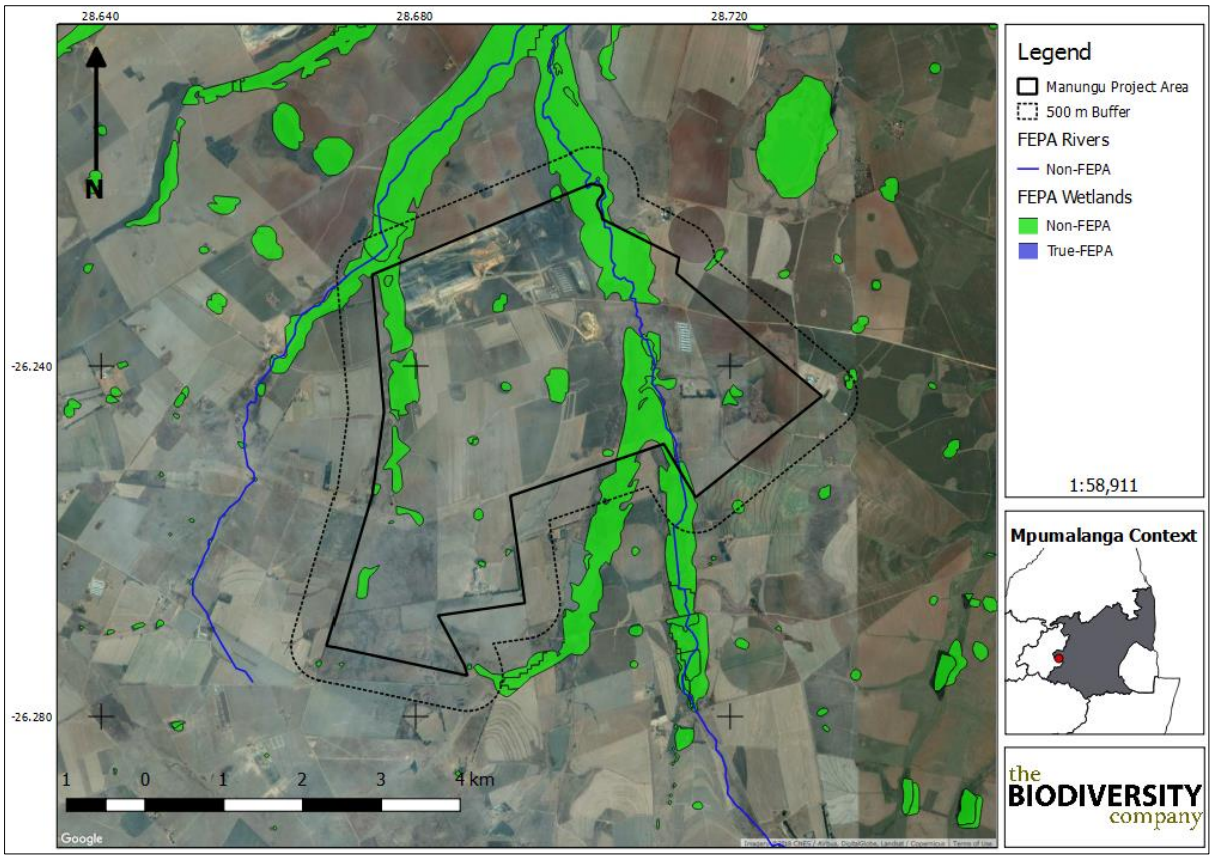

Figure 7: The Project area in relation to the National Freshwater Ecosystem Priority Areas

8.6 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 Ecological Support Area (ESA) – Wetlands, Heavily Modified Areas, Dams and Other Natural Areas (ONAs) (Figure 8).

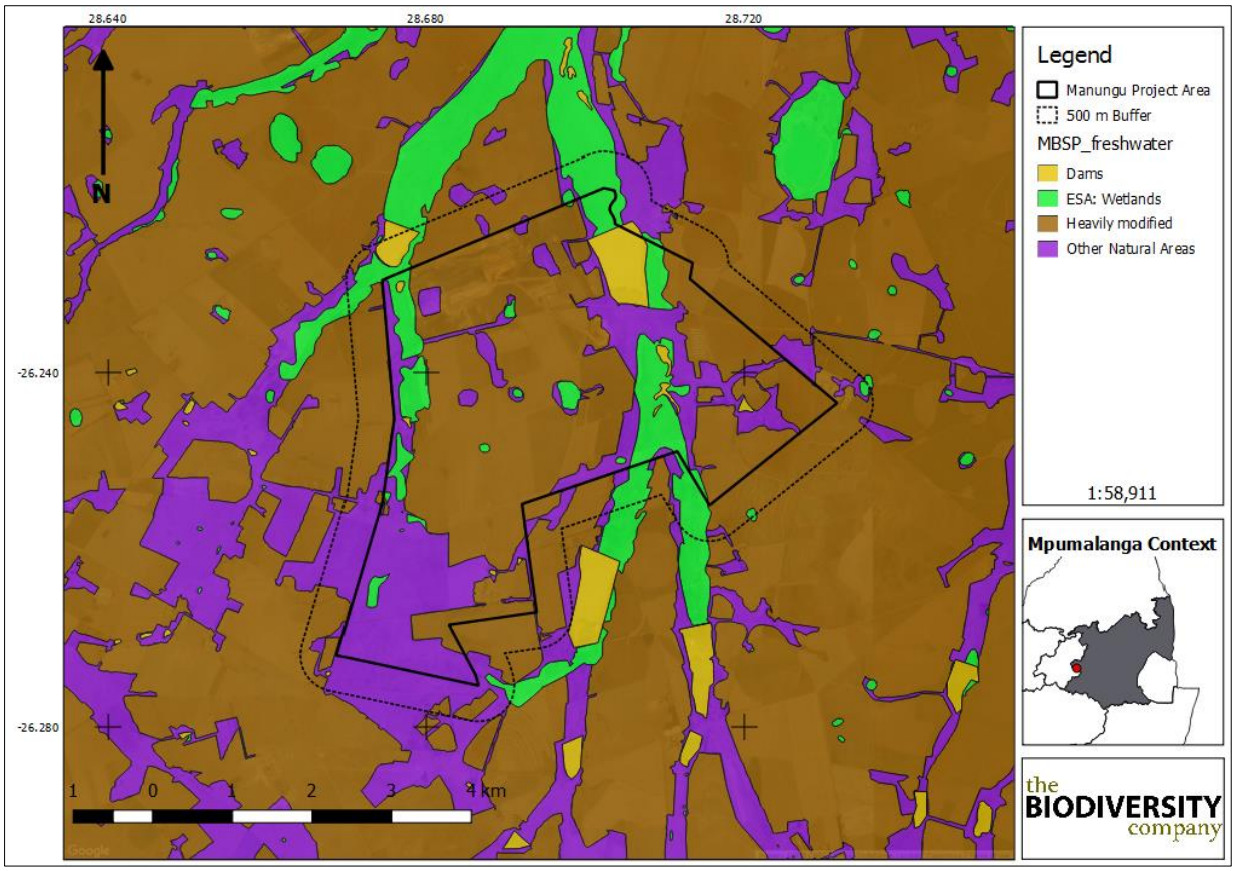

Figure 8: The Manungu Project area in relation to the MBSP Freshwater Assessment

8.7 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 ≥ 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.

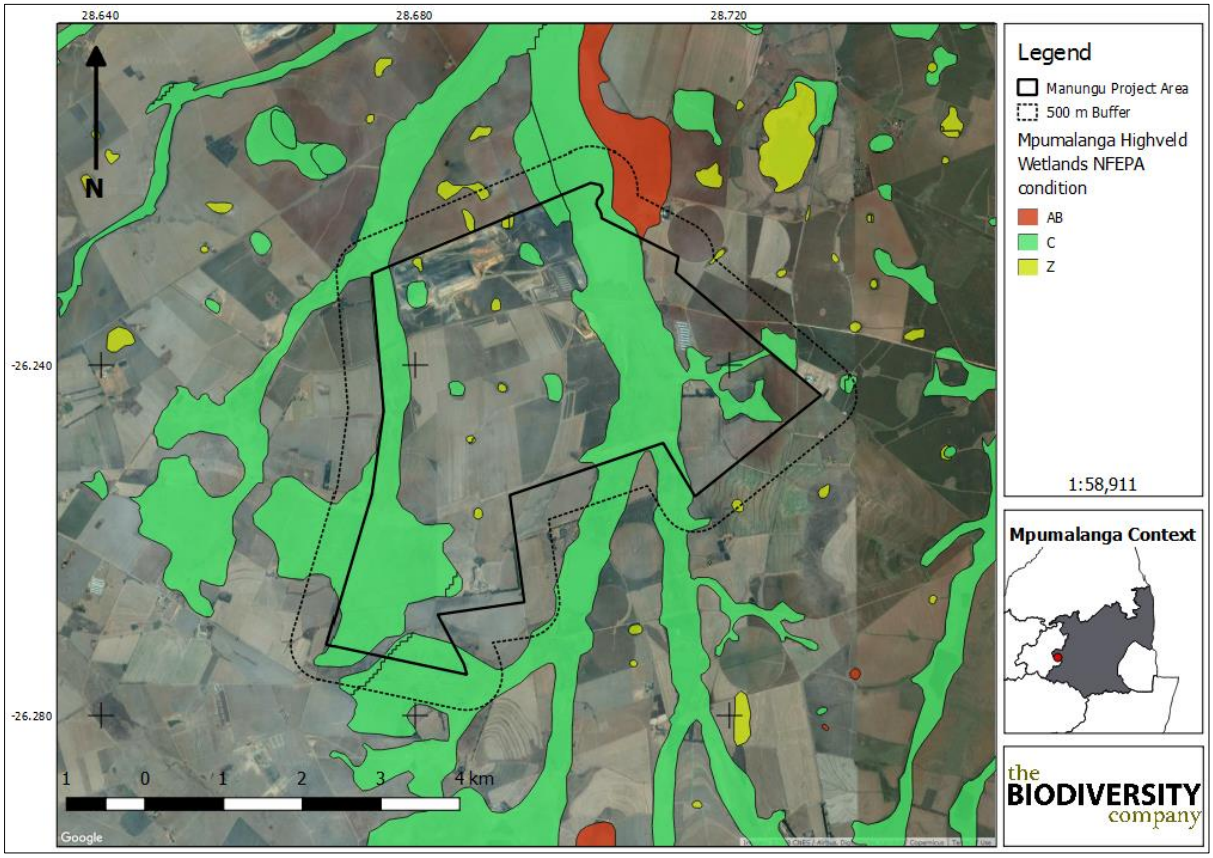

Figure 10: Shows the overall Project area in relation to the Mpumalanga Highveld Wetlands (SANBI, 2012)

8.7.1.1 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.

9 Results & Discussion

9.1 Desktop Assessment

9.1.1 Vegetation Assessment

The Manungu expansion 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.

9.1.2 Vegetation Types

The grassland biome comprises many different vegetation types. The Project area is situated across two different vegetation types; the Eastern Highveld Grassland (GM12) and the Soweto Highveld Grassland (GM8) vegetation types, according to Mucina & Rutherford (2006) (Figure 11). A third vegetation type, the Eastern Temperate Freshwater Wetlands (AZf3), occurs adjacent to the Project area.

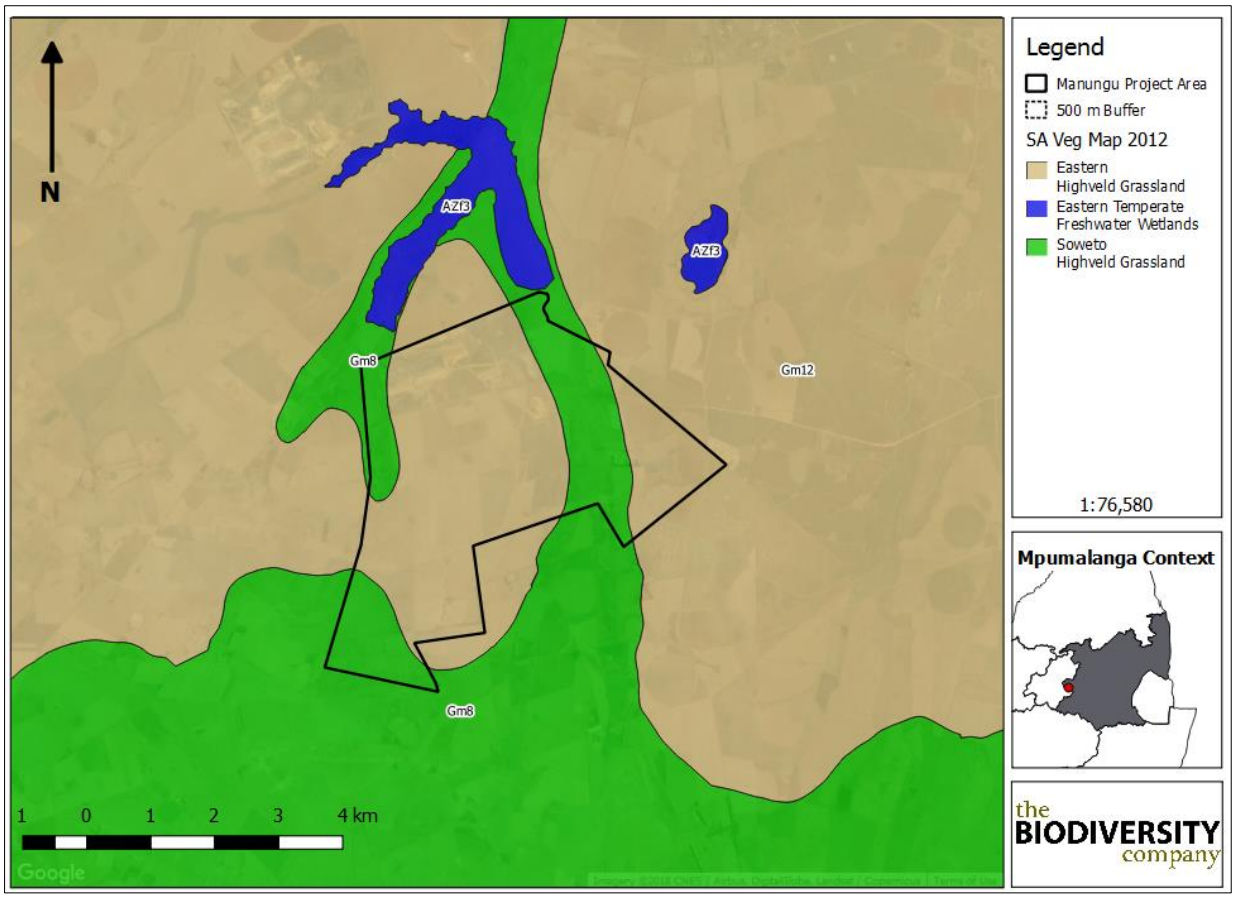

Figure 11: Project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS,2017)

9.1.3 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 (Arsitida, 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).

9.1.4 Soweto Highveld Grassland

The Soweto Highveld Grassland vegetation type is found in Mpumalanga, Gauteng and to a small extent also in neighbouring Free State and North-West Provinces. This vegetation type typically comprises of an undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. Scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover (Mucina & Rutherford, 2006).

9.1.5 Important Plant Taxa

Important plant taxa are those species that have a high abundance, a frequent occurrence or are prominent in the landscape within a particular vegetation type (Mucina & Rutherford, 2006).

The following species are important in the **Soweto Highveld Grassland** vegetation type:

Graminoids: *Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus , Eragrostis capensis, E. chloromelas, E. curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus, Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum* (Mucina & Rutherford, 2006).

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

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

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

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 ceresiiforme, 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, Harpochloa 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.*

9.1.5.1 Conservation Status

9.1.5.2 Soweto 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 Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, Rolfe's Pan Nature Reserves or privately conserved in Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site.

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

9.1.5.3 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 (Holkranse, Kransbank, Morgenstond).

Some 44% of this vegetation type has already been transformed 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.

9.1.5.4 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 393 plant species are expected to occur in the area (Figure 12). The list of expected plant species is provided in Appendix A.

Of the 393-plant species, five (5) species are listed as being Species of Conservation Concern (SCC) (Table 1).

