

# TERRESTRIAL ECOLOGY ASSESSMENT FOR PROPOSED ADDITIONAL INFRASTRUCTURE AT BELFAST COAL MINE

Final Report - August 2021



Submitted to:

**Delia Maré**

Golder Associates Africa (Pty) Ltd.

Building 1, Maxwell Office Park

Waterfall City, Midrand

Gauteng

South Africa

Report Compiled By:

Andrew Zinn (*Pr.Sci.Nat.*)

Hawkhead Consulting

## Details of the Expertise of the Specialist

Specialist Information	
<b>Name</b>	Andrew Zinn Pr.Sci.Nat. - Ecological Science (400687/15)
<b>Designation</b>	Report Author – Terrestrial Ecologist
<b>Cell Phone Number</b>	+27 83 361 0373
<b>Email Address</b>	andrew@hawkhead.co.za
<b>Qualifications</b>	M.Sc. Resource Conservation Biology B.Sc. Hons. Ecology and Conservation Biology B.Sc. Zoology and Grassland Science
<b>Summary of Past Experience</b>	Andrew Zinn is a terrestrial ecologist with Hawkhead Consulting. In this role he conducts varied specialist ecology studies, including flora and fauna surveys for baseline ecological assessments and ecological impact assessments. He has over a decade of experience working in the fields of ecology and conservation research. He has worked on projects in several African countries including Botswana, Democratic Republic of Congo, Ethiopia, Ghana, Mozambique, South Africa, Tanzania and Zambia.

## Declaration of Independence by Specialist

I, Andrew Zinn, declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed Belfast Extension Project at Belfast Coal Mine;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have, nor will have, a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity; and
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document.

## Executive Summary

Hawkhead Consulting was appointed by Golder Associates (Pty) Ltd to compile a terrestrial ecology assessment for proposed new infrastructure at Exxaro Coal's (Pty) Ltd Belfast Coal Mine in Mpumalanga Province, South Africa.

Belfast Coal Mine is located approximately 10 km south-west of Belfast. The mining rights area for the mine is approximately 5 819 ha in extent and currently comprises transformed land (mining and agriculture), alien tree plantations, and semi-natural and natural grassland and wetland.

Proposed Project infrastructure that require authorisation include a new ramp area, open pit extension, underground workings, a conveyor/haul road and a discard dump (the clearing and development of the footprint for the proposed discard dump has already been approved under the existing BIP authorisation). All proposed Project infrastructure will be located within the mining rights area (study area).

As there is an existing terrestrial ecology baseline for the study area that is based on previous specialist studies and a long-term monitoring programme, no additional field work was conducted for this terrestrial ecology assessment report. The approach to this study included reviewing existing ecological data, updating the baseline characterisation of the study area with specific reference to the proposed infrastructure footprints, and identifying and assessing anticipated Project impacts.

The study area is located within the Eastern Highveld Grassland vegetation type, with elements of Eastern Temperate Freshwater Wetlands (Mucina and Rutherford, 2011). Both are 'Vulnerable' ecosystems according to the NEMBA Threatened Ecosystems (2011). The study area also falls within the Steenkampsberg Important Bird Area (IBA), which is a globally recognised IBA.

The MBSP (2019) indicates that the majority of land within the proposed development footprints of the Project is classified as 'Heavily modified' and 'Moderately modified – old lands'. Smaller patches of 'Other natural areas' are also present. It is noted however, that a patch of 'CBA Optimal' land is located in the north of the proposed Pit 9 footprint and this will be impacted during mining.

The footprint of each proposed Project infrastructure component is characterised by a mosaic of vegetation communities/land units, including moist grassland and wetlands, dry mixed grasslands, alien tree plantations and woodlots, and cultivated fields. Eleven flora species of conservation concern have been recorded in the study area, and based on literature, up to 29 additional species of conservation concern occur in the broader region in which the study area is located, and thus may be present in areas of undisturbed habitats (i.e., areas of moist grassland and wetlands, dry mixed grasslands). Most of these species are not threatened, but listed as 'protected' at a provincial level. In terms of fauna, 30 mammal, 148 bird, three reptile and eight amphibian species have been recorded in the study area to-date. These include nine mammal and six bird species of conservation concern.

Despite the modified and fragmented nature of habitat within the study area, grassland and wetland patches are important habitat for flora and fauna, and are likely to play an important functional role in maintaining the ecosystem dynamics and connectivity of the broader landscape. In addition, despite being dominated by alien species, alien tree plantations and woodlots increase overall landscape heterogeneity and provide refuge habitat for fauna species. Accordingly, the ecological

sensitivity of on-site habitats with regard to possible ecological disturbances, ranges from Low (alien tree plantations and woodlots), to Moderate (dry mixed grassland) and High (moist grassland and wetlands).

Several negative impacts on terrestrial ecology associated with the proposed Project have been identified. Of these, the loss and modification of natural habitat resulting from vegetation clearing and earth works during construction is the primary impact of concern and will, prior to mitigation have a high impact significance. With successful mitigation, impact significance can be reduced to moderate for all proposed infrastructure components. Vegetation clearing and earth works, coupled with other general Project activities will also cause several additional impacts. These include: habitat fragmentation; the loss of flora and fauna species of conservation concern; the killing, injuring or disturbance of general fauna; and, the spread of alien invasive species. These can also be effectively mitigated through the application of the recommended management measures.

Several management measures have been identified to mitigate the significance of all identified impacts. It is important that these are included in the EMP for the proposed Project and that they are actively implemented during the appropriate Project phases. Key mitigation measures include, *inter alia*:

- Limiting vegetation clearing to the minimum area required for construction and operations;
- Avoiding clearing in moist grassland and wetland habitats, as far as possible;
- Rehabilitating all disturbed areas;
- Conducting ongoing alien invasive species control; and
- Conducting surveys for Red List and protected flora in the proposed Project development footprints and implementing a relocation programme for these species, prior to initiation of any construction activities.

Based on the findings of this study, and provided that the mitigation measures and monitoring requirements detailed in this report are adhered to, the Project may be authorised from a terrestrial ecology perspective.

## Acronyms and Abbreviations

Abbreviation	Explanation
AIS	Alien Invasive Species
CARA	Conservation of Agricultural Resources Act
EMPr	Environmental Management Programme Report
IBA	Important Bird Area
HA	Hectare
MBSP	Mpumalanga Biodiversity Sector Plan
MPTA	Mpumalanga Parks and Tourism Authority
MRA	Mining Rights Area
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
SABAP2	South African Bird Atlas Project 2
SANBI	South African National Biodiversity Institute
ToPS	Threatened or Protected Species
QDS	Quarter Degree Squares

## Appendix 6 of the EIA Regulations

Where applicable, this baseline report has been written in compliance with Appendix 6 of the EIA Regulations.

Section	Requirements	Section addressed in report
1.(1)	specialist report prepared in terms of these Regulations must contain	
(a)	Details of	
(i)	the specialist who prepared the report; and	Preceding Page
(ii)	the expertise of that specialist to compile a specialist report including a curriculum vitae	Preceding Page
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority	Preceding Page
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA)	an indication of the quality and age of base data used for the specialist report;	Section 4.1
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5.1.11 and Section 5.6
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 4.1
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
(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 4
(g)	an identification of any areas to be avoided, including buffers;	Section 5.2 and 5.4
(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 5.2
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.4.2
(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 5
(k)	any mitigation measures for inclusion in the EMPr;	Section 5.4
(l)	any conditions for inclusion in the environmental authorisation;	Section 6
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5.5
(n)	a reasoned opinion—	
(i)	(as to) whether the proposed activity, activities or portions thereof should be authorised;	Section 6

(iA)	regarding the acceptability of the proposed activity or activities; and	Section 6
(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 5.4
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	-
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	-
(q)	any other information requested by the competent authority.	-
2.	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	-