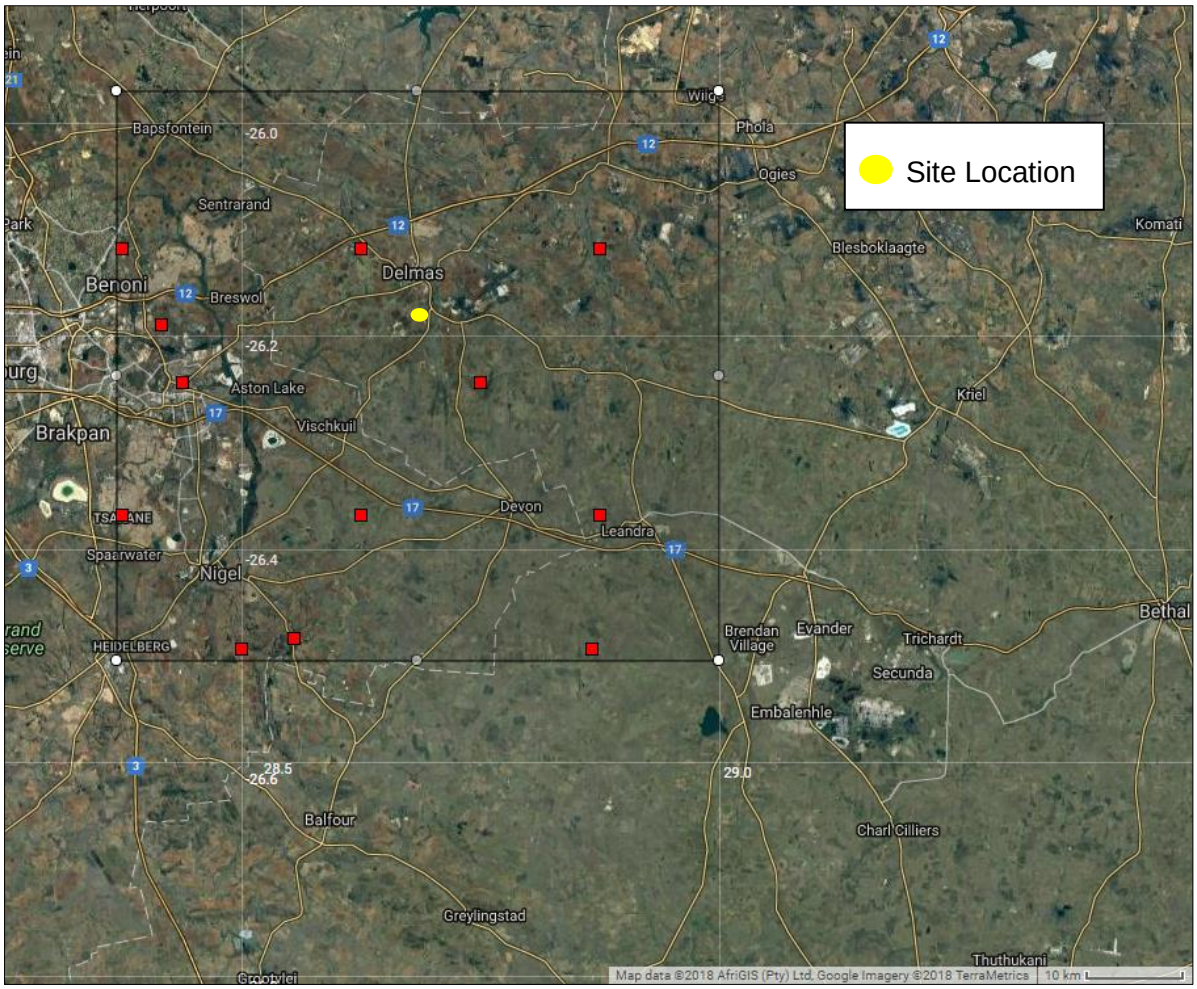

*Figure 12: Map showing the grid drawn in order to compile an expected species list (*BODATSA-POSA, 2016*)*

Table 1: Plant Species of Conservation Concern (SCC) expected to occur in the project area (BODATSA-POSA, 2016)

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

9.1.6 Faunal Assessment

9.1.6.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 288 bird species are expected to occur in 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 expected bird species, twenty-four (24) species (8.3%) are listed as SCC either on a regional (21) or global scale (15) (Table 2).

The 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 2).

Table 2: 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)	
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC	Moderate
Anthropoides paradiseus	Crane, Blue	NT	VU	High

Calidris ferruginea	Sandpiper, Curlew	LC	NT	Moderate
Charadrius pallidus	Plover, Chestnut-banded	NT	NT	Moderate
Ciconia abdimii	Stork, Abdim's	NT	LC	High
Circus macrourus	Harrier, Pallid	NT	NT	Moderate
Circus maurus	Harrier, Black	EN	VU	Moderate
Circus ranivorus	Marsh-harrier, African	EN	LC	High
Coracias garrulus	Roller, European	NT	LC	Moderate
Eupodotis caerulescens	Korhaan, Blue	LC	NT	Moderate
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC	Moderate
Falco biarmicus	Falcon, Lanner	VU	LC	High
Falco vespertinus	Falcon, Red-footed	NT	NT	High
Geronticus calvus	Ibis, Southern Bald	VU	VU	High
Glareola nordmanni	Pratincole, Black-winged	NT	NT	Moderate
Mirafra cheniana	Lark, Melodious	LC	NT	Moderate
Mycteria ibis	Stork, Yellow-billed	EN	LC	High
Neotis denhami	Bustard, Denham's	VU	NT	Moderate
Oxyura maccoa	Duck, Maccoa	NT	NT	High
Phoeniconaias minor	Flamingo, Lesser	NT	NT	High
Phoenicopterus ruber	Flamingo, Greater	NT	LC	High
Podica senegalensis	Finfoot, African	VU	LC	Moderate
Sagittarius serpentarius	Secretarybird	VU	VU	High
Tyto capensis	Grass-owl, African	VU	LC	High

Some 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 saltpans (IUCN, 2017). Due to the presence of some of these habitat types within the project area the likelihood of occurrence of this species was rated as moderate.

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

Mycteria ibis (Yellow-billed Stork) is listed as EN on a regional scale and Least Concern (LC) on a global scale (Table 2). 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 (Denhams 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 it's 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 moderates.

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.

9.1.6.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that could be expected 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 3).

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 3).

On a global scale, 1 species is listed as EN, 2 are listed as VU and 2 as NT (Table 3).

Table 3: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

Species	Common name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Aonyx capensis	Cape Clawless Otter	NT	NT	High
Atelerix frontalis	South Africa Hedgehog	NT	LC	High
Crocidura mariquensis	Swamp Musk Shrew	NT	LC	High
Dasymys incomtus	African Marsh Rat	NT	LC	High
Felis nigripes	Black-footed Cat	VU	VU	Moderate
Leptailurus serval	Serval	NT	LC	High
Mystromys albicaudatus	White-tailed Rat	VU	EN	Moderate
Ourebia ourebi	Oribi	EN	LC	Low
Panthera pardus	Leopard	VU	VU	Low
Pelea capreolus	Grey Rhebok	NT	LC	Low
Poecilogale albinucha	African Striped Weasel	NT	LC	Moderate
Redunca fulvorufula	Mountain Reedbuck	EN	LC	Low

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 various dams, the likelihood of occurrence of this species occurring in the project area is considered to be high.

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

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

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

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

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 moderate 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.

9.1.6.3 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 are expected to occur in the project area (Appendix D). Of the expected reptile species, only one (1) is regarded as a SCC, namely *Crocodylus niloticus* (Nile Crocodile) which is listed as Near Threatened (NT) regionally (Table 4). Although this species is listed as expected to occur in the project, the lack of very large water bodies or rivers which this species requires and the lack of recent records for the surrounding area, suggest that the likelihood of occurrence is low (Table 4).

Table 4: 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)	
Crocodylus niloticus	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 are expected to occur in the project area (Appendix E). No amphibian species of conservation concern should be present in the project area according to the above-mentioned sources but *in situ* confirmation is required.

10 Field Survey

The field survey for the Manungu expansion project (flora and fauna (mammals, avifauna, amphibians and reptiles)) was conducted from the 15th - 18th January 2018, and a further field survey was conducted on the 22nd January 2018. During the surveys the floral and faunal communities in the Project area were assessed. The Project area was ground-truthed on foot, which included spot checks in pre-selected areas to validate desktop data. Photographs were recorded during the site visits and some are provided under the Results section in this report. All site photographs are available on request.

10.1 Site Coverage

The fieldwork was conducted during what is generally considered the middle of the wet season for Mpumalanga grassland habitats. This is the ideal season for identifying flowering plants and grasses, and is also the period when faunal activity is highest. However, the species recorded to date can by no means be regarded as comprehensive and successive surveys across entire seasons and phenological cycles will greatly supplement the baseline data gathered to date. The wet season site coverage by the specialists, as evaluated from their GPS tracks is shown in Figure 13.

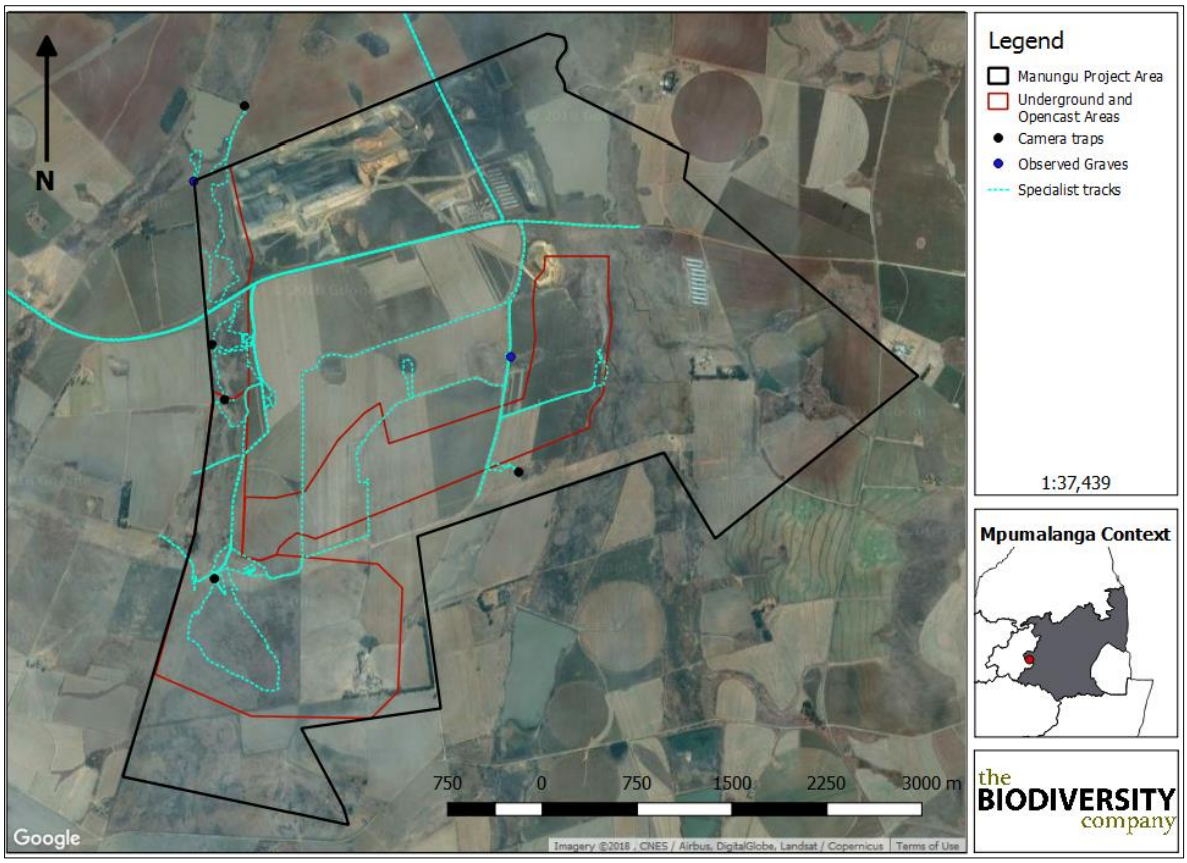

Figure 13: Specialist site coverage for the wet season fieldwork across the Project area.

10.1.1 Vegetation Assessment

The vegetation assessment concentrated on the areas which still seemed intact in comparison the surround areas which have either been mined or used for agricultural reasons. These areas were mapped according to the field data (Figure 14).

The following areas were identified and the approximate size of each of the specific areas was calculated as follows:

- Agricultural areas (923 ha – 49.3% of the total Project area);
- Mining (283 ha – 15.1% of the total Project area);
- Disturbed Grassland (58.4 ha – 3.1% of the total Project area);
- Mesic Grassland (150 ha – 8.0% of the total Project area);
- Wetland (444 ha – 23.7% of the total Project area); and
- Pans (15.57 ha – 0.8% of the total Project area).

The agricultural and mining areas (dark and light green) are the areas which has been degraded significantly. The agricultural areas where mostly cultivated with Maize and Soya whereas the areas being mined had large occurrence of weeds and bare soil due to the disturbance to the topsoil layer. The disturbed area didn't contain a large amount of diverse indigenous vegetation mainly due to the anthropogenic influence. Weeds such as *Bidens pilosa, Conyza bonariensis* and *Tagetes minuta* occurred throughout and the overall state of the area was degraded. The roads are maintained, and all the vegetation removed on a constant basis and will most likely be a monoculture of a certain grass species.

The disturbed grassland area has been constantly disturbed, mainly due to grazing pressure from livestock and consists of a monoculture of grass species, mainly *Eragrostis curvula*.

The mesic grassland contained many of the same species that occurred within the wetland area, the main distinction between the mesic grassland and the wetland is the amount of soil moisture available. The wetland is characterised by permanently saturated conditions whereas the mesic grassland is characterised by historic signs of wetness. The dominating species were *Themeda triandra*, *Setaria sphacelata var sericea* as well as *Cymbopogon caesius*. *Eucomis autumnalis* also in patches throughout which is an indication of the moisture throughout the area.

The wetland area had the greatest species composition in comparison to all the different areas. Patches of *Imperata cylindrica*, *Agrostis lachnantha var. lachnantha* as well as *Typha capenis* occurred throughout the wetland. *Crinum bulbispermum, Eucomis autumnalis* as well as *Nerine angustifolia* are flora species associated with marshy or moist areas which occurred throughout the wetland area. Some areas within the wetland were dominated by *Bidens formosa*, depending on the degree of the disturbance caused by the surrounding agriculture as well as the grazing of livestock.

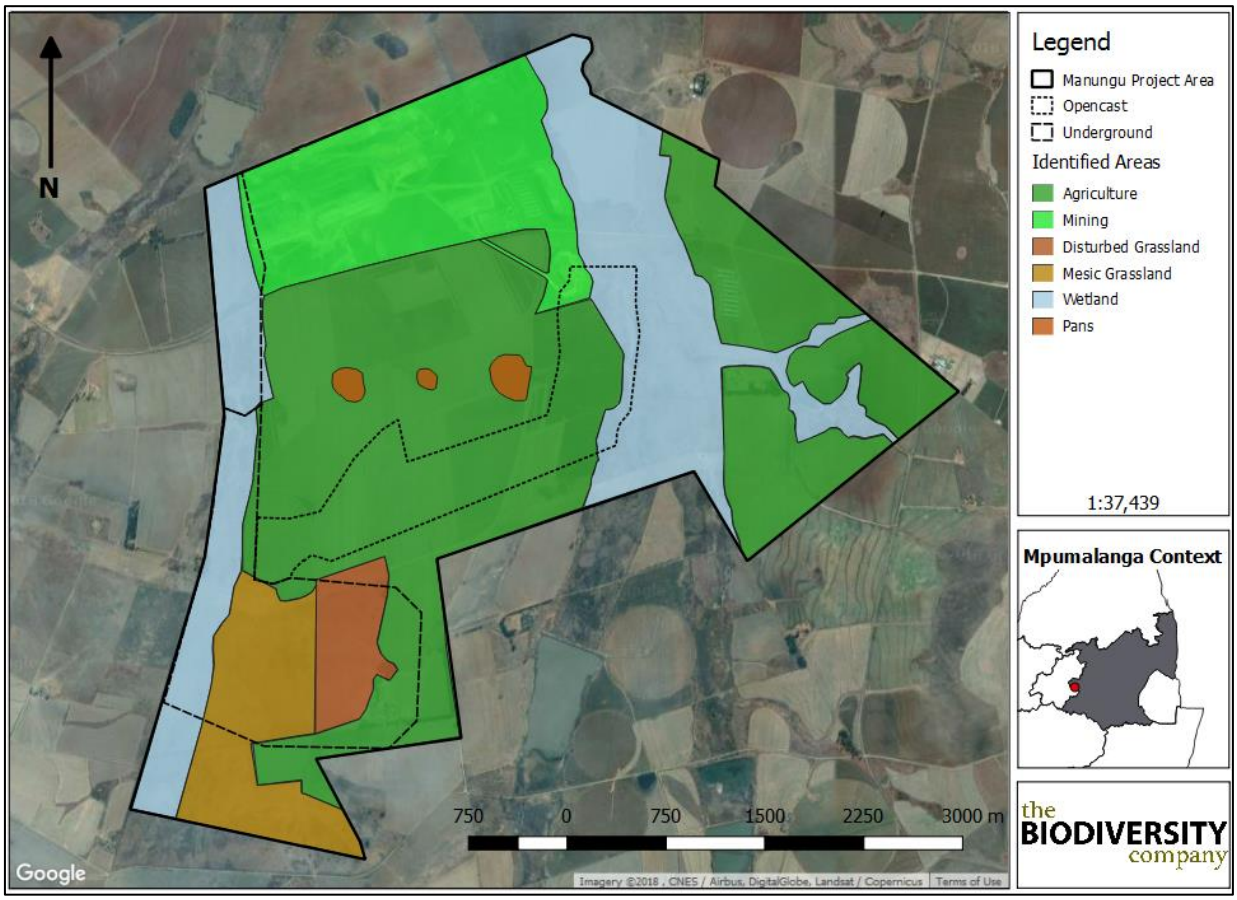

Figure 14: The areas identified during the fieldwork.

A total of 85 tree, shrub and herbaceous plant species were recorded in the proposed Project area during the January 2018 field assessment (Table 5). Alien/Exotic/Invader plant species appear in blue text, NEMBA Category 1 Plants in green. Some of the recorded plant species are shown in Figure 15.

Table 5: Trees, shrubs and weeds recorded at the proposed project area (species name in red are listed species)

Species	Threat status (SANBI, 2017)	SA Endemic	NEMBA Category
Acacia mearnsii			Category 2
Agave americana			Category 2
Agrostis lachnantha var. lachnantha	LC	No	
Albuca setosa	LC	No	
Aloe sp			
Andropogon appendiculatus	LC	No	
Aptosimum sp			
Aristida junciformis	LC	No	
Berkheya radula	LC	No	
Bidens formosa			Not Indigenous; Naturalised
Brachiaria serrata	LC	No	
Bromus catharticus			Not Indigenous; Naturalised
Campuloclinium macrocephalum			NEMBA Category 1b.
Chironia palustris subsp. palustris	LC		
Chironia purpurascens	LC	No	
Chloris virgata	LC	No	
Cirsium vulgare			NEMBA Category 1b.
Convolvulus natalensis	LC	No	
Conyza bonariensis			Invasive
Cortaderia selloana			NEMBA Category 1b.
Crinum bulbispermum	LC	No	
Cucumis zeyheri	LC	No	
Cymbopogon caesius	LC	No	
Cynodon dactylon	LC	No	
Datura ferox			NEMBA Category 1b.
Datura stramonium			NEMBA Category 1b.
Denekia capensis	LC	No	
Digitaria eriantha	LC	No	
Eragrostis chloromelas	LC	No	
Eragrostis curvula	LC	No	
Eragrostis lehmanniana	LC	No	
Eragrostis superba	LC	No	
Eucalyptus sp			NEMBA Category 1b.
Eucomis autumnalis	LC	No	
Eulophia welwitschii	LC	No	
Euphorbia clavarioides	LC	Yes	
Fingerhuthia africana	LC	No	
Gladiolus sericeovillosus	LC	Yes	
Gomphocarpus fruticosus	LC	No	
Gomphrena celosioides			Not Indigenous; Naturalised

Haplocarpha scaposa	LC	No	
Helichrysum rugulosum			
Heliotropium amplexicaule			Not Indigenous; Naturalised
Heteropogon contortus	LC	No	
Hibiscus trionum			Not Indigenous; Naturalised
Hyparrhenia hirta	LC	No	
Hypoxis hemerocallidea	LC	No	
Hypoxis iridifolia	LC	No	
Hypoxis rigidula var. rigidula	LC	No	
Imperata cylindrica	LC	No	
Ipomoea crassipes	LC	No	
Kyllinga alba	LC	No	
Ledebouria ovatifolia	LC	No	
Leersia hexandra	LC	No	
Melinis repens	LC	No	
Nerine angustifolia	LC	No	
Nidorella podocephala	LC	No	
Oenothera rosea			Not Indigenous; Naturalised
Paspalum dilatatum	LC	No	
Pennisetum clandestinum			NEMBA Category 1b in protected areas and wetlands.
Persicaria attenuata subsp. africana	LC	No	
Phragmites australis	LC	No	
Quercus sp			Not Indigenous
Ranunculus multifidus	LC	No	
Robinia pseudoacacia			NEMBA Category 1b.
Rumex crispus			Not Indigenous; Naturalised; Invasive
Salvia repens var. transvaalensis	LC	No	
Scabiosa columbaria			
Schinus molle			NEMBA Category 3.
Schkuhria pinnata			Invasive
Senecio inornatus	LC	No	
Seriphium plumosum	LC	No	
Setaria pumila	LC	No	
Setaria sphacelata var sericea	LC	No	
Solanum panduriforme			
Sonchus asper			Invasive
Sporobolus africanus	LC	No	
Tagetes minuta			Not Indigenous; Naturalised
Themeda triandra	LC	No	
Trachyandra saltii	LC	No	
Trifolium africanum var. africanum	NE		
Typha capensis	LC	No	
Verbena bonariensis			NEMBA Category 1b.
Wahlenbergia krebsii	LC	No	
Xysmalobium undulatum	LC	No	

Figure 15: Photographs of flora identified within the Project area. A- Hypoxis rigidula var. rigidula. B- Nerine angustifolia. C- Crinum bulbispermum. D- Eucomis autumnalis. E- Gladiolus sericeovillosus. F-

Eulophia welwitschii. G- Chironia palustris subsp. palustris. H- Trachyandra saltii. I- Hypoxis hemerocallidea. I- Helichrysum rugulosum.

10.2 Alien and Invasive Plants

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

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

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

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

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

- Notify the competent authority in writing

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

Nine (9) category 1b invasive species were recorded at the site and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act as stated above. The NEMBA listed species identified within the project area are marked in green (Table 5).

10.3 Species of Conservation Concern

The relevant regional ecosystems and vegetation types have been identified in the *vegetation overview* section. At least five (5) Red List plant species are expected within and/or surrounding the Project area.

Although care was taken to traverse as much of the suitable habitat during the fieldwork in search for these SCC, the effort failed to record any of these species. The fieldwork did however, reveal the disturbed nature of most of the habitats within the Project area, largely due to overgrazing.

Based on the field observations, the likelihood of occurrence of any of the Red and Orange List plant species outlined in Table 5 is low to medium and repeated field surveys throughout the phenological cycles of these plant SCC may yield observations of this species within the Project area.

10.4 Faunal Assessment

The faunal assessment was completed based on the desktop review and intensive biodiversity surveys which were conducted across the Project area. Faunal surveys were conducted based on the following methodologies:

- Camera trapping;
- Active searching;
- Audio sampling for amphibians;
- Point count surveys; and
- Sherman-trap sampling for small mammals.

10.4.1 Avifauna

Seventy-six (76) bird species were recorded in the project area during the January 2018 survey based on either direct observations, or the presence of visual tracks & signs (Table 6) (Figure 16). No bird SCC were recorded during the survey, although based on the various wetland habitats encountered in the project area, the likelihood that bird SCC occur there is rated as

high. Many important roosting and nesting sites were noted during the survey around wetland and marsh areas (Figure 16).

Table 6: A list of avifaunal species recorded for the Project area

Species	Common Name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Acridotheres tristis	Myna, Common	Unlisted	LC
Acrocephalus baeticatus	Reed-warbler, African	Unlisted	Unlisted
Actitis hypoleucos	Sandpiper, Common	Unlisted	LC
Alopochen aegyptiacus	Goose, Egyptian	Unlisted	LC
Anas undulata	Duck, Yellow-billed	Unlisted	LC
Anhinga rufa	Darter, African	Unlisted	LC
Apus affinis	Swift, Little	Unlisted	LC
Apus caffer	Swift, White-rumped	Unlisted	LC
Ardea melanocephala	Heron, Black-headed	Unlisted	LC
Ardea purpurea	Heron, Purple	Unlisted	LC
Asio capensis	Owl, Marsh	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Bubulcus ibis	Egret, Cattle	Unlisted	LC
Burhinus capensis	Thick-knee, Spotted	Unlisted	LC
Burhinus vermiculatus	Thick-knee, Water	Unlisted	LC
Buteo rufofuscus	Buzzard, Jackal	Unlisted	LC
Buteo vulpinus	Buzzard, Common	Unlisted	Unlisted
Centropus burchellii	Coucal, Burchell's	Unlisted	Unlisted
Ceryle rudis	Kingfisher, Pied	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Chrysococcyx caprius	Cuckoo, Diderick	Unlisted	LC
Corvus albus	Crow, Pied	Unlisted	LC
Corythaixoides concolor	Go-away-bird, Grey	Unlisted	LC
Cossypha caffra	Robin-chat, Cape	Unlisted	LC
Coturnix coturnix	Quail, Common	Unlisted	LC
Crithagra gularis	Seedeater, Streaky-headed	Unlisted	LC
Dicrurus adsimilis	Drongo, Fork-tailed	Unlisted	LC
Egretta alba	Egret, Great	Unlisted	LC
Elanus caeruleus	Kite, Black-shouldered	Unlisted	LC
Euplectes axillaris	Widowbird, Fan-tailed	Unlisted	LC
Euplectes capensis	Bishop, Yellow	Unlisted	LC
Euplectes orix	Bishop, Southern Red	Unlisted	LC
Euplectes progne	Widowbird, Long-tailed	Unlisted	LC
Falco amurensis	Falcon, Amur	Unlisted	LC
Falco rupicoloides	Kestrel, Greater	Unlisted	LC
Fulica cristata	Coot, Red-knobbed	Unlisted	LC
Gallinago nigripennis	Snipe, African	Unlisted	LC
Gallinula chloropus	Moorhen, Common	Unlisted	LC
Hirundo abyssinica	Swallow, Lesser Striped	Unlisted	LC

Lamprotornis nitens	Starling, Cape Glossy	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Lybius torquatus	Barbet, Black-collared	Unlisted	LC
Macronyx capensis	Longclaw, Cape	Unlisted	LC
Milvus aegyptius	Kite, Yellow-billed	Unlisted	Unlisted
Motacilla aguimp	Wagtail, African Pied	Unlisted	LC
Myrmecocichla formicivora	Chat, Anteating	Unlisted	LC
Numida meleagris	Guineafowl, Helmeted	Unlisted	LC
Onychognathus morio	Starling, Red-winged	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	Unlisted
Phoeniculus purpureus	Wood-hoopoe, Green	Unlisted	LC
Platalea alba	Spoonbill, African	Unlisted	LC
Plectropterus gambensis	Goose, Spur-winged	Unlisted	LC
Plegadis falcinellus	Ibis, Glossy	Unlisted	LC
Ploceus velatus	Southern Masked-weaver	Unlisted	LC
Prinia subflava	Prinia, Tawny-flanked	Unlisted	LC
Pternistis swainsonii	Spurfowl, Swainson's	Unlisted	LC
Quelea quelea	Quelea, Red-billed	Unlisted	LC
Saxicola torquatus	Stonechat, African	Unlisted	LC
Scopus umbretta	Hamerkop, Hamerkop	Unlisted	LC
Sigelus silens	Flycatcher, Fiscal	Unlisted	LC
Spermestes cucullatus	Mannikin, Bronze	Unlisted	Unlisted
Streptopelia capicola	Turtle-dove, Cape	Unlisted	LC
Streptopelia senegalensis	Dove, Laughing	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turtur chalcospilos	Wood-dove, Emerald-spotted	Unlisted	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops virens	White-eye, Cape	Unlisted	LC

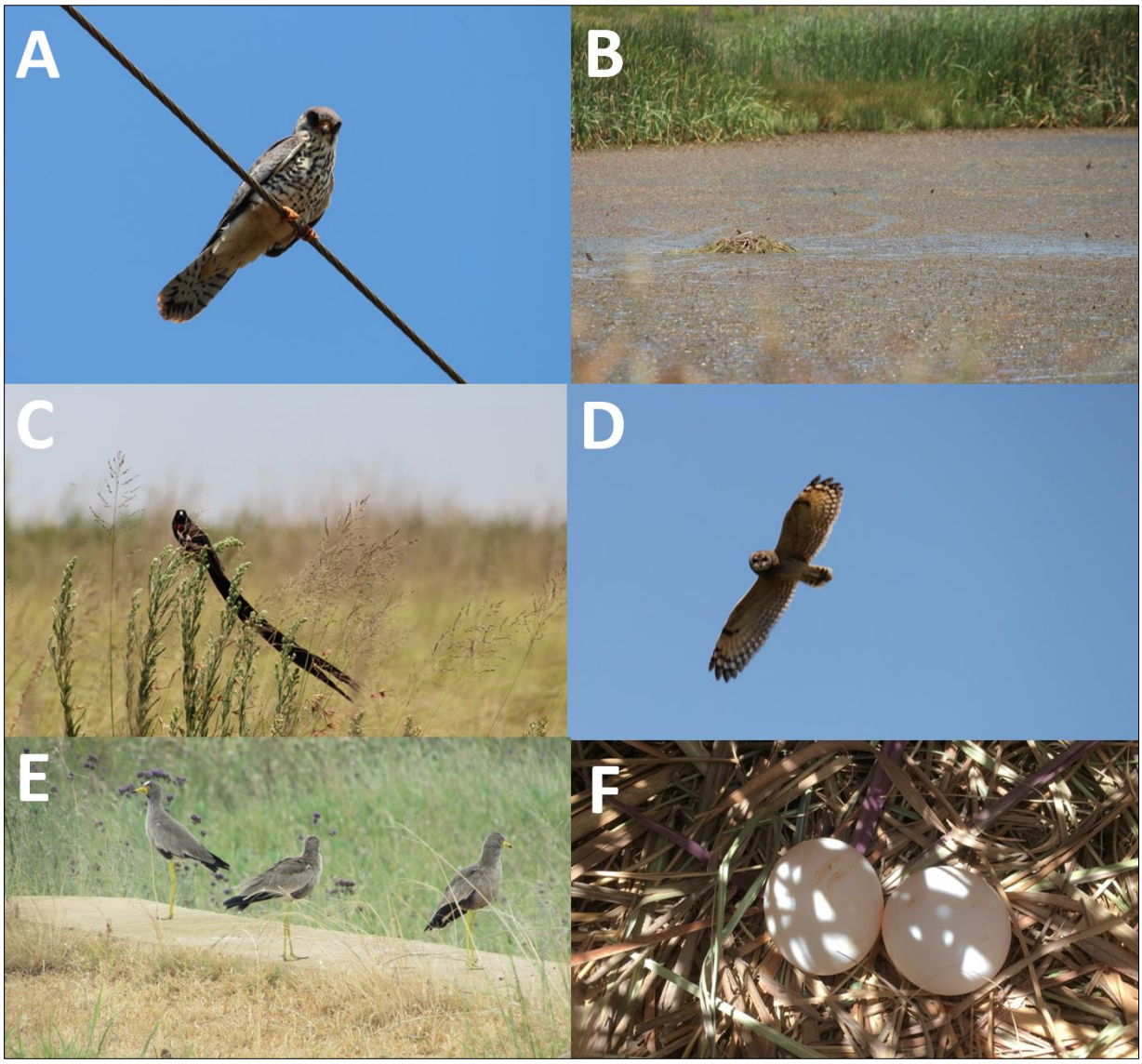

Figure 16: Some of the avifaunal species recorded during the survey: A) Female Amur Falcon; B) Red-knobbed Coot nest in wetland area; C) Long-tailed Widowbird; D) African Marsh Owl; E) Wattled Lapwing; and F) Eggs from an African Marsh Owl nest

10.4.2 Mammals

Overall, mammal diversity in the project area was high, with eighteen (18) mammal species being recorded during the January 2018 survey based on either direct observation, camera trap photographs or the presence of visual tracks & signs (Table 7).

Table 7: Mammals recorded in the project area during the January 2018 survey

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aonyx capensis	**Cape Clawless Otter**	**NT**	**NT**
Atilax paludinosus	Water Mongoose	LC	LC
Bos taurus	Domesticated Cow	-	-
Canis mesomelas	Black-backed Jackal	LC	LC
Crocidura spp.	Shrew	-	-

Cynictis penicillata	Yellow Mongoose	LC	LC
Genetta maculata	Rusty-spotted Genet	LC	LC
Herpestes ichneumon	Large Grey Mongoose	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Leptailurus serval	**Serval**	**NT**	**LC**
Lepus victoriae	African Savanna Hare	LC	LC
Micaelamys namaquensis	Namaqua Rock Mouse	LC	LC
Otomys auratus	**Vlei Rat (Grassland type)**	**NT**	**NT**
Potamochoerus larvatus	Bushpig	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rhabdomys dilectus	Mesic Four-striped Mouse	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC

Three (3) mammal SCC were recorded in the project area (Table 7). Serval (*Leptailurus serval*) were encountered on a number of occasions during the survey, and it appears that a healthy population of these threatened mammals occur within the project area. Similarly, there seems to be healthy populations of Cape Clawless Otters (*Aonyx capensis*) along the wetland areas and in the dams within the project area and adjacent to it. Observed and captured mammal species can be seen in Figure 17.

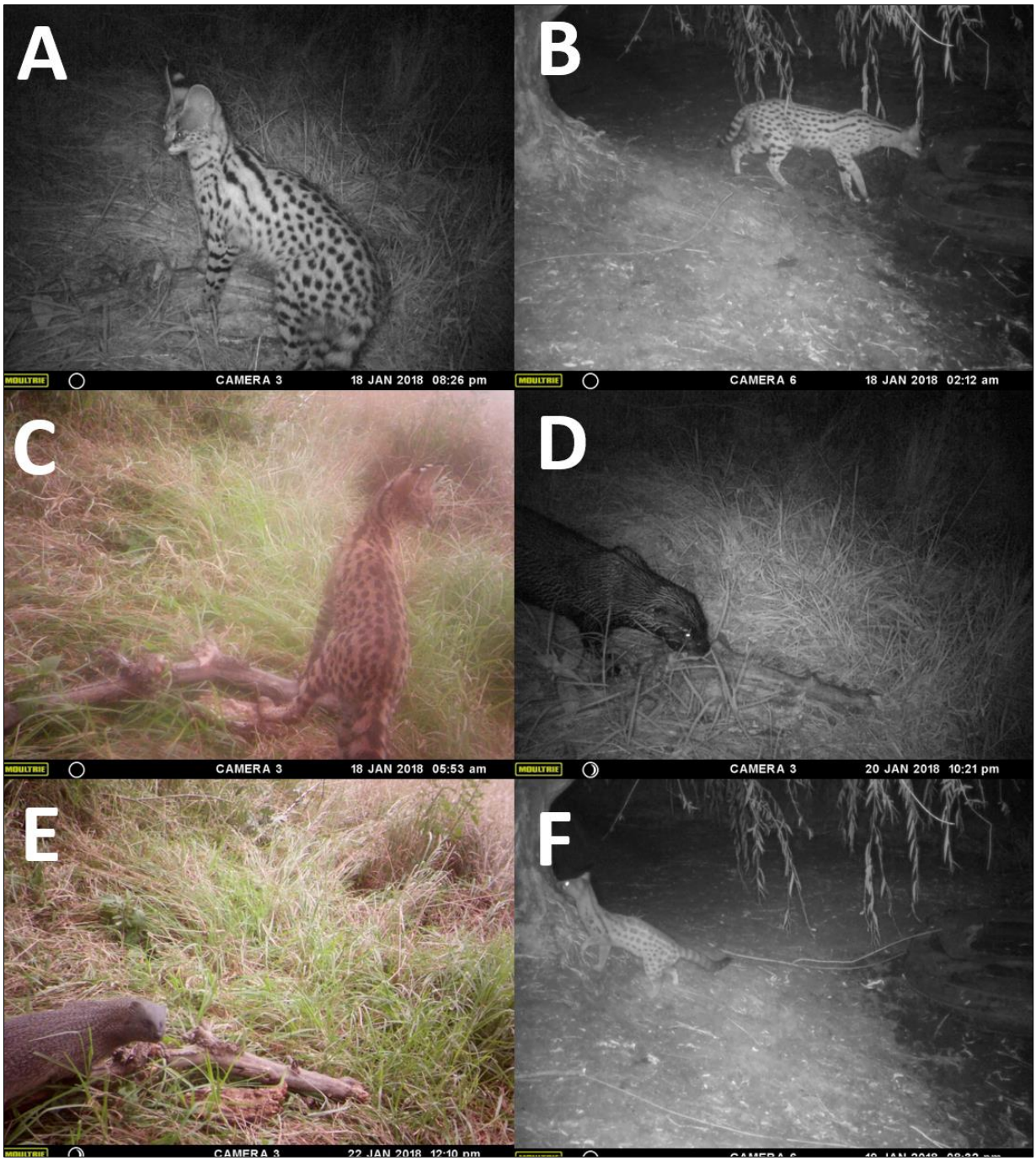

Figure 17: Some of the mammal species recorded during the survey: A), B) and C) Serval (Leptailurus serval); D) Cape Clawless Otter (Aonyx capensis); E) Large Grey Mongoose (Herpestes ichneumon); and F) Rusty-spotted Genet (Genetta maculate)

10.4.3 Herpetofauna (Reptiles & Amphibians)

Six (6) reptile species were recorded in the project area during the January 2018 survey (Table 8*Table 8*). One near-endemic snake and one endemic snake species were recorded in the project area (Table 8) (Figure 18).