## Contents

Details of the Expertise of the Specialist .....	2
Declaration of Independence by Specialist.....	2
Executive Summary.....	3
Acronyms and Abbreviations .....	5
Appendix 6 of the EIA Regulations.....	6
List of Figures .....	9
List of Tables .....	10
1. Introduction .....	11
1.1. Purpose of the Report.....	11
2. Project Location and Extent.....	11
3. Applicable Legislation, Guidelines and Standards .....	12
4. Methodology.....	15
4.1. Approach to the Terrestrial Ecology Assessment .....	15
4.2. Literature Review .....	15
4.2.1. Vegetation Types and Flora Species .....	15
4.2.2. Fauna Communities .....	16
4.3. Baseline Assessment.....	16
4.3.1. Vegetation Community Sensitivity Analysis.....	16
4.3.2. Species of Conservation Concern.....	18
4.3.3. Habitat Suitability Assessments for Species of Conservation Concern.....	18
4.3.4. Alien Invasive and Medicinal Flora Species.....	19
4.4. Study Limitations .....	19
4.4.1. Data Used for the Specialist Study.....	19
4.4.2. Assumptions, Uncertainties or Gaps in Knowledge (Study Limitations).....	19
5. Results.....	20
5.1. Baseline Description.....	20
5.1.1. Grassland Biome .....	20
5.1.2. Eastern Highveld Grassland .....	20
5.1.3. Eastern Temperate Freshwater Wetlands .....	21
5.1.4. Conservation Context.....	21
5.1.5. Vegetation Communities .....	26
5.1.6. Flora Species of Conservation Concern.....	32
5.1.7. Flora of Medicinal Value .....	35



5.1.8.	Declared Alien Invasive Species .....	36
5.1.9.	Fauna Communities and Species of Concern.....	37
5.1.10.	Ecological Attributes and Processes .....	50
5.1.11.	Description of Existing and Future Impacts On-Site .....	51
5.2.	Summary of Site Sensitivity Assessment .....	52
5.3.	Impact Assessment Methodology.....	54
5.4.	Impact Assessment .....	55
5.4.1.	Habitat Loss and Modification .....	56
5.4.2.	Habitat Fragmentation.....	58
5.4.3.	Establishment and Spread of Alien Invasive Species .....	60
5.4.4.	Mortality and Disturbance of Fauna .....	62
5.4.5.	Loss of Flora of Conservation Concern .....	65
5.4.6.	Loss and Disturbance of Fauna of Conservation Concern .....	67
5.5.	Monitoring Requirements.....	69
5.6.	Cumulative Impacts .....	69
6.	Conclusions and Recommendations .....	70
6.1.	Conditions for Inclusion in the Environmental Authorisation .....	71
7.	References .....	72
	Appendix A: Flora species recorded in the Study Area.....	75
	Appendix B: Bird species recorded in the Study Area .....	82

## List of Figures

Figure 1: Regional location of Belfast Coal Mine. ....	13
Figure 2: Aerial photograph of the study area (Belfast mining rights area). Note modified landscape comprising a mosaic of mine facilities, cultivated fields, alien tree plantations, grassland and wetland habitats. ....	14
Figure 3: Study area in relation to Mucina and Rutherford's (2011) regional vegetation types. ....	24
Figure 4: The Belfast Mining Rights Area in relation to the Mpumalanga Biodiversity Sector Plan (2019). ....	25
Figure 5: Moist grassland and wetland vegetation along a stream in the study area.....	27
Figure 6: Map of vegetation communities in the study area.....	28
Figure 7: Typical dry mixed grassland in the study area, dominated by Eragrostis grass species.....	30
Figure 8: Cultivated land under active maize production.....	31
Figure 9: Alien tree plantation and woodlot in the study area.....	32
Figure 10: <i>Boophone disticha</i> .....	35
Figure 11: <i>Eucomus autumnalis</i> .....	35
Figure 12: <i>Gladiolus ecklonii</i> .....	35

Figure 13: Gladiolus papilio.....	35
Figure 14: Serval (Leptailurus serval).....	39
Figure 15: Black-backed Jackal (Canis mesomelas).....	39
Figure 16: Water Mongoose (Atilax paludinosus) .....	39
Figure 17: Cape Clawless Otter (Aonyx capensis).....	39
Figure 18: Porcupine (Hystrix africaeaustalis) .....	39
Figure 19: Striped Polecat (Ictonyx striatus).....	39
Figure 20: Secretarybird (Sagittarius serpentarius) .....	43
Figure 21: Southern-Bald Ibis (Geronticus calvus).....	43
Figure 22: Cape Vulture (Gyps coprotheres) .....	43
Figure 23: Spotted Grass Snake (Psammophylax rhombeatus).....	48
Figure 24: Bubbling Kassina (Kassina senegalensis).....	48
Figure 25: Common Platanna (Xenopus laevis) .....	48
Figure 26: Ecological sensitivities of affected vegetation communities.....	53

## List of Tables

Table 1: Criteria for rating habitat sensitivity .....	16
Table 2: Flora species of conservation concern occurring and potentially occurring in the study area. .....	33
Table 3: Flora species of medicinal value. ....	35
Table 4: Declared alien invasive species recorded in the study area. ....	36
Table 5: Mammals recorded in the study area.....	37
Table 6: Mammals of conservation concern occurring and potentially occurring in the study area...40	
Table 7: Birds of conservation importance recorded and potentially occurring in the study area.....44	
Table 8: Herpetofauna recorded and potentially present in the study area.....46	
Table 9: Reptiles and amphibians of conservation concern potentially occurring in the study area. .49	
Table 10: Sensitivity of Affected Habitats.....	52
Table 11: Magnitude definition for ecological impact assessment .....	54
Table 12: Terrestrial ecology receptors for impact assessment.....	55
Table 13: Approximate extent of habitat loss of each of vegetation community.....	58

# 1. Introduction

Hawkhead Consulting (Hawkhead) was appointed by Golder Associates (Pty) Ltd (Golder) to conduct a terrestrial ecology impact assessment for proposed new infrastructure that will form part of the Belfast Expansion Project at Exxaro Coal's (Pty) Ltd (Exxaro) Belfast Coal Mine, in Mpumalanga Province, South Africa. Proposed new infrastructure that require authorisation include a new open cast shaft, discard dump, open pit extension, underground workings, and a conveyor. These project components are collectively referred to as the 'Project' or the 'Belfast Expansion Project' (BEP).

## 1.1. Purpose of the Report

The terrestrial ecology assessment forms part of a larger environmental authorisation process that is aimed at obtaining the necessary authorisations to undertake the proposed Project activities. This report provides:

- A baseline ecological characterisation of the mining rights area of Belfast Coal Mine based on existing data sources, with specific reference to the proposed Project's aboveground infrastructure footprints;
- An assessment of ecological impacts associated with proposed Project activities; and
- Recommended mitigation and monitoring measures for inclusion in the Project's environmental management programme and/or authorisation.

## 2. Project Location and Extent

Belfast Coal Mine is located approximately 10 km south-west of Belfast in Mpumalanga Province (Figure 1). The mining rights area (MRA) is approximately 5 819 ha in extent and currently comprises areas that have been transformed by mining and agriculture, alien tree plantations, and semi-natural and natural grassland and wetland habitats. All proposed Project infrastructure will be located within the MRA.