Reptile diversity was notably high in the project area considering the extent of existing mining activities and agriculture which has already transformed some of the natural ecosystems.

Importantly, many reptile eggs were discovered which suggests that numerous reptile species are breeding in the project area (Figure 18).

Four (4) amphibian species was recorded in the project area during the January 2018 survey based on visual observations as well as from calls made by various frog species (Figure 18).

Table 8: A list of herpetofauna recorded in the project area

Species	Common Name	South African Endemic	Conservation Status	
			Regional (Eskom, 2016	Global (IUCN, 2017)
Reptiles				
Afrotyphlops bibronii	**Bibron's Blind Snake**	**Near-endemic**	**LC**	**LC**
Lamprophis aurora	**Aurora House Snake**	**Endemic**	**LC**	**LC**
Leptotyphlops spp.	Thread Snake	No	LC	LC
Psammophylax rhombeatus	Spotted Grass Snake	No	LC	LC
Trachylepis punctatissima	Speckled Rock Skink	No	LC	Unlisted
Trachylepis varia	Variable Skink	No	LC	Unlisted
Amphibians				
Ametia quecketti	Common River Frog	No	LC	Unlisted
Sclerophrys gutturalis	Guttural Toad	No	LC	LC
Cacosternum boettgeri	Boettger's Caco	No	LC	LC
Sclerophrys ranger	Raucous Toad	No	LC	Unlisted

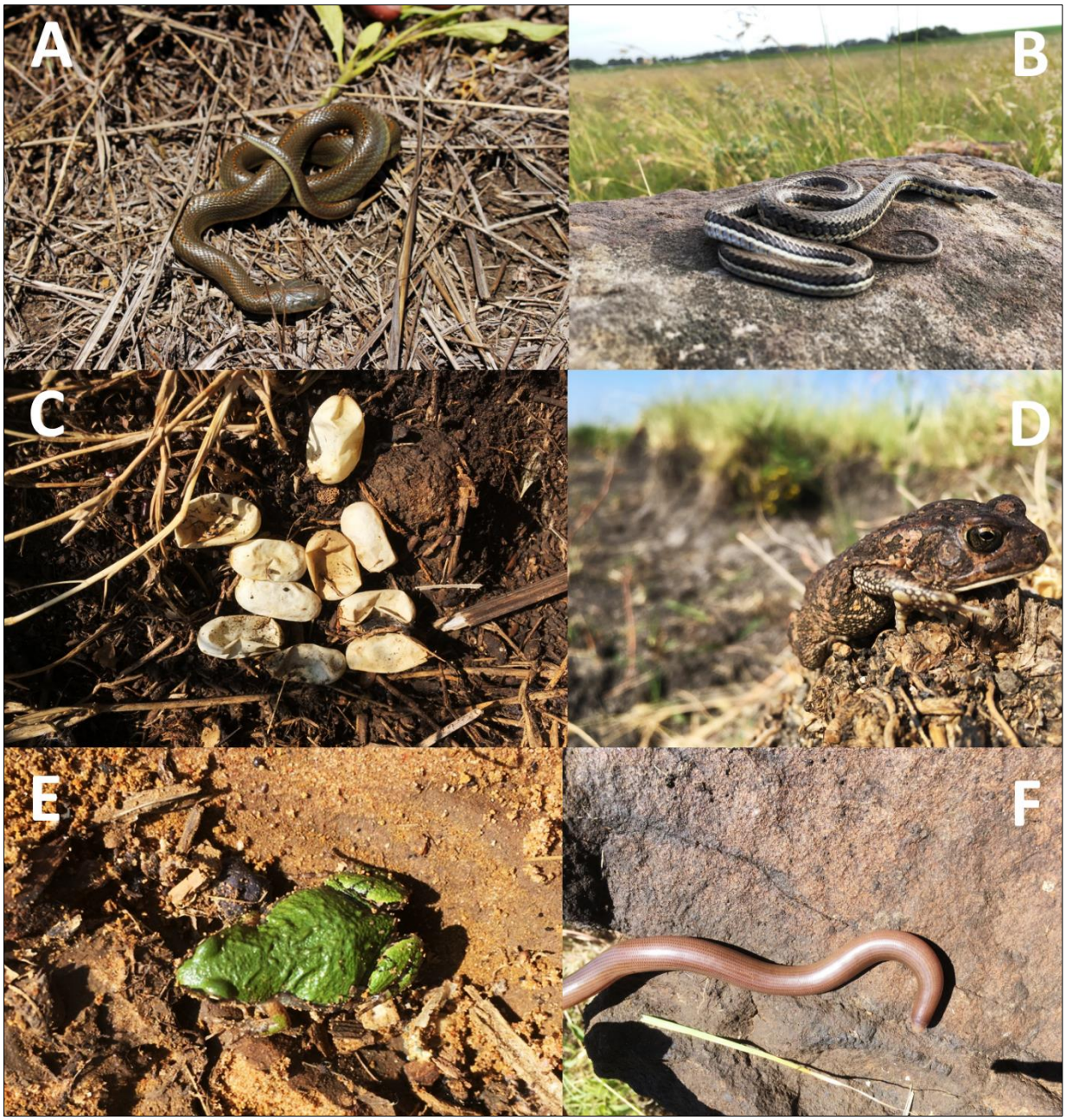

Figure 18: Some of the herpetofauna recorded during the survey: A) the endemic Aurora House Snake; B) Spotted Grass Snake; C) Snake eggs; D) Guttural Toad; E) Boettger's Caco; and F) Bibrons Blind Snake

11 Habitat Sensitivity Mapping

As per the terms of reference for the Manungu Colliery Expansion Project a GIS sensitivity map is required in order to identify sensitive features in terms of the relevant specialist discipline/s within the study area. Site sensitivities shall be classified and mapped in terms of the EIMS sensitivity mapping methodology below, as provided by EIMS.

11.1 Methodology

EIMS has developed a comprehensive sensitivity mapping methodology for use by all specialists in order to standardise the scoring system which allows for a comparative

assessment of all impacts. The methodology utilises a revised scoring table as well as including a base score for the entire study area in question. This deviated from the past approach where features were scored based on their inherent sensitivity.

The updated methodology has shifted the focus from: (1) Scoring inherent environmental sensitivity towards' (2) Scoring the proposed project impact on landscape features. The new scoring methodology (Figure 19) shifted focus to identifying sensitive/non-sensitive areas in terms of the development activity, rather than the original method which focused purely on the sensitivity of the landscape/environment.

The new scoring methodology has made provision for specialists to score areas/features that would be suitable or preferred for development. It should be noted that features/areas should be scored in terms of the proposed project context and not purely on "perceived sensitivity of landscape features". Thus, the specialist should continually be asking themselves the question "how will this feature be affected by the proposed development". In cases where the development is anticipated to create a high negative impact, the high or very high scoring should be applied. High and very high scores must be justified. The final shape files must include a column indicating why each feature was assigned a certain score/sensitivity. In addition, a separate column must be provided indicating the numerical score in Figure 19.

To ensure that accurate site selection decisions will take place, the specialist must score sensitivity relative to the site in question. Ideally the specialist should only use very high sensitivity in rare cases, where such a score can be justified. Please note that legal licencing requirements or permit requirements should not be factored into the sensitivity score, this should be represented by a separate shape file indicating additional legal requirements.

An example of the above would be for vegetation features that might have a low sensitivity score but locating the project there would require a NEMBA permit for removal of vegetation. Another example would a wetland with a low sensitivity score that would trigger a water use licence within a certain distance of the feature. The wetland buffer would thus be in a separate shapefile. The "legal requirements" layer will be presented separately to the client enabling them to ascertain where additional licences/permits will be required, separate to the sensitivity map.

Sensitivity Rating	Description	Weighting	Preference
Least Concern	The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1	Preferable
Low/Poor	The proposed development will have not have a significant effect on the inherent feature status and sensitivity.	0	Negotiabl
High	The proposed development will negatively influence the current status of the feature.	+1	Restricted
Very High	The proposed development will negatively significantly influence the current status of the feature.	+2	

Figure 19: The sensitivity matrix utilised for the sensitivity mapping process (as provided by EIMS)

11.2 Habitat Sensitivity

The sensitivity scores were rated on a scale as seen in (Figure 19). The sensitivity scores for each habitat were then visually mapped (Figure 20). The habitat sensitivity map does not make any allowances for the recommended buffer areas.

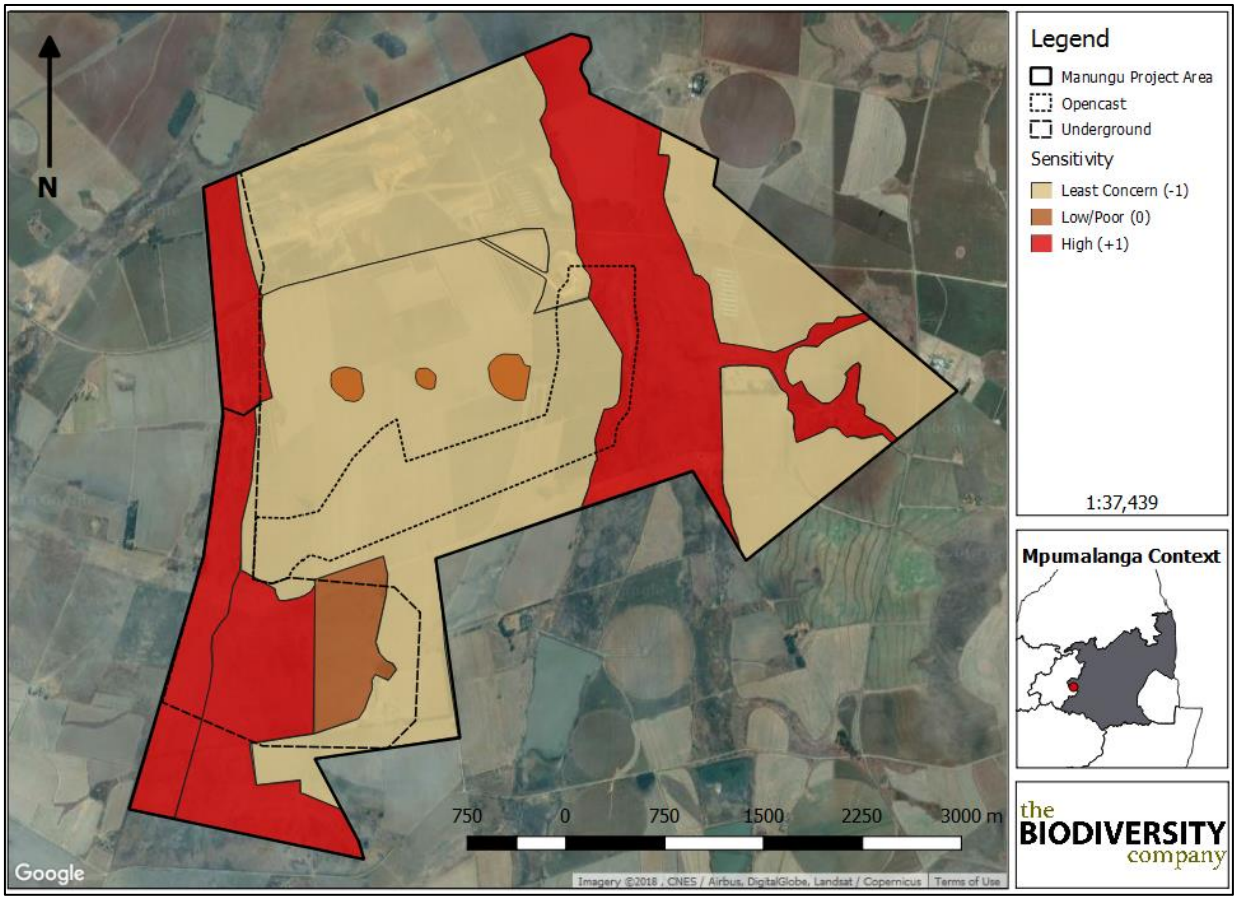

Figure 20: Habitat sensitivity within the Manungu application area.

The wetland and mesic grassland was classified with a high (+1) sensitivity from an inherent environmental sensitivity point of view due to the largely natural state of this habitat, the conservation status of these areas according to the C-plan of Mpumalanga and the protected species and species of conservation concern that were recorded, and which are also expected to occur in these unique habitats.

The wetland and mesic grassland was classified with a high (+1) sensitivity from the impact that the development activity will have pint of view due to the close proximity if the proposed opencast area and the associated impacts to these two areas.

The mining-and agriculture areas was rated the lowest sensitivity (-1) because of the transformed nature of these area. The major driving forces of the disturbed and degraded state of these areas are mainly anthropogenic; such as clearing of vegetation, presence of a large amount of alien and invasive plant species, livestock, large amount of dust.

12 Impact Assessment

The biodiversity impact assessment report includes the following:

- Assess impacts of ongoing and proposed activities on biodiversity of the project area;
- Assess whether proposed activities are likely to have significant impacts on biodiversity and specifically species of conservation concern;
- Identify practically implementable mitigation measures to reduce the significance of proposed activities on biodiversity; and
- Assess residual and cumulative impacts after implementation of mitigation measures.

Methodology

The methodology used in determining the significance of potential environmental impacts relating to the Manungu Project was supplied by EIMS. The details of this methodology can be made available on request.

12.1 Current impacts

The current impacts observed during surveys are listed below. Photographic evidence of a selection of these impacts is shown in Figure 21.

- Commercial crop production and plantations;
- Fences;
- Overgrazing and trampling of natural vegetation and wetlands by livestock;
- Farm roads (and traffic);
- Artificial impoundments;
- Artificial drainage in agricultural fields;
- Farmsteads and houses;
- Alien and/or Invasive Plants (AIP);
- Servitudes and infrastructure (powerlines)
- Extensive coal dust precipitation;
- Blasting;
- Water contamination; and
- Vegetation removal.

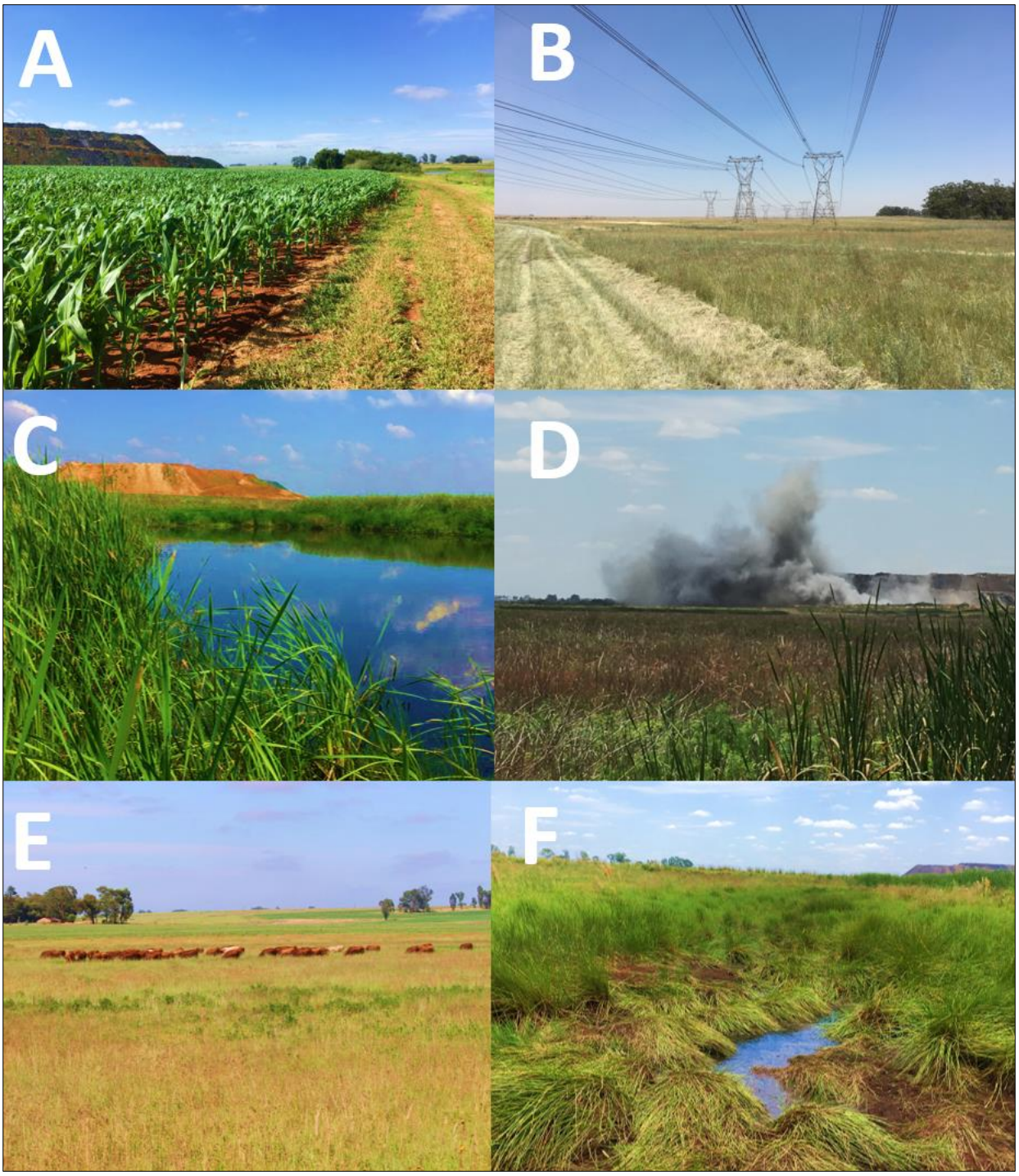

Figure 21: Some of the identified impacts within the project area: A) Agricultural and existing mine dump; B) Eskom powerlines. C) Dump placed within wetland boundary; D) Blasting and extensive dust pollution; E) Cattle grazing in a wetland area; and F) Trampling of wetland vegetation by cattle

12.2 Anticipated Impact Framework

No details pertaining to specific project activities were provided, but an anticipated impact framework was considered for the impact assessment. The following list provides a framework for the anticipated major impacts associated with the project.

1. Loss / degradation of ecosystems

a. Project activities that can cause loss of habitat
    i. Physical removal of vegetation
    ii. Access roads and servitudes
    iii. Construction camps & laydown areas
    iv. Infrastructure development (buildings)
    v. Linear trench excavation and berm creation
    vi. Soil dust precipitation
    vii. Coal dust precipitation
    viii. Stochastic events such as fire (cooking fires or cigarettes from staff)
b. Secondary impacts anticipated
    i. Loss of shallow recharge zones
    ii. Displacement/loss of flora & fauna (including SCC)
    iii. Increased potential for soil erosion (in conjunction with alterations in hydrological regimes)
    iv. Habitat fragmentation & loss of habitat corridors
    v. Increased potential for establishment of alien & invasive vegetation
    vi. Loss of stored carbon & carbon sequestration potential
    vii. Loss of ecosystem services

2. Spread and/or establishment of alien and/or invasive species
    a. Project activities that can cause the spread and/or establishment of alien and/or invasive species
        i. Vegetation removal
        ii. Soil excavations and soil transportation
        iii. Transportation vehicles potentially spreading seed while moving on, to and from mining areas
        iv. Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents
        v. Creation of infrastructure suitable for breeding activities of alien and/or invasive birds
    b. Secondary impacts anticipated
        i. Habitat loss for native flora & fauna (including SCC)
        ii. Reduced forage quality of grazing habitat
        iii. Spreading of potentially dangerous diseases
        iv. Alteration of fauna assemblages due to habitat modification
3. Direct mortality of fauna
    a. Project activities that can cause direct mortality of fauna
        i. Clearing of vegetation
        ii. Roadkill due to vehicle collision
        iii. Earth moving (removal and storage of topsoil and overburden)
        iv. Blasting and excavation
        v. Pollution of water resources due to dust effects, chemical spills, acid mine drainage etc.
        vi. Intentional killing of fauna for food (hunting) or otherwise (killing of snakes)
        vii. Bird collisions with electrical lines and infrastructure guide wires
    b. Secondary impacts anticipated
        i. Loss of ecosystem services

        ii. Explosion of rodent populations and associated disease risk
4. Reduced dispersal/migration of fauna
    a. Project activities that can cause reduced dispersal/migration of fauna
        i. Linear trenches and berms
        ii. Compacted roads
        iii. Removal of vegetation
    b. Secondary impacts associated with reduced dispersal/migration of fauna
        i. Loss of ecosystem services
        ii. Reduced plant seed dispersal
5. Environmental pollution due to increased sedimentation and chemical runoff in watercourses
    a. Project activities that can cause pollution in water courses
        i. Chemical (organic/inorganic) spills
        ii. Erosion
        iii. Acid mine drainage (decanting)
        iv. Untreated runoff or effluent
    b. Secondary impacts associated with pollution in water courses
        i. Faunal mortality (direct and indirectly e.g. algal blooms)
        ii. Groundwater pollution
        iii. Loss of ecosystem services
6. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise
    a. Project activities that can cause disruption/alteration of ecological life cycles due to noise
        i. Blasting
        ii. Operation of machinery (generators, crushers, vehicles)
    b. Secondary impacts associated with disruption/alteration of ecological life cycles due to noise
        i. Loss of ecosystem services
7. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to dust
    a. Project activities that can cause disruption/alteration of ecological life cycles due to dust
        i. Blasting
        ii. Operation of vehicles (generators, crushers, vehicles)
        iii. Coal crushing and transportation
        iv. Uncovered soil and coal stockpiles
    b. Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
        i. Loss of ecosystem services
8. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to light
    a. Project activities that can cause disruption/alteration of ecological life cycles due to light
        i. External lighting to enable project activities at night
        ii. Vehicles operating at night

    b. Secondary impacts associated with disruption/alteration of ecological life cycles due to light
        i. Loss of ecosystem services
9. Staff interacting directly with potentially dangerous fauna
    a. Project activities that can cause staff to interact directly with potentially dangerous fauna
        i. All activities outdoors

13 Impact Assessment Results

The comprehensive qualitative impact assessment results with mitigation measures as a comprehensive Microsoft Excel spreadsheet is available as a separate document on request.

Two separate impact assessments were conducted for the purpose of this report due to the nature of the development which includes both open cast and underground mining activities. Due to the very different impacts these types of mining can have in terms of biodiversity, it was deemed prudent to examine these activities separately against the possible impacts. The possible impacts were separated into the construction, operational and decommissioning and closure phases, and are elaborated on below.

13.1.1 Construction Phase

The following potential impacts were considered on biodiversity:

- Further loss and fragmentation of the vegetation community as well the destruction of a portion of a Vulnerable vegetation type (NBA, 2012);
- Loss of important Critical Biodiversity Areas (Optimal) and Other Natural Areas (MTPA, 2014); and
- Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise).

13.1.2 Operational Phase

The following potential impacts were considered on biodiversity:

- Spread and/or establishment of alien and/or invasive species;
- Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise); and
- Infringement by humans into the few remaining natural grassland and wetlands areas, with associated impacts such as poaching, litter and introduction of diseases and feral species such as cats.

13.1.3 Decommissioning & Closure Phase

- Further impacts due to the spread and/or establishment of alien and/or invasive species; and

- Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise).

13.2 Assessment of Significance – Open Cast Mining

From the summary tables below (Table 9 to Table 16) it is clear that the overall impact significance for the construction phase ranges from high to moderately-high before mitigation, and this changes to a significance of high, moderately-high and moderate for all listed activities following the implementation of mitigation measures and recommendations. Due to the extent and nature of an open cast development and its inherently high impacts on biodiversity, and the difficulties in implementing mitigation measures that can have a genuine positive influence on the outcome once mining has commenced, the level of significance is still relatively high post-mitigation.

13.2.1 Construction Phase

The tables below (Table 9 to Table 11) show the significance of potential impacts associated with the development on floral and faunal communities before and after implementation of mitigation measures during the construction phase only.

Due to the known occurrence of some species of conservation importance in the secondary grassland and wetland areas, the existence of a CBA: Optimal and the location of the proposed development within an Endangered vegetation type the significance was generally rated as high prior to mitigation.

Table 9: Open cast - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Further loss and fragmentation of the vegetation community as well the destruction of a portion of a Endangerd vegetation type (NBA, 2012)**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	4
Extent of Impact	4	4	Reversibility of Impact	5	4
Duration of Impact	5	4	Probability	5	5
Environmental Risk (Pre-mitigation)					-23,75
Mitigation Measures					
Environmental Risk (Post-mitigation)					-20,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					

Prioritisation Factor	1,67
Final Significance	-33,33

Table 10: Open cast - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Loss of important Critical Biodiversity Areas (Optimal) and Other Natural Areas (MTPA, 2014)**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	5	5	Reversibility of Impact	5	5
Duration of Impact	5	5	Probability	5	4
Environmental Risk (Pre-mitigation)					-25,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-20,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1,67
Final Significance					-33,33

Table 11: Open cast - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	5
Extent of Impact	4	4	Reversibility of Impact	4	4
Duration of Impact	5	5	Probability	5	5
Environmental Risk (Pre-mitigation)					-22,50
Mitigation Measures					
Environmental Risk (Post-mitigation)					-22,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					

Public Response	2
Issue has received a meaningful and justifiable public response	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).	
Prioritisation Factor	1,67
Final Significance	-37,50

13.3 Operational Phase

The tables below (Table 12 to Table 14) show the significance of potential impacts associated with the development on floral and faunal communities before and after implementation of mitigation measures during the operational phase only.

Due to the known occurrence of some species of conservation importance in the secondary grassland and wetland areas, the existence of a CBA: Optimal and the location of development within an Endangered vegetation type the significance was generally rated as high prior to mitigation.

As an example, the significance of encroachment of alien invasive plant species on the vegetation community was rated as highly significant prior to mitigation (Table 12). Implementation of mitigation measures in the form an alien invasive plant management plan and rehabilitation of project footprint after completion of construction reduced the significance of the impact to low (Table 12).

Table 12: Open cast - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Spread and/or establishment of alien and/or invasive species**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	5	3
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	5	3	Probability	5	4
Environmental Risk (Pre-mitigation)					-22,50
Mitigation Measures					
Environmental Risk (Post-mitigation)					-12,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3

The impact may result in the irreplaceable loss of resources of high value (services and/or functions).	
Prioritisation Factor	1,67
Final Significance	-20,00

Table 13: Open cast - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	4	3	Probability	5	4
Environmental Risk (Pre-mitigation)					-20,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-13,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1,67
Final Significance					-21,67

Table 14: Open cast - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Infringement by humans into the few remaining natural grassland and wetlands areas, with associated impacts such as poaching, litter and introduction of diseases and feral species such as cats**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	4	3	Probability	5	4
Environmental Risk (Pre-mitigation)					-20,00
Mitigation Measures					

Environmental Risk (Post-mitigation)	-13,00
Degree of confidence in impact prediction:	High
Impact Prioritisation	
Public Response	2
Issue has received a meaningful and justifiable public response	
Cumulative Impacts	2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.	
Degree of potential irreplaceable loss of resources	3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).	
Prioritisation Factor	1,67
Final Significance	-21,67

13.3.1 Closure & Decommissioning Phase

The tables below (Table 15 and Table 16) show the significance of potential impacts associated with the development on floral and faunal communities before and after implementation of mitigation measures during the closure and decommissioning phase only.

Due to the known occurrence of some species of conservation importance in the secondary grassland and wetland areas, the existence of a CBA: Optimal and the location of the development within an Endangered vegetation type the significance of impacts (pre-mitigation) was rated as moderately high (for impacts relating to alien invasive flora) and as high for impacts relating to the faunal community in the area.

Table 15: Open cast - Impact significance during the closure & decommissioning phase pre- and post-mitigation

Impact Name	**Further impacts due to the spread and/or establishment of alien and/or invasive species**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	4
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	5	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-17,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-9,75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3

The impact may result in the irreplaceable loss of resources of high value (services and/or functions).	
Prioritisation Factor	1,67
Final Significance	-16,25

Table 16: Open cast - Impact significance during the closure & decommissioning phase pre- and post-mitigation

Impact Name	**Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of Impact	4	3	Probability	4	4
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-12,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1,67
Final Significance					-20,00

Assessment of Significance – Underground Mining

The summary tables below (Table 17 to Table 24) show the significance of the various impacts, which range from high to low before mitigation for the construction phase of the underground mining portion of the project. The significance of the impacts changes to a significance of moderate or low for all listed activities following the implementation of mitigation measures and recommendations.

Overall, the impacts of the underground mining have much lower significance and impact than those for the opencast mining as this type of mining has less of an influence on biodiversity in the area. Nonetheless, underground mining also requires extensive surface infrastructure and waste dumps, and the significance of these impacts cannot be overlooked or underestimated. Furthermore, for this specific project, the underground mine shaft and associated infrastructure which includes various offices and machinery is located in a sensitive area as

far as floral and faunal species are concerned, as well as being placed directly adjacent to a wetland and a declared CBA area. As such, some of the mitigation measures will not be sufficient to bring the impacts down to a low significance.

13.3.2 Construction Phase – Underground Mining

The tables below (Table 17 to Table 19) show the significance of potential construction phase impacts on floral and faunal communities before and after implementation of mitigation measures.

Due to the known occurrence of some species of conservation importance in the secondary grassland and wetland areas, the existence of a CBA: Optimal and the location of the development within an Endangerd vegetation type the significance was generally rated as moderate to high prior to mitigation.

Table 17: Underground Mining - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Further loss and fragmentation of the vegetation community as well the destruction of a portion of an Endangered vegetation type (NBA, 2012)**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	3	4
Extent of Impact	3	3	Reversibility of Impact	3	3
Duration of Impact	4	3	Probability	3	4
Environmental Risk (Pre-mitigation)					-9,75
Mitigation Measures					
Environmental Risk (Post-mitigation)					-13,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1,67
Final Significance					-21,67

Table 18: Underground Mining - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Loss of important Critical Biodiversity Areas (Optimal) and Other Natural Areas (MTPA, 2014)**
Alternative	**0**
Phase	**Construction**
Environmental Risk	

Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	5	3	Reversibility of Impact	5	2
Duration of Impact	4	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-18,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-8,25
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					
Prioritisation Factor					1,83
Final Significance					-15,13

Table 19: Underground Mining - Impact significance during the construction phase pre- and post-mitigation

Impact Name	**Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Construction**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	4	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-16,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-9,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					3
Issue has received an intense meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss of resources of high value (services and/or functions).					

Prioritisation Factor	1,83
Final Significance	-16,50

13.3.3 Operational Phase – Underground Mining

The tables below (Table 20 to Table 22) show the significance of potential operational phase impacts on floral and faunal communities before and after implementation of mitigation measures.

Due to the known occurrence of some species of conservation importance in the secondary grassland and wetland areas, the existence of a CBA: Optimal and the presence of the development within an Endangered vegetation type the significance was generally rated as moderate prior to mitigation. The spread of alien or invasive plant species was rated as the most significant impact for the operational phase.

Table 20: Underground Mining - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Spread and/or establishment of alien and/or invasive species**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	4	3	Reversibility of Impact	4	3
Duration of Impact	5	2	Probability	5	3
Environmental Risk (Pre-mitigation)					-21,25
Mitigation Measures					
Environmental Risk (Post-mitigation)					-7,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,33
Final Significance					-10,00

Table 21: Underground Mining - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Infringement by humans into the few remaining natural grassland and wetlands areas, with associated impacts such as poaching, litter and introduction of diseases and feral species such as cats**
Alternative	**0**
Phase	**Operation**
Environmental Risk	

Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	4	3	Reversibility of Impact	5	3
Duration of Impact	5	4	Probability	4	3
Environmental Risk (Pre-mitigation)					-18,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-9,75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,50
Final Significance					-14,63

Table 22: Underground Mining - Impact significance during the operational phase pre- and post-mitigation

Impact Name	**Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Operation**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of Impact	4	4	Probability	4	3
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-9,75
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					

Prioritisation Factor	1,50
Final Significance	-14,63

13.3.4 Closure & Decommissioning Phase – Underground Mining

The tables below (Table 23 to Table 24) show the significance of potential closure and decommissioning phase impacts on floral and faunal communities before and after implementation of mitigation measures.

Due to the fact that the closure phase will entailed a significant decrease in the number of people present on site and eventually the removal of people altogether, this was removed as a potential impact during this phase.

Table 23: Underground Mining - Impact significance during the closure and decommissioning phase pre- and post-mitigation

Impact Name	**Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**
Nature of Impact	-1	-1	Magnitude of Impact	4	2
Extent of Impact	3	3	Reversibility of Impact	4	3
Duration of Impact	4	2	Probability	4	3
Environmental Risk (Pre-mitigation)					-15,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-7,50
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					2
Issue has received a meaningful and justifiable public response					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,50
Final Significance					-11,25

Table 24: Underground Mining - Impact significance during the closure and decommissioning phase pre- and post-mitigation

Impact Name	**Further impacts due to the spread and/or establishment of alien and/or invasive species**				
Alternative	**0**				
Phase	**Decommissioning**				
Environmental Risk					
Attribute	**Pre-mitigation**	**Post-mitigation**	**Attribute**	**Pre-mitigation**	**Post-mitigation**

Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	4	2	Reversibility of Impact	4	4
Duration of Impact	5	3	Probability	4	3
Environmental Risk (Pre-mitigation)					-17,00
Mitigation Measures					
Environmental Risk (Post-mitigation)					-9,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Prioritisation Factor					1,33
Final Significance					-12,00

13.4 Mitigation Measure 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 Vulernable) and the CBAs 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 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.

13.4.1 Mitigation Measures for Impacts on Vegetation Communities

Recommended mitigation and rehabilitation measures include the following:

- As far as possible, the proposed developments should be placed in areas that have already been disturbed (low sensitivity areas as defined in this report), and no further loss of secondary grassland or wetlands should be permitted;

- 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 work areas, offices, tailings dumps, and access roads must be clearly demarcated from surrounding natural areas and no persons should be allowed to enter these areas under any circumstances;
- Areas of indigenous vegetation, even secondary communities should under no circumstances be fragmented or disturbed further or used as an area for dumping of waste;
- Areas rated as highly sensitive in this report, should be declared as 'no-go' areas during the construction phase and operational phase and all efforts must be made to prevent access to this area from construction workers and machinery;
- It should be made an offence for any staff to bring any plant species into any portion of the project site, including offices. 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 office 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);
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated. No dust is allowed, whether intentionally or otherwise, to be blown across the wetland areas as they are demarcated in this report;
- Areas of indigenous vegetation should be delineated, and rehabilitation measures implemented in areas where the indigenous community is still present but degraded;
- 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. This includes on-going maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation;
- All dumping of waste material, especially bricks and contaminated materials or soils, must be prevented; and
- Compilation of and implementation of an alien vegetation management plan for the entire site, including the surrounding project area and especially the wetland areas.

13.4.2 Mitigation Measures for Impacts on Faunal Communities

Recommended mitigation and rehabilitation measures for faunal communities hinge largely on protecting their habitats and ensuring it remains intact, as well as limited other disturbance factors such as noise and dust. In additional to this the following measures are recommended:

- The primary mitigation measure recommended for the project area is for there to be no development in the high-sensitivity wetlands and grasslands portions of the project area where species of conservation concern occur;
- If any faunal species are recorded during construction, activities should temporarily cease, and an appropriate specialist should be consulted to identify the correct course of action. This is applicable to all species, even smaller species such as rodents, reptiles and amphibians;
- 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 declared a 'no-go' area during the construction phase and operational phase and all efforts must be made to prevent access to this area from construction workers and machinery;
- 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.