Proposed new above ground infrastructure that may have an impact on terrestrial flora and fauna communities include:

- The proposed opencast shaft will be located in the east of the MRA and has an approximate footprint of 45 ha.
  - Two shaft options have been proposed - Opencast Shaft Option 1 and Opencast Option 2 (preferred option);
- The proposed conveyor/haul road route runs on a north-south axis in the east of MRA and will have an approximate footprint of 7.3 ha. It will link the proposed underground area to the existing Belfast Implementation Project (BIP) processing facilities;
  - One conveyor/haul road route option (Option 1 Conveyor) has been assessed for Ramp Option 1;
  - Four conveyor/haul road route options have been assessed for Ramp area associated with Option 1, viz, Conveyor Alternative A, Conveyor Alternative B, Conveyor Alternative B, Conveyor Alternative D (preferred option); and
- The proposed open pit extension areas are located along the northern portion of the MRA, and have a combined footprint of approximately 636.8 ha;

- The proposed discard dump will be located along the south-western boundary of the MRA. The clearing of this site for mine-related development has already been approved under the authorisation for the Belfast Implementation Project.

Two spatial scales were considered for the terrestrial ecology assessment;

- The 'study area' is defined as the entire MRA, and was used to frame ecological baseline character and landscape context (i.e., the on-site fauna and flora communities, ecological processes and functional attributes).
- For the impact assessment component, a finer-scale of analysis was used, and reference was made to the 'proposed Project/infrastructure aboveground footprints' as a collective, or individually by component name (e.g., the proposed ramp footprint).

### 3. Applicable Legislation, Guidelines and Standards

The following national and provincial legislation were consulted during the study:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- National Environmental Management: Protected Areas Act (Act No. 57 of 2003);
- Environment Conservation Act (ECA) (Act No. 73 of 1989);
- Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983); and
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998).

Guidelines and standards under the NEMA that were consulted include:

- Procedures for the assessment and minimum criteria for reporting in identified themes in terms of the NEMA;
- Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial animal species;
- Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial plant species; and
- Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity.

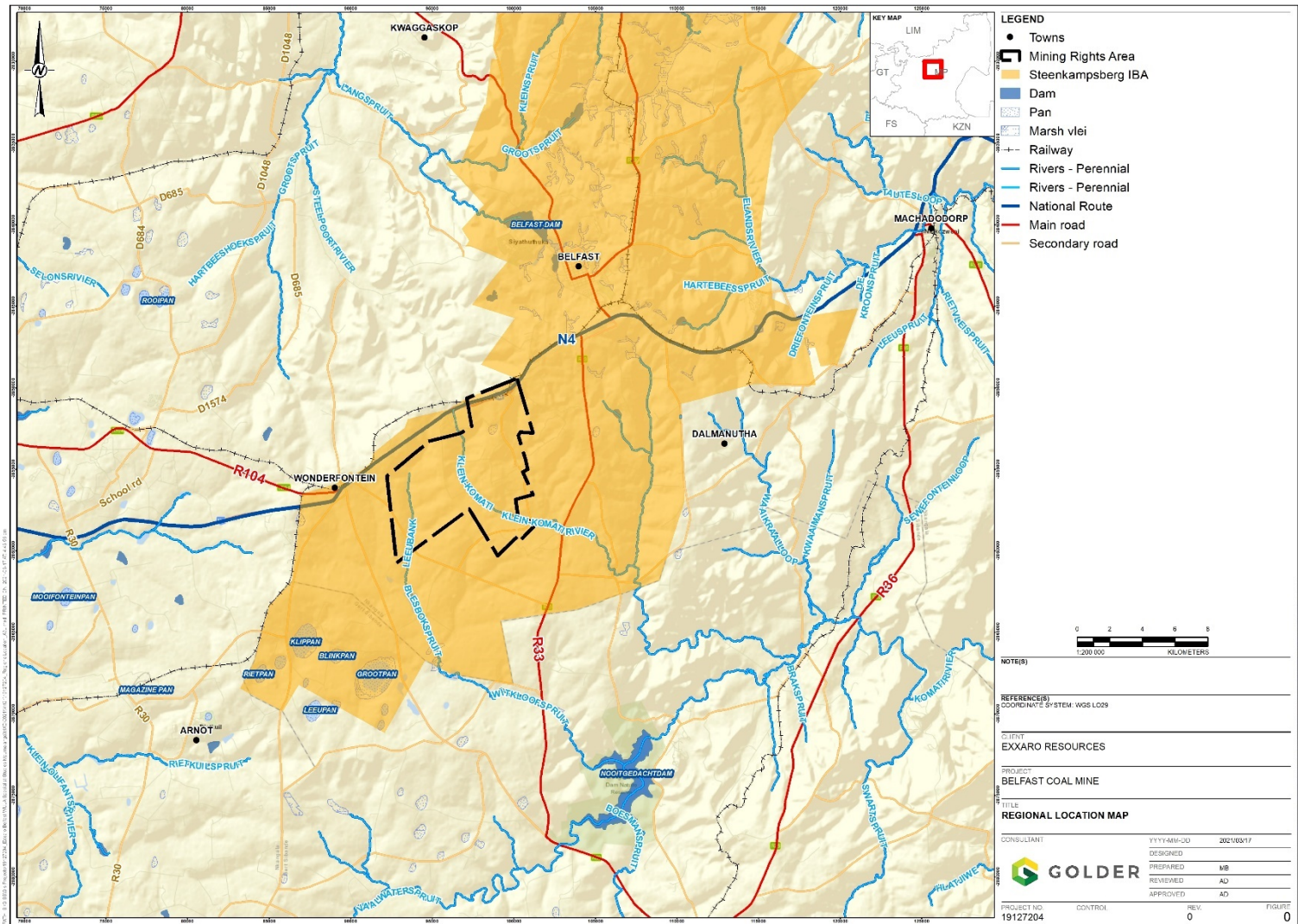


Figure 1: Regional location of Belfast Coal Mine.