13.5 Recommendations

These recommendations may supplement the prescribed mitigation measures, but these recommendations must be investigated prior to the issuing of environmental authorisation. These recommendations must be investigated for the feasibility to realistically achieve what is intended for this project. The following recommendations are applicable for this project:

1. The MBSP has been used to identify biodiversity/environmentally sensitive areas. 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. A minimum buffer zone of 175 m is recommended for the wetlands with regards to a mining operation, infrastructure and associated activities;
2. In the event that wetland areas will be impacted on, or lost, a wetland offset (mitigation) strategy is required. A key component of this strategy would be to ensure the securing of the proposed offsite areas by means of proclamation. The proposed offsite area/s may not be subjected to mining or any other land use / activity within the foreseeable future. It is further recommended that no environmental authorisation be issued until such a proclamation is confirmed. The offset area/s could be gazetted as a Section 49 area;
3. A study must be completed to assess the magnitude to which the relevant wetland systems are interlinked (or connected) and the likely dependence of these systems on the recharge of aquifers. In the event that wetland systems are determined to be

connected or dependant on groundwater recharge, the extent of these wetlands must preferably be avoided. If environmental authorisation is issued for the project, similarly, the entire extent of the connected wetlands must be assumed to be lost (even if only partially mined) and included for the offset compensation ratio;

4. If the bord and pillar method is to be used for mining, then the bord and pillar safety factor for the project area must be determined and ensure that the likelihood of subsidence if not possible. Once this has been confirmed, underground mining of the wetlands may be considered. *Note: Point 3 above must also be determined*;
5. It is recommended that environmental authorisation for the project only be considered on the acceptance of a comprehensive rehabilitation plan, including a comprehensive alien vegetation management plan. It is further recommended that a condition of the operating licence must be to review and report on the implementation of the rehabilitation annually. If it is determined during this review period that the rehabilitation plan has not been implemented, or poorly at that, all mining must cease until rehabilitation of the area is adequate;
6. It is recommended that a Project area specific but also species-specific biodiversity monitoring and action plan be compiled for consideration prior to the issuing of environmental authorisation. The monitoring and action plan must inform and guide the proposed project, and prescribed clear goals and objectives that can be practically implemented and easily monitored using appropriate variables. The key aspects must include the following:
    a. The collation and generation of data for selected species, ecosystems and/or habitats;
    b. Assess and determine the conservation status of species within specified ecosystems;
    c. Prescribe aims, objectives and targets for conservation and restoration; and
    d. Establish and assign budgets, timelines, reporting structures and partnerships for implementing the action plan;
7. Finally, it is recommended that the placement of the entrance of the underground mining facilities and associated offices be revised and alternative options for its placement be investigated. At the present location it is considered too close to sensitive critical biodiversity areas as well as to close to wetland areas were species of conservation of concern occur are known to occur.

14 Conclusion

The completion of a comprehensive desktop study, in conjunction with the detailed results from the surveys mean that there is a high confidence in the information provided. The two surveys which were completed, and the corresponding studies resulted in good site coverage, assessing the major habitats and ecosystems, obtaining a general species (fauna and flora) overview and observing the major current impacts.

It is clear from the regional ecological overview, as well as the baseline data collected to date that the Project area has been altered (historically and currently) predominantly by agricultural land use. It is further evident that the remaining natural habitats have been impacted on as a result of poor grazing practices. The development of the general area, and the increase in mining operations and supporting activities have also contributed to the altered ecological status and functioning of the systems.

However, despite these impacts the remaining natural *Highveld grassland* habitats (including grassland and wetland habitats) exhibited a healthy balance between various common grassland species and associated herbaceous plants.

The ecological integrity, importance and functioning of the natural grassland and wetland systems within the larger Project area is furthermore reflected in the diverse community structures. This diversity is indicative of the importance of these systems to collectively provide refugia, food and corridors for dispersal in and through the Project area. The preservation of these systems, albeit the majority are modified to some extent, is the most important aspect to consider for the consideration of the proposed mining project.

The impacts associated with the proposed underground mining method are considerably less significant when compared to the proposed opencast mining methods. This compounded with the placement of new infrastructure, access routes and mining activities will have a significant impact on the local environment and ecological processes. Careful consideration must be afforded each of the recommendations provided herein. In the event that environmental authorisation is issued for this project, proven ecological (or environmental) controls and mitigation measures must be entrenched in the management framework. It is strongly recommended that a comprehensive biodiversity action plan be compiled prior to the issuing of any environmental authorisation.

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

- Much of the Project area is identified as being heavily modified, although a portion of the south-western Project area overlaps with a CBA: Optimal and a few other areas area classified as ONAs;
- Based on the National Biodiversity Assessment (NBA, 2012) the Project area overlaps entirely with ecosystems that are listed as Vulnerable (VU). The Project area is also within a few kilometres of ecosystems which are listed as Critically Endangered;
- The majority of the terrestrial ecosystems associated with the development are rated as *not protected*;
- 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;
- The Project area does overlap with certain wetland areas, and two perennial rivers. However, none of these areas are classified as NFEPA wetlands or rivers;
- The Project area, in relation to the MBSP Freshwater Assessment, overlaps with Ecological Support Area (ESA) – Wetlands, Heavily Modified Areas, Dams and Other Natural Areas (ONAs);
- The Project area is situated across two different vegetation types; the Eastern Highveld Grassland (GM12) and the Soweto Highveld Grassland (GM8) vegetation types, according to Mucina & Rutherford (2006). Both of these vegetation types are classified as *Endangered*;

- Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 393 plant species are expected to occur in the Project area. Of the 393-plant species, five (5) species are listed as being Species of Conservation Concern (SCC);
- Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 288 bird species are expected to occur in the vicinity of 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);
- The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that could be expected to occur within the project area. Of these, twelve (12) (17.4%) are listed as being of conservation concern on a regional or global basis;
- Nine (9) category 1b invasive species were recorded at the site and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act;
- Seventy-six (76) bird species were recorded in the project area during the January 2018 survey;
- Overall, mammal diversity in the project area was considered high, with eighteen (18) mammal species being recorded during the January 2018 survey based on either direct observation, camera trap photographs or the presence of visual tracks & signs;
- Three (3) mammal SCC were recorded in the project area. Serval (*Leptailurus serval*) were encountered on a number of occasions during the survey, and it appears that a healthy population of these threatened mammals occur within the project area. Similarly, there seems to be healthy populations of Cape Clawless Otters (*Aonyx capensis*) along the wetland areas and in the dams within the project area and adjacent to it; and
- Six (6) reptile species were recorded in the project area during the January 2018 survey. One near-endemic snake and one endemic snake species were recorded in the project area.
- Potential impacts on the Critical Biodiversity Areas and wetland areas was rated as highly significant prior to mitigation. Although some of the wetlands have been impacted upon due to existing impacts such as grazing by cattle, most of the wetlands were in good condition and were given a high sensitivity rating;
- The presence of various species of conservation concern also increased the habitat sensitivities of the wetland and grasslands areas;
- Potential impacts on the vegetation community were rated as highly significant prior to mitigation. Implementation of mitigation measures reduced the significance of impacts to moderate levels;
- The primary mitigation measure recommended for the project area is for there to be no development in or adjacent to the high-sensitivity wetlands or grassland areas, especially in the south-western, western and eastern portions of the project area where species of conservation concern occur. Based on the sensitivity map in this report, it

is recommended that no mining or associated acitivities take place within 100 m of any of the sensitive areas defined; and

- Over and above the mititgation measures include in this report, it is further recommended that the placement of the entrance of the underground mining facilities and associated offices be revised and alternative options for its placement be investigated. At the present location it is considered far too close to sensitive critical biodiversity areas as well as to close to wetland areas were species of conservation of concern occur.

15 Impact Statement

An impact statement is required as per the NEMA regulations with regards to the proposed development.

Considering the above-mentioned conclusions, it is the opinion of the specialist that the project be favourably considered but that the mitigation measures and recommendations should be strictly adhered to and enforced. Importantly, this means that the areas marked as sensitive according the results from the field survey must be not be impacted upon during, or post, development and that a 100 m buffer must be maintained as specificed. These wetland and grassland areas were marked as highly sensitive due to the high biodiversity values assigned to them as well as the presence of species of conservation concern.

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

Family	*Scientific Name*	Author	SANBI listing (2017)	Ecology
Malvaceae	*Abutilon sonneratianum*	(Cav.) Sweet	LC	Indigenous
Euphorbiaceae	*Acalypha angustata*	Sond.	LC	Indigenous
Euphorbiaceae	*Acalypha caperonioides var. caperonioides*	Baill.	DD	Indigenous
Asteraceae	*Acanthospermum glabratum*	(DC.) Wild		notIndigenous; Naturalised
Asteraceae	*Achillea millefolium*	L.		notIndigenous; Naturalised
Amaranthaceae	*Achyranthes aspera var. aspera*	L.		notIndigenous; Naturalised
Crassulaceae	*Adromischus umbraticola subsp. umbraticola*	C.A.Sm.		Indigenous; Endemic
Fabaceae	*Aeschynomene rehmannii var. leptobotrya*	Schinz	LC	Indigenous
Apiaceae	*Afrosciadium magalismontanum*	(Sond.) P.J.D.Winter	LC	Indigenous
Agapanthaceae	*Agapanthus campanulatus subsp. patens*	F.M.Leight.	LC	Indigenous
Poaceae	*Agrostis continuata*	Stapf	LC	Indigenous
Poaceae	*Agrostis lachnantha var. lachnantha*	Nees	LC	Indigenous
Hyacinthaceae	*Albuca baurii*	Baker		Indigenous
Hyacinthaceae	*Albuca fastigiata var. fastigiata*	Dryand.		Indigenous
Hyacinthaceae	*Albuca setosa*	Jacq.		Indigenous
Hyacinthaceae	*Albuca shawii*	Baker		Indigenous
Apiaceae	*Alepidea peduncularis*	Steud. ex A.Rich.	DD	Indigenous
Poaceae	*Alloteropsis semialata subsp. semialata*	(R.Br.) Hitchc.	LC	Indigenous
Asphodelaceae	*Aloe jeppeae*	Klopper & Gideon F.Sm.	LC	Indigenous

Asphodelaceae	*Aloe subspicata*	(Baker) Boatwr. & J.C.Manning		Indigenous
Cyatheaceae	*Alsophila dregei*	(Kunze) R.M.Tryon	LC	Indigenous
Amaranthaceae	*Alternanthera pungens*	Kunth		notIndigenous; Naturalised
Amaranthaceae	*Amaranthus thunbergii*	Moq.	LC	Indigenous
Lythraceae	*Ammannia baccifera subsp. baccifera*	L.		notIndigenous; Naturalised
Apiaceae	*Ammi majus var. glaucifolium*	L.		notIndigenous; Naturalised
Apocynaceae	*Ancylobotrys capensis*	(Oliv.) Pichon	LC	Indigenous
Poaceae	*Andropogon appendiculatus*	Nees	LC	Indigenous
Poaceae	*Andropogon schirensis*	Hochst. ex A.Rich.	LC	Indigenous
Aponogetonaceae	*Aponogeton junceus*	Lehm.	LC	Indigenous
Asteraceae	*Arctotis arctotoides*	(L.f.) O.Hoffm.	LC	Indigenous
Fabaceae	*Argyrolobium harveyanum*	Oliv.	LC	Indigenous
Fabaceae	*Argyrolobium speciosum*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Argyrolobium tuberosum*	Eckl. & Zeyh.	LC	Indigenous
Iridaceae	*Aristea torulosa*	Klatt	LC	Indigenous
Poaceae	*Aristida bipartita*	(Nees) Trin. & Rupr.	LC	Indigenous
Poaceae	*Aristida congesta subsp. congesta*	Roem. & Schult.	LC	Indigenous
Poaceae	*Aristida diffusa subsp. burkei*	Trin.	LC	Indigenous
Poaceae	*Aristida junciformis subsp. junciformis*	Trin. & Rupr.	LC	Indigenous
Asteraceae	*Artemisia afra var. afra*	Jacq. ex Willd.	LC	Indigenous
Poaceae	*Arundinella nepalensis*	Trin.	LC	Indigenous

Apocynaceae	*Asclepias adscendens*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias albens*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias aurea*	(Schltr.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias brevipes*	(Schltr.) Schltr.	LC	Indigenous; Endemic
Apocynaceae	*Asclepias crispa var. crispa*	P.J.Bergius	LC	Indigenous; Endemic
Apocynaceae	*Asclepias eminens*	(Harv.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias fallax*	(Schltr.) Schltr.	LC	Indigenous; Endemic
Apocynaceae	*Asclepias gibba var. gibba*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias gibba var. media*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias multicaulis*	(E.Mey.) Schltr.	LC	Indigenous
Apocynaceae	*Asclepias stellifera*	Schltr.	LC	Indigenous
Apocynaceae	*Aspidoglossum biflorum*	E.Mey.	LC	Indigenous
Apocynaceae	*Aspidoglossum glabrescens*	(Schltr.) Kupicha	LC	Indigenous; Endemic
Apocynaceae	*Aspidoglossum interruptum*	(E.Mey.) Bullock	LC	Indigenous
Apocynaceae	*Aspidoglossum lamellatum*	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	*Aspidoglossum ovalifolium*	(Schltr.) Kupicha	LC	Indigenous
Apocynaceae	*Aspidoglossum restioides*	(Schltr.) Kupicha	LC	Indigenous; Endemic
Aspleniaceae	*Asplenium cordatum*	(Thunb.) Sw.	LC	Indigenous
Amaranthaceae	*Atriplex suberecta*	I.Verd.	LC	Indigenous
Rhamnaceae	*Berchemia zeyheri*	(Sond.) Grubov		Indigenous

Elatinaceae	*Bergia decumbens*	Planch. ex Harv.	LC	Indigenous
Asteraceae	*Berkheya pinnatifida subsp. ingrata*	(Thunb.) Thell.	LC	Indigenous; Endemic
Asteraceae	*Berkheya radula*	(Harv.) De Wild.	LC	Indigenous
Asteraceae	*Berkheya seminivea*	Harv. & Sond.	LC	Indigenous; Endemic
Asteraceae	*Berkheya setifera*	DC.	LC	Indigenous
Asteraceae	*Berkheya zeyheri subsp. zeyheri*	Oliv. & Hiern	LC	Indigenous
Poaceae	*Bewsia biflora*	(Hack.) Gooss.	LC	Indigenous
Asteraceae	*Bidens pilosa*	L.		notIndigenous; Naturalised
Poaceae	*Brachiaria advena*	Vickery	NE	notIndigenous; Naturalised
Poaceae	*Brachiaria serrata*	(Thunb.) Stapf	LC	Indigenous
Apocynaceae	*Brachystelma chloranthum*	(Schltr.) Peckover	LC	Indigenous
Scrophulariaceae	*Buddleja saligna*	Willd.	LC	Indigenous
Scrophulariaceae	*Buddleja salviifolia*	(L.) Lam.	LC	Indigenous
Asteraceae	*Callilepis leptophylla*	Harv.	LC	Indigenous
Poaceae	*Catalepis gracilis*	Stapf & Stent	LC	Indigenous
Cannabaceae	*Celtis africana*	Burm.f.	LC	Indigenous
Caryophyllaceae	*Cerastium arabidis*	E.Mey. ex Fenzl		Indigenous
Caryophyllaceae	*Cerastium capense*	Sond.		Indigenous
Pteridaceae	*Cheilanthes hirta var. brevipilosa*	Sw.	LC	Indigenous; Endemic
Pteridaceae	*Cheilanthes multifida subsp. lacerata*	(Sw.) Sw.	LC	Indigenous
Amaranthaceae	*Chenopodium glaucum*	L.		notIndigenous; Naturalised

Amaranthaceae	*Chenopodium phillipsianum*	Aellen		Indigenous
Gentianaceae	*Chironia palustris subsp. palustris*	Burch.	LC	Indigenous
Gentianaceae	*Chironia purpurascens subsp. humilis*	(E.Mey.) Benth. & Hook.f.	LC	Indigenous
Asteraceae	*Cirsium vulgare*	(Savi) Ten.		notIndigenous; Naturalised; Invasive
Cleomaceae	*Cleome maculata*	(Sond.) Szyszyl.	LC	Indigenous
Cleomaceae	*Cleome monophylla*	L.	LC	Indigenous
Euphorbiaceae	*Clutia hirsuta var. hirsuta*	(Sond.) Müll.Arg.	LC	Indigenous
Euphorbiaceae	*Clutia pulchella var. pulchella*	L.	LC	Indigenous
Combretaceae	*Combretum apiculatum subsp. apiculatum*	Sond.	LC	Indigenous
Apocynaceae	*Cordylogyne globosa*	E.Mey.	LC	Indigenous
Caryophyllaceae	*Corrigiola litoralis subsp. litoralis*	L.		Indigenous
Crassulaceae	*Cotyledon orbiculata var. oblonga*	L.	LC	Indigenous
Crassulaceae	*Crassula alba var. alba*	Forssk.		Indigenous
Crassulaceae	*Crassula capitella subsp. nodulosa*	Thunb.		Indigenous
Crassulaceae	*Crassula lanceolata subsp. lanceolata*	(Eckl. & Zeyh.) Endl. ex Walp.		Indigenous; Endemic
Crassulaceae	*Crassula natans var. natans*	Thunb.		Indigenous; Endemic
Crassulaceae	*Crassula setulosa var. setulosa*	Harv.	NE	Indigenous
Asteraceae	*Crepis hypochaeridea*	(DC.) Thell.		notIndigenous; Naturalised
Fabaceae	*Crotalaria distans subsp. distans*	Benth.	LC	Indigenous

Fabaceae	*Crotalaria globifera*	E.Mey.	LC	Indigenous
Araliaceae	*Cussonia paniculata subsp. sinuata*	Eckl. & Zeyh.		Indigenous
Amaranthaceae	*Cyathula cylindrica var. cylindrica*	Moq.	LC	Indigenous
Amaranthaceae	*Cyathula uncinulata*	(Schrad.) Schinz	LC	Indigenous
Poaceae	*Cymbopogon caesius*	(Hook. & Arn.) Stapf	LC	Indigenous
Poaceae	*Cymbopogon pospischilii*	(K.Schum.) C.E.Hubb.	NE	Indigenous
Aizoaceae	*Delosperma leendertziae*	N.E.Br.	NT	Indigenous; Endemic
Caryophyllaceae	*Dianthus micropetalus*	Ser.		Indigenous
Caryophyllaceae	*Dianthus mooiensis subsp. kirkii*	F.N.Williams		Indigenous
Caryophyllaceae	*Dianthus zeyheri subsp. zeyheri*	Sond.		Indigenous; Endemic
Fabaceae	*Dichilus gracilis*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Dichilus lebeckioides*	DC.	LC	Indigenous
Fabaceae	*Dichilus pilosus*	Conrath ex Schinz	LC	Indigenous; Endemic
Fabaceae	*Dichilus strictus*	E.Mey.	LC	Indigenous
Asteraceae	*Dicoma anomala subsp. anomala*	Sond.	LC	Indigenous
Poaceae	*Digitaria diagonalis var. diagonalis*	(Nees) Stapf	LC	Indigenous
Poaceae	*Digitaria eriantha*	Steud.	LC	Indigenous
Poaceae	*Digitaria monodactyla*	(Nees) Stapf	LC	Indigenous
Poaceae	*Digitaria tricholaenoides*	Stapf	LC	Indigenous
Poaceae	*Diheteropogon amplectens var. amplectens*	(Nees) Clayton	LC	Indigenous
Poaceae	*Diheteropogon filifolius*	(Nees) Clayton	LC	Indigenous
Asteraceae	*Dimorphotheca caulescens*	Harv.	LC	Indigenous

Asteraceae	*Dimorphotheca spectabilis*	Schltr.	LC	Indigenous
Ebenaceae	*Diospyros austro-africana var. microphylla*	De Winter		Indigenous
Ebenaceae	*Diospyros lycioides subsp. guerkei*	Desf.		Indigenous
Ebenaceae	*Diospyros whyteana*	(Hiern) F.White		Indigenous
Hyacinthaceae	*Dipcadi gracillimum*	Baker		Indigenous
Hyacinthaceae	*Dipcadi marlothii*	Engl.		Indigenous
Hyacinthaceae	*Dipcadi viride*	(L.) Moench		Indigenous
Malvaceae	*Dombeya rotundifolia var. rotundifolia*	(Hochst.) Planch.	LC	Indigenous
Hyacinthaceae	*Drimia calcarata*	(Baker) Stedje		Indigenous
Hyacinthaceae	*Drimia depressa*	(Baker) Jessop		Indigenous
Hyacinthaceae	*Drimia elata*	Jacq.		Indigenous
Hyacinthaceae	*Drimia multisetosa*	(Baker) Jessop		Indigenous
Droseraceae	*Drosera burkeana*	Planch.	LC	Indigenous
Droseraceae	*Drosera madagascariensis*	DC.	LC	Indigenous
Poaceae	*Echinochloa jubata*	Stapf	LC	Indigenous
Fabaceae	*Elephantorrhiza elephantina*	(Burch.) Skeels	LC	Indigenous
Poaceae	*Eleusine coracana*	(L.) Gaertn.		Indigenous
Poaceae	*Eleusine coracana subsp. africana*	(L.) Gaertn.	LC	Indigenous
Poaceae	*Eleusine multiflora*	A.Rich.	NE	notIndigenous; Naturalised
Poaceae	*Elionurus muticus*	(Spreng.) Kunth	LC	Indigenous
Polygonaceae	*Emex australis*	Steinh.	LC	Indigenous
Poaceae	*Eragrostis capensis*	(Thunb.) Trin.	LC	Indigenous

Poaceae	*Eragrostis chloromelas*	Steud.	LC	Indigenous
Poaceae	*Eragrostis cilianensis*	(All.) Vignolo ex Janch.	LC	Indigenous
Poaceae	*Eragrostis curvula*	(Schrad.) Nees	LC	Indigenous
Poaceae	*Eragrostis micrantha*	Hack.	LC	Indigenous
Poaceae	*Eragrostis patentipilosa*	Hack.	LC	Indigenous
Poaceae	*Eragrostis racemosa*	(Thunb.) Steud.	LC	Indigenous
Poaceae	*Eragrostis stapfii*	De Winter	LC	Indigenous
Poaceae	*Eragrostis tef*	(Zuccagni) Trotter	NE	notIndigenous; Naturalised
Fabaceae	*Erythrina zeyheri*	Harv.	LC	Indigenous
Ebenaceae	*Euclea crispa subsp. crispa*	(Thunb.) Gürke		Indigenous
Hyacinthaceae	*Eucomis autumnalis subsp. clavata*	(Mill.) Chitt.	NE	Indigenous
Orchidaceae	*Eulophia cooperi*	Rchb.f.	LC	Indigenous; Endemic
Orchidaceae	*Eulophia hians var. hians*	Spreng.	LC	Indigenous
Orchidaceae	*Eulophia hians var. nutans*	Spreng.	LC	Indigenous
Orchidaceae	*Eulophia ovalis var. bainesii*	Lindl.	LC	Indigenous
Orchidaceae	*Eulophia ovalis var. ovalis*	Lindl.	LC	Indigenous
Euphorbiaceae	*Euphorbia epicyparissias*	E.Mey. ex Boiss.	LC	Indigenous
Euphorbiaceae	*Euphorbia prostrata*	Aiton	NE	notIndigenous; Naturalised
Asteraceae	*Euryops transvaalensis subsp. transvaalensis*	Klatt	LC	Indigenous
Polygonaceae	*Fallopia convolvulus*	(L.) Holub		notIndigenous; Naturalised
Poaceae	*Festuca scabra*	Vahl	LC	Indigenous
Poaceae	*Fingerhuthia africana*	Lehm.	LC	Indigenous
Poaceae	*Fingerhuthia sesleriiformis*	Nees	LC	Indigenous

Asteraceae	*Gazania krebsiana subsp. serrulata*	Less.	LC	Indigenous
Asteraceae	*Gerbera ambigua*	(Cass.) Sch.Bip.	LC	Indigenous
Asteraceae	*Gerbera piloselloides*	(L.) Cass.	LC	Indigenous
Thymelaeaceae	*Gnidia gymnostachya*	(C.A.Mey.) Gilg	LC	Indigenous
Thymelaeaceae	*Gnidia nodiflora*	Meisn.	LC	Indigenous
Apocynaceae	*Gomphocarpus fruticosus subsp. decipiens*	(L.) Aiton f.	LC	Indigenous
Apocynaceae	*Gomphocarpus fruticosus subsp. fruticosus*	(L.) Aiton f.	LC	Indigenous
Amaranthaceae	*Gomphrena celosioides*	Mart.		notIndigenous; Naturalised
Malvaceae	*Grewia flava*	DC.	LC	Indigenous
Malvaceae	*Grewia occidentalis var. occidentalis*	L.	LC	Indigenous
Orchidaceae	*Habenaria bicolor*	Conrath & Kraenzl.	NT	Indigenous
Orchidaceae	*Habenaria epipactidea*	Rchb.f.	LC	Indigenous
Asteraceae	*Haplocarpha scaposa*	Harv.	LC	Indigenous
Asteraceae	*Helichrysum argyrosphaerum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum aureonitens*	Sch.Bip.	LC	Indigenous
Asteraceae	*Helichrysum caespititium*	(DC.) Harv.	LC	Indigenous
Asteraceae	*Helichrysum cephaloideum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum chionosphaerum*	DC.	LC	Indigenous
Asteraceae	*Helichrysum difficile*	Hilliard	LC	Indigenous
Asteraceae	*Helichrysum lepidissimum*	S.Moore	LC	Indigenous
Asteraceae	*Helichrysum lineare*	DC.	LC	Indigenous
Asteraceae	*Helichrysum setosum*	Harv.	LC	Indigenous
Brassicaceae	*Heliophila carnosa*	(Thunb.) Steud.	LC	Indigenous

Brassicaceae	*Heliophila rigidiuscula*	Sond.	LC	Indigenous
Malvaceae	*Hermannia cordata*	(E.Mey. ex E.Phillips) De Winter	LC	Indigenous; Endemic
Malvaceae	*Hermannia depressa*	N.E.Br.	LC	Indigenous
Malvaceae	*Hermannia grandistipula*	(Buchinger ex Hochst.) K.Schum.	LC	Indigenous
Malvaceae	*Hermannia lancifolia*	Szyszyl.	LC	Indigenous; Endemic
Malvaceae	*Hermannia oblongifolia*	(Harv.) Hochr.	LC	Indigenous; Endemic
Apiaceae	*Heteromorpha arborescens var. abyssinica*	(Spreng.) Cham. & Schltdl.	LC	Indigenous
Poaceae	*Heteropogon contortus*	(L.) Roem. & Schult.	LC	Indigenous
Malvaceae	*Hibiscus engleri*	K.Schum.	LC	Indigenous
Malvaceae	*Hibiscus microcarpus*	Garcke	LC	Indigenous
Malvaceae	*Hibiscus sabdariffa*	L.		notIndigenous; Naturalised
Malvaceae	*Hibiscus trionum*	L.		notIndigenous; Naturalised
Asteraceae	*Hilliardiella aristata*	(DC.) H.Rob.	LC	Indigenous
Asteraceae	*Hilliardiella hirsuta*	(DC.) H.Rob.	LC	Indigenous
Asteraceae	*Hilliardiella oligocephala*	(DC.) H.Rob.	LC	Indigenous
Poaceae	*Hyparrhenia anamesa*	Clayton	LC	Indigenous
Poaceae	*Hyparrhenia hirta*	(L.) Stapf	LC	Indigenous
Poaceae	*Hyparrhenia poecilotricha*	(Hack.) Stapf	LC	Indigenous
Hypericaceae	*Hypericum aethiopicum subsp. sonderi*	Thunb.	LC	Indigenous
Hypericaceae	*Hypericum lalandii*	Choisy	LC	Indigenous
Hypoxidaceae	*Hypoxis multiceps*	Buchinger ex Baker	LC	Indigenous
Hypoxidaceae	*Hypoxis rigidula var. rigidula*	Baker	LC	Indigenous

Poaceae	*Imperata cylindrica*	(L.) Raeusch.	LC	Indigenous
Fabaceae	*Indigofera confusa*	Prain & Baker f.	LC	Indigenous
Fabaceae	*Indigofera hedyantha*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Indigofera hilaris var. hilaris*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Indigofera hybrida*	N.E.Br.	VU	Indigenous; Endemic
Fabaceae	*Indigofera obscura*	N.E.Br.	LC	Indigenous
Fabaceae	*Indigofera setiflora*	Baker	LC	Indigenous
Poaceae	*Ischaemum fasciculatum*	Brongn.	LC	Indigenous
Crassulaceae	*Kalanchoe paniculata*	Harv.		Indigenous
Crassulaceae	*Kalanchoe rotundifolia*	(Haw.) Haw.		Indigenous
Aizoaceae	*Khadia acutipetala*	(N.E.Br.) N.E.Br.	LC	Indigenous; Endemic
Aizoaceae	*Khadia beswickii*	(L.Bolus) N.E.Br.	VU	Indigenous; Endemic
Achariaceae	*Kiggelaria africana*	L.	LC	Indigenous
Poaceae	*Koeleria capensis*	(Steud.) Nees	LC	Indigenous
Asteraceae	*Lactuca inermis*	Forssk.	LC	Indigenous
Hydrocharitaceae	*Lagarosiphon muscoides*	Harv.	LC	Indigenous
Thymelaeaceae	*Lasiosiphon canoargenteus*	C.H.Wright	LC	Indigenous; Endemic
Thymelaeaceae	*Lasiosiphon kraussianus*	(Meisn.) Meisn.		Indigenous
Thymelaeaceae	*Lasiosiphon microcephalus*	(Meisn.) J.C.Manning & Magee		Indigenous
Asteraceae	*Launaea rarifolia var. rarifolia*	(Oliv. & Hiern) Boulos	LC	Indigenous
Hyacinthaceae	*Ledebouria luteola*	Jessop	LC	Indigenous
Hyacinthaceae	*Ledebouria marginata*	(Baker) Jessop	LC	Indigenous

Hyacinthaceae	*Ledebouria ovatifolia*	(Baker) Jessop		Indigenous; Endemic
Hyacinthaceae	*Ledebouria revoluta*	(L.f.) Jessop	LC	Indigenous
Poaceae	*Leersia hexandra*	Sw.	LC	Indigenous
Fabaceae	*Leobordea arida*	(Dümmer) B.-E.van Wyk & Boatwr.	LC	Indigenous; Endemic
Fabaceae	*Leobordea divaricata*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Leobordea eriantha*	(Benth.) B.-E.van Wyk & Boatwr.	LC	Indigenous
Fabaceae	*Leobordea mucronata*	(Conrath) B.-E.van Wyk & Boatwr.		Indigenous
Brassicaceae	*Lepidium bonariense*	L.		notIndigenous; Naturalised
Brassicaceae	*Lepidium transvaalense*	Marais	LC	Indigenous
Poaceae	*Leptochloa fusca*	(L.) Kunth	LC	Indigenous
Fabaceae	*Lessertia prostata*	DC.	LC	Indigenous
Limeaceae	*Limeum viscosum subsp. viscosum*	(J.Gay) Fenzl	NE	Indigenous
Linaceae	*Linum thunbergii*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Listia heterophylla*	E.Mey.	LC	Indigenous
Lobeliaceae	*Lobelia erinus*	L.	LC	Indigenous
Lobeliaceae	*Lobelia flaccida subsp. flaccida*	(C.Presl) A.DC.	LC	Indigenous
Lobeliaceae	*Lobelia sonderiana*	(Kuntze) Lammers	LC	Indigenous
Poaceae	*Lolium perenne*	L.	NE	notIndigenous; Naturalised
Asteraceae	*Lopholaena coriifolia*	(Sond.) E.Phillips & C.A.Sm.	LC	Indigenous
Fabaceae	*Lotononis laxa*	Eckl. & Zeyh.	LC	Indigenous
Fabaceae	*Lotus discolor subsp. discolor*	E.Mey.	LC	Indigenous

Poaceae	*Loudetia simplex*	(Nees) C.E.Hubb.	LC	Indigenous
Onagraceae	*Ludwigia palustris*	(L.) Elliott		notIndigenous; Naturalised
Capparaceae	*Maerua cafra*	(DC.) Pax	LC	Indigenous
Poaceae	*Melinis repens subsp. repens*	(Willd.) Zizka	LC	Indigenous
Fabaceae	*Melolobium wilmsii*	Harms	LC	Indigenous; Endemic
Poaceae	*Microchloa caffra*	Nees	LC	Indigenous
Lobeliaceae	*Monopsis decipiens*	(Sond.) Thulin	LC	Indigenous
Iridaceae	*Moraea natalensis*	Baker	LC	Indigenous
Iridaceae	*Moraea pallida*	(Baker) Goldblatt	LC	Indigenous
Iridaceae	*Moraea simulans*	Baker	LC	Indigenous
Iridaceae	*Moraea stricta*	Baker	LC	Indigenous
Myrothamnaceae	*Myrothamnus flabellifolius*	Welw.	DD	Indigenous
Myrsinaceae	*Myrsine africana*	L.	LC	Indigenous
Celastraceae	*Mystroxylon aethiopicum subsp. aethiopicum*	(Thunb.) Loes.	LC	Indigenous; Endemic
Lythraceae	*Nesaea sagittifolia var. sagittifolia*	(Sond.) Koehne		Indigenous
Lythraceae	*Nesaea schinzii*	Koehne		Indigenous
Stilbaceae	*Nuxia congesta*	R.Br. ex Fresen.	LC	Indigenous
Onagraceae	*Oenothera rosea*	L'Hér. ex Aiton		notIndigenous; Naturalised
Onagraceae	*Oenothera stricta subsp. stricta*	Ledeb. ex Link		notIndigenous; Naturalised
Onagraceae	*Oenothera tetraptera*	Cav.		notIndigenous; Naturalised
Asteraceae	*Oncosiphon piluliferus*	(L.f.) Källersjö	LC	Indigenous
Asteraceae	*Oncosiphon suffruticosus*	(L.) Källersjö	LC	Indigenous

Asteraceae	*Osteospermum moniliferum subsp. canescens*	L.	LC	Indigenous
Asteraceae	*Osteospermum scariosum var. scariosum*	DC.	NE	Indigenous
Santalaceae	*Osyris lanceolata*	Hochst. & Steud.	LC	Indigenous
Fabaceae	*Otholobium polystictum*	(Benth. ex Harv.) C.H.Stirt.	LC	Indigenous
Fabaceae	*Otholobium wilmsii*	(Harms) C.H.Stirt.	LC	Indigenous
Asteraceae	*Othonna natalensis*	Sch.Bip.	LC	Indigenous
Polygonaceae	*Oxygonum dregeanum subsp. canescens*	Meisn.	NE	Indigenous
Apocynaceae	*Pachycarpus rigidus*	E.Mey.	LC	Indigenous
Apocynaceae	*Pachycarpus schinzianus*	(Schltr.) N.E.Br.	LC	Indigenous
Apocynaceae	*Pachycarpus suaveolens*	(Schltr.) Nicholas & Goyder	VU	Indigenous
Poaceae	*Panicum natalense*	Hochst.	LC	Indigenous
Poaceae	*Panicum schinzii*	Hack.	LC	Indigenous
Poaceae	*Panicum stapfianum*	Fourc.	LC	Indigenous
Papaveraceae	*Papaver aculeatum*	Thunb.	LC	Indigenous
Apocynaceae	*Parapodium costatum*	E.Mey.	LC	Indigenous
Poaceae	*Paspalum distichum*	L.	LC	Indigenous
Malvaceae	*Pavonia burchellii*	(DC.) R.A.Dyer	LC	Indigenous
Fabaceae	*Pearsonia cajanifolia subsp. cajanifolia*	(Harv.) Polhill	LC	Indigenous; Endemic
Fabaceae	*Pearsonia sessilifolia subsp. sessilifolia*	(Harv.) Dümmer	LC	Indigenous
Pteridaceae	*Pellaea calomelanos var. calomelanos*	(Sw.) Link	LC	Indigenous
Poaceae	*Pennisetum thunbergii*	Kunth	LC	Indigenous

Apocynaceae	*Periglossum mackenii*	Harv.	LC	Indigenous
Polygonaceae	*Persicaria attenuata subsp. africana*	(R.Br.) Soják	LC	Indigenous
Pittosporaceae	*Pittosporum viridiflorum*	Sims	LC	Indigenous
Poaceae	*Poa annua*	L.	NE	notIndigenous; Naturalised
Poaceae	*Pogonarthria squarrosa*	(Roem. & Schult.) Pilg.	LC	Indigenous
Caryophyllaceae	*Pollichia campestris*	Aiton		Indigenous
Polygalaceae	*Polygala gerrardii*	Chodat	LC	Indigenous; Endemic
Polygalaceae	*Polygala hottentotta*	C.Presl	LC	Indigenous
Polygalaceae	*Polygala houtboshiana*	Chodat	LC	Indigenous
Polygalaceae	*Polygala producta*	N.E.Br.	LC	Indigenous
Polygalaceae	*Polygala uncinata*	E.Mey. ex Meisn.	LC	Indigenous
Polygalaceae	*Polygala virgata var. decora*	Thunb.	LC	Indigenous
Potamogetonaceae	*Potamogeton nodosus*	Poir.	LC	Indigenous
Potamogetonaceae	*Potamogeton pectinatus*	L.	LC	Indigenous
Molluginaceae	*Psammotropha mucronata var. mucronata*	(Thunb.) Fenzl	LC	Indigenous
Molluginaceae	*Psammotropha myriantha*	Sond.	LC	Indigenous
Amaranthaceae	*Pupalia lappacea var. lappacea*	(L.) A.Juss.	LC	Indigenous
Ranunculaceae	*Ranunculus multifidus*	Forssk.	LC	Indigenous
Apocynaceae	*Raphionacme hirsuta*	(E.Mey.) R.A.Dyer	LC	Indigenous
Apocynaceae	*Raphionacme velutina*	Schltr.	LC	Indigenous
Vitaceae	*Rhoicissus tridentata subsp. cuneifolia*	(L.f.) Wild & R.B.Drumm.		Indigenous
Apocynaceae	*Riocreuxia polyantha*	Schltr.	LC	Indigenous

Lythraceae	*Rotala filiformis*	(Bellardi) Hiern	LC	Indigenous
Polygonaceae	*Rumex acetosella subsp. angiocarpus*	L.		notIndigenous; Naturalised
Polygonaceae	*Rumex crispus*	L.		notIndigenous; Naturalised; Invasive
Polygonaceae	*Rumex lanceolatus*	Thunb.	LC	Indigenous
Lamiaceae	*Salvia repens var. transvaalensis*	Burch. ex Benth.	LC	Indigenous
Asteraceae	*Schistostephium crataegifolium*	(DC.) Fenzl ex Harv.	LC	Indigenous
Asteraceae	*Schkuhria pinnata*	(Lam.) Kuntze ex Thell.		notIndigenous; Naturalised
Anacardiaceae	*Searsia discolor*	(E.Mey. ex Sond.) Moffett		Indigenous
Anacardiaceae	*Searsia magalismontana subsp. magalismontana*	(Sond.) Moffett		Indigenous
Anacardiaceae	*Searsia pyroides var. gracilis*	(Burch.) Moffett		Indigenous
Anacardiaceae	*Searsia pyroides var. pyroides*	(Burch.) Moffett		Indigenous
Anacardiaceae	*Searsia rigida var. margaretae*	(Mill.) F.A.Barkley		Indigenous
Gentianaceae	*Sebaea exigua*	(Oliv.) Schinz	LC	Indigenous
Gentianaceae	*Sebaea leiostyla*	Gilg	LC	Indigenous
Selaginellaceae	*Selaginella dregei*	(C.Presl) Hieron.		Indigenous
Scrophulariaceae	*Selago capitellata*	Schltr.	LC	Indigenous; Endemic
Asteraceae	*Senecio asperulus*	DC.	LC	Indigenous
Asteraceae	*Senecio burchellii*	DC.	LC	Indigenous; Endemic
Asteraceae	*Senecio consanguineus*	DC.	LC	Indigenous

Asteraceae	*Senecio coronatus*	(Thunb.) Harv.	LC	Indigenous
Asteraceae	*Senecio erubescens var. erubescens*	Aiton	NE	Indigenous; Endemic
Asteraceae	*Senecio inornatus*	DC.	LC	Indigenous
Asteraceae	*Senecio isatideus*	DC.	LC	Indigenous
Asteraceae	*Senecio laevigatus var. laevigatus*	Thunb.	LC	Indigenous; Endemic
Asteraceae	*Senecio lydenburgensis*	Hutch. & Burtt Davy	LC	Indigenous
Asteraceae	*Senecio othonniflorus*	DC.	LC	Indigenous
Asteraceae	*Senecio oxyriifolius subsp. oxyriifolius*	DC.	LC	Indigenous
Asteraceae	*Senecio venosus*	Harv.	LC	Indigenous
Asteraceae	*Seriphium plumosum*	L.		Indigenous
Poaceae	*Setaria incrassata*	(Hochst.) Hack.	LC	Indigenous
Poaceae	*Setaria nigrirostris*	(Nees) T.Durand & Schinz	LC	Indigenous
Poaceae	*Setaria sphacelata var. torta*	(Schumach.) Stapf & C.E.Hubb. ex M.B.Moss	LC	Indigenous
Malvaceae	*Sida dregei*	Burtt Davy	LC	Indigenous
Malvaceae	*Sida rhombifolia subsp. rhombifolia*	L.	LC	Indigenous
Caryophyllaceae	*Silene burchellii subsp. pilosellifolia*	Otth		Indigenous
Caryophyllaceae	*Silene undulata*	Aiton		Indigenous
Apocynaceae	*Sisyranthus randii*	S.Moore	LC	Indigenous
Asteraceae	*Sonchus nanus*	Sond. ex Harv.	LC	Indigenous
Asteraceae	*Sonchus oleraceus*	L.		notIndigenous; Naturalised; Invasive

Malpighiaceae	*Sphedamnocarpus pruriens subsp. galphimiifolius*	(A.Juss.) Szyszyl.	LC	Indigenous
Poaceae	*Sporobolus discosporus*	Nees	LC	Indigenous
Poaceae	*Sporobolus pectinatus*	Hack.	LC	Indigenous; Endemic
Apocynaceae	*Stapelia leendertziae*	N.E.Br.	LC	Indigenous
Poaceae	*Stiburus conrathii*	Hack.	LC	Indigenous
Asteraceae	*Tagetes minuta*	L.		notIndigenous; Naturalised; Invasive
Portulacaceae	*Talinum caffrum*	(Thunb.) Eckl. & Zeyh.		Indigenous
Fabaceae	*Tephrosia capensis var. acutifolia*	(Jacq.) Pers.	LC	Indigenous; Endemic
Fabaceae	*Tephrosia capensis var. capensis*	(Jacq.) Pers.	LC	Indigenous
Fabaceae	*Tephrosia elongata var. elongata*	E.Mey.	LC	Indigenous
Fabaceae	*Tephrosia semiglabra*	Sond.	LC	Indigenous
Santalaceae	*Thesium hirsutum*	A.W.Hill	LC	Indigenous; Endemic
Santalaceae	*Thesium pallidum*	A.DC.	LC	Indigenous
Santalaceae	*Thesium transvaalense*	Schltr.	LC	Indigenous; Endemic
Santalaceae	*Thesium utile*	A.W.Hill	LC	Indigenous
Asteraceae	*Tolpis capensis*	(L.) Sch.Bip.	LC	Indigenous
Fabaceae	*Trifolium africanum var. africanum*	Ser.	NE	Indigenous
Fabaceae	*Trifolium africanum var. lydenburgense*	Ser.	NE	Indigenous
Poaceae	*Tristachya rehmannii*	Hack.	LC	Indigenous
Malvaceae	*Triumfetta pilosa var. tomentosa*	Roth	NE	Indigenous
Alliaceae	*Tulbaghia acutiloba*	Harv.	LC	Indigenous; Endemic

Alliaceae	*Tulbaghia leucantha*	Baker	LC	Indigenous
Asteraceae	*Ursinia nana subsp. leptophylla*	DC.	LC	Indigenous
Caryophyllaceae	*Vaccaria hispanica var. hispanica*	(Mill.) Rauschert		notIndigenous; Naturalised
Campanulaceae	*Wahlenbergia undulata*	(L.f.) A.DC.	LC	Indigenous
Apocynaceae	*Xysmalobium brownianum*	S.Moore	LC	Indigenous
Apocynaceae	*Xysmalobium undulatum var. undulatum*	(L.) Aiton f.	LC	Indigenous
Potamogetonaceae	*Zannichellia palustris*	L.	LC	Indigenous
Rutaceae	*Zanthoxylum capense*	(Thunb.) Harv.	LC	Indigenous
Rhamnaceae	*Ziziphus mucronata subsp. mucronata*	Willd.		Indigenous
Rhamnaceae	*Ziziphus zeyheriana*	Sond.		Indigenous
Fabaceae	*Zornia capensis subsp. capensis*	Pers.	LC	Indigenous
Fabaceae	*Zornia linearis*	E.Mey.	LC	Indigenous
Fabaceae	*Zornia milneana*	Mohlenbr.	LC	Indigenous

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

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

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

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

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

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

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

Sylvietta rufescens	Crombec, Long-billed	Unlisted	LC
Tachybaptus ruficollis	Grebe, Little	Unlisted	LC
Tachymarptis melba	Swift, Alpine	Unlisted	LC
Tadorna cana	Shelduck, South African	Unlisted	LC
Telophorus zeylonus	Bokmakierie, Bokmakierie	Unlisted	LC
Terpsiphone viridis	Paradise-flycatcher, African	Unlisted	LC
Thalassornis leuconotus	Duck, White-backed	Unlisted	LC
Thamnolaea cinnamomeiventris	Cliff-chat, Mocking	Unlisted	LC
Threskiornis aethiopicus	Ibis, African Sacred	Unlisted	LC
Trachyphonus vaillantii	Barbet, Crested	Unlisted	LC
Tricholaema leucomelas	Barbet, Acacia Pied	Unlisted	LC
Tringa glareola	Sandpiper, Wood	Unlisted	LC
Tringa nebularia	Greenshank, Common	Unlisted	LC
Tringa stagnatilis	Sandpiper, Marsh	Unlisted	LC
Turdoides jardineii	Babbler, Arrow-marked	Unlisted	LC
Turdus libonyanus	Thrush, Kurrichane	Unlisted	Unlisted
Turdus olivaceus	Thrush, Olive	Unlisted	LC
Turdus smithi	Thrush, Karoo	Unlisted	LC
Turtur chalcospilos	Wood-dove, Emerald-spotted	Unlisted	LC
Tyto alba	Owl, Barn	Unlisted	LC
Tyto capensis	Grass-owl, African	VU	LC
Upupa africana	Hoopoe, African	Unlisted	LC
Urocolius indicus	Mousebird, Red-faced	Unlisted	LC
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus coronatus	Lapwing, Crowned	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC
Vidua macroura	Whydah, Pin-tailed	Unlisted	LC
Zosterops pallidus	White-eye, Orange River	Unlisted	LC
Zosterops virens	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)
Aethomys ineptus	Tete Veld Rat	LC	LC
Micaelamys namaquensis	Namaqua Rock Mouse	LC	LC
Alcelaphus buselaphus	Red Hartebeest	LC	LC
Antidorcas marsupialis	Springbok	LC	LC
Aonyx capensis	Cape Clawless Otter	**NT**	**NT**
Atelerix frontalis	South Africa Hedgehog	**NT**	LC
Atilax paludinosus	Water Mongoose	LC	LC
Canis mesomelas	Black-backed Jackal	LC	LC
Caracal caracal	Caracal	LC	LC
Ceratotherium simum	White Rhinoceros	**NT**	**NT**
Connochaetes gnou	Black Wildebeest	LC	LC
Connochaetes taurinus	Blue Wildebeest	LC	LC
Crocidura cyanea	Reddish-grey Musk Shrew	LC	LC
Crocidura mariquensis	Swamp Musk Shrew	**NT**	LC
Crocidura silacea	Lesser Grey-brown Musk Shrew	LC	LC
Cryptomys hottentotus	Common Mole-rat	LC	LC
Cynictis penicillata	Yellow Mongoose	LC	LC
Damaliscus pygargus	Blesbok	LC	LC
Dasymys incomtus	African Marsh Rat	**NT**	LC
Desmodillus auricularis	Short-tailed Gerbil	LC	LC
Diceros bicornis	Black Rhinoceros	**EN**	**CR**
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT
Elephantulus brachyrhynchus	Short-snouted Sengi	LC	LC
Elephantulus myurus	Eastern Rock Sengi	LC	LC
Eptesicus hottentotus	Long-tailed Serotine Bat	LC	LC
Equus quagga	Plains Zebra	LC	NT
Felis nigripes	Black-footed Cat	**VU**	**VU**
Felis silvestris	African Wildcat	LC	LC
Genetta genetta	Small-spotted Genet	LC	LC
Gerbilliscus brantsii	Highveld Gerbil	LC	LC
Gerbilliscus leucogaster	Bushveld Gerbil	LC	LC
Herpestes sanguineus	Slender Mongoose	LC	LC
Hydrictis maculicollis	Spotted-necked Otter	VU	NT
Hystrix africaeaustralis	Cape Porcupine	LC	LC
Ichneumia albicauda	White-tailed Mongoose	LC	LC
Ictonyx striatus	Striped Polecat	LC	LC
Kerivoula lanosa	Lesser Woolly Bat	LC	LC
Leptailurus serval	Serval	**NT**	LC
Lepus saxatilis	Scrub Hare	LC	LC

Lepus victoriae	African Savanna Hare	LC	LC
Mastomys coucha	Multimammate Mouse	LC	LC
Mastomys natalensis	Natal Multimammate Mouse	LC	LC
Mellivora capensis	Honey Badger	LC	LC
Mungos mungo	Banded Mongoose	LC	LC
Mus musculus	House Mouse	Unlisted	LC
Myotis welwitschii	Welwitsch's Hairy Bat	LC	LC
Mystromys albicaudatus	White-tailed Rat	**VU**	**EN**
Neoromicia capensis	Cape Serotine Bat	LC	LC
Neoromicia zuluensis	Aloe Bat	LC	LC
Nycteris thebaica	Egyptian Slit-faced Bat	LC	LC
Orycteropus afer	Aardvark	LC	LC
Otomys angoniensis	Angoni Vlei Rat	LC	LC
Otomys irroratus	Vlei Rat (Fynbos type)	LC	LC
Ourebia ourebi	Oribi	**EN**	LC
Panthera pardus	Leopard	**VU**	**VU**
Papio ursinus	Chacma Baboon	LC	LC
Parahyaena brunnea	Brown Hyaena	**NT**	**NT**
Pedetes capensis	Springhare	LC	LC
Pelea capreolus	Grey Rhebok	**NT**	LC
Poecilogale albinucha	African Striped Weasel	**NT**	LC
Procavia capensis	Rock Hyrax	LC	LC
Pronolagus randensis	Jameson's Red Rock Rabbit	LC	LC
Pronolagus saundersiae	Hewitt's Red Rock Rabbit	LC	LC
Proteles cristata	Aardwolf	LC	LC
Raphicerus campestris	Steenbok	LC	LC
Rattus rattus	House Rat	Exotic (Not listed)	LC
Redunca fulvorufula	Mountain Reedbuck	**EN**	LC
Rhabdomys pumilio	Xeric Four-striped Mouse	LC	LC
Rhinolophus blasii	Peak-saddle Horseshoe Bat	LC	LC
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	LC
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	LC
Saccostomus campestris	Pouched Mouse	LC	LC
Sauromys petrophilus	Flat-headed Free-tail Bat	LC	LC
Scotophilus dinganii	Yellow House Bat	LC	LC
Steatomys pratensis	Fat Mouse	LC	LC
Suncus varilla	Lesser Dwarf Shrew	LC	LC
Suricata suricatta	Suricate	LC	LC
Sylvicapra grimmia	Common Duiker	LC	LC
Syncerus caffer	African Buffalo	LC	LC
Tadarida aegyptiaca	Egyptian Free-tailed Bat	LC	LC
Taphozous mauritianus	Mauritian Tomb Bat	LC	LC
Thryonomys swinderianus	Greater Cane Rat	LC	LC
Tragelaphus oryx	Common Eland	LC	LC

Vulpes chama	Cape Fox	LC	LC

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

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aparallactus capensis	Black-headed Centipede-eater	LC	LC
Chamaeleo dilepis	Common Flap-neck Chameleon	LC	LC
Crocodylus niloticus	Nile Crocodile	VU	LC
Dasypeltis scabra	Rhombic Egg-eater	LC	LC
Duberria lutrix	South African Slug-eater	LC	LC
Hemachatus haemachatus	Rinkhals	LC	LC
Lamprophis aurora	Aurora House Snake	LC	LC
Lycodonomorphus inornatus	Olive House Snake	LC	LC
Prosymna ambigua	East African Shovel-Snout	LC	LC
Psammophis subtaeniatus	Stripe-bellied Sand Snake	LC	LC
Psammophylax tritaeniatus	Striped Skaapsteker	LC	LC
Trachylepis punctatissima	Speckled Rock Skink	LC	LC
Agama atra	Southern Rock Agama	LC	LC
Boaedon capensis	Brown House Snake	LC	Unlisted
Lycodonomorphus rufulus	Brown Water Snake	LC	Unlisted
Psammophylax rhombeatus	Spotted Grass Snake	LC	Unlisted
Trachylepis varia	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)
Amietia angolensis	Angola river frog	LC	LC
Breviceps adspersus	Bushveld Rain Frog	LC	LC
Cacosternum boettgeri	Common Caco	LC	LC
Kassina senegalensis	Bubbling Kassina	LC	LC
Phrynobatrachus natalensis	Snoring Puddle Frog	LC	LC
Pyxicephalus adspersus	Giant Bull Frog	LC	LC
Sclerophrys capensis	Raucous Toad	LC	LC
Sclerophrys garmani	Olive Toad	LC	LC
Sclerophrys gutturalis	Guttural Toad	LC	LC
Semnodactylus wealii	Rattling Frog	LC	LC
Strongylopus fasciatus	Striped Stream Frog	LC	LC
Tomopterna cryptotis	Tremelo Sand Frog	LC	LC
Tomopterna natalensis	Natal Sand Frog	LC	LC
Tomopterna tandyi	Tandy's Sand Frog	LC	LC
Xenopus laevis	Common Platanna	LC	LC
Amietia fuscigula	Cape River Frog	LC	LC
Schismaderma carens	Red Toad	LC	LC