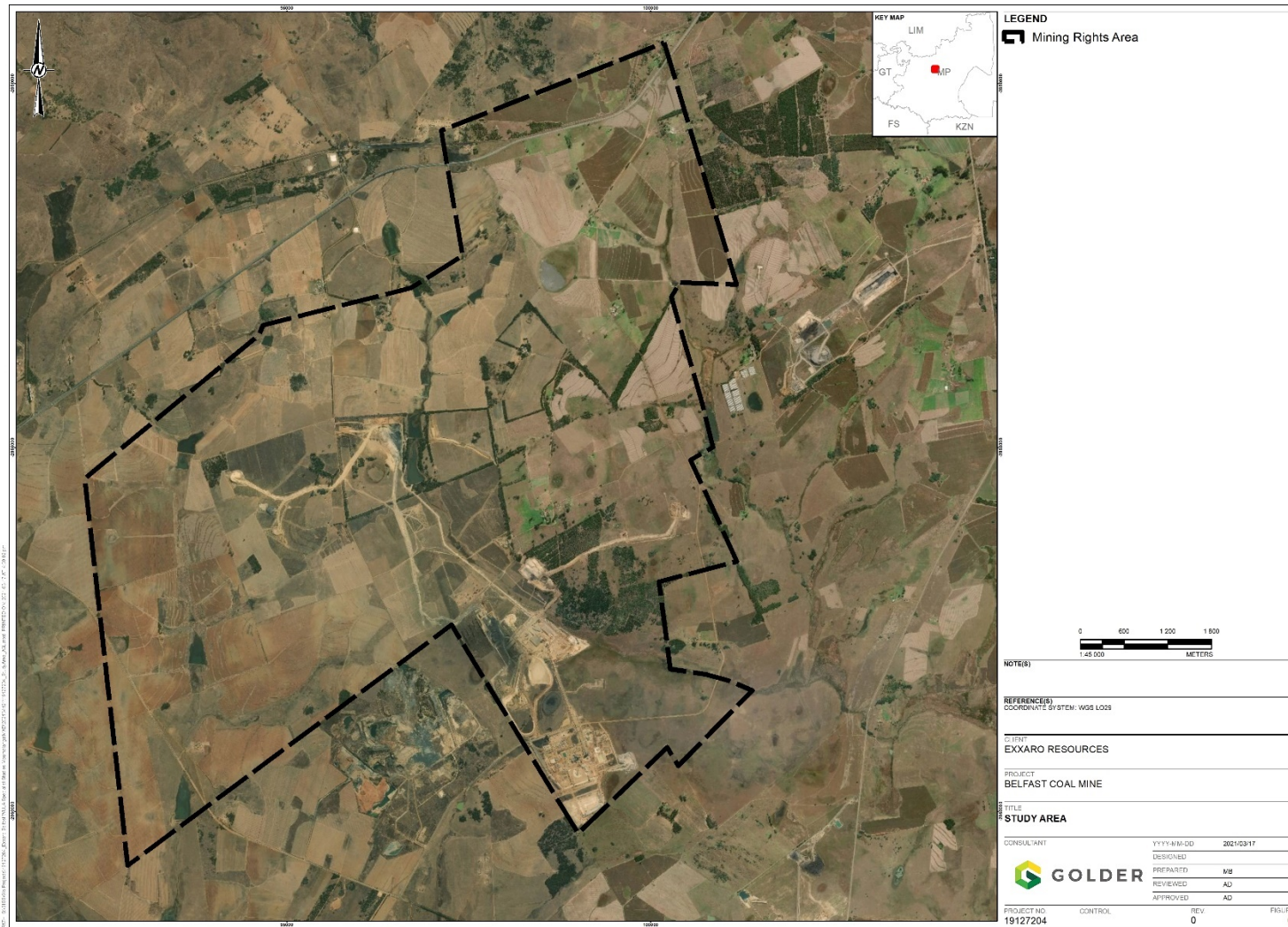


Figure 2: Aerial photograph of the study area (Belfast mining rights area). Note modified landscape comprising a mosaic of mine facilities, cultivated fields, alien tree plantations, grassland and wetland habitats.

## 4. Methodology

### 4.1. Approach to the Terrestrial Ecology Assessment

The original ecological baseline studies for Belfast Coal Mine were conducted by Golder in 2011. These studies included, amongst other components, a terrestrial ecology assessment that focused on the entire study area. In 2016, Golder on behalf of Exxaro, implemented a long-term ecological monitoring programme that included bi-annual (wet and dry season) and then annual (wet season) monitoring of terrestrial fauna and flora and wetland systems in the study area. A separate wet-season study focusing on species of conservation concern was also conducted by GroundTruth in 2017. The ecological data from these various studies and monitoring reports forms a substantial, multi-season and long-term ecological baseline dataset for the study area.

The National Web-based Environmental Screening Tool characterised the Animal Species Theme for the study area as High Sensitivity, the Plant Species Theme as Medium Sensitivity, and Terrestrial Biodiversity Theme as Very High.

Considering the presence of the existing ecological dataset, no additional field work was conducted for the proposed Project. The approach followed for this terrestrial ecology assessment therefore included:

- Reviewing and consolidating existing ecological data;
- Developing and updating the baseline ecological characterisation of the study area, with specific reference to the proposed infrastructure footprints, and
- Identifying and assessing anticipated Project impacts.

### 4.2. Literature Review

#### 4.2.1. Vegetation Types and Flora Species

- A general habitat description relevant to the study area and the region surrounding the study area was obtained from Mucina and Rutherford (2011) and SANBI (2013);
- The formal conservation context and significant landscape features of the region at a provincial and national level was established based on the Mpumalanga Biodiversity Sector Plan (2019), the National List of Threatened Ecosystems (NEMBA Threatened Ecosystems, 2011), the national Protected Areas Expansion Strategy for South Africa (DEA, 2016) and the River Freshwater Ecosystem Priority Areas;
- A list of threatened flora species that are known from the region and that may occur in the study area was obtained from the SANBI's online Botanical Database of Southern Africa (BODATSA). This was augmented with:
  - Flora information presented in the original ecological study (Golder, 2011);
  - Data and information on general floristics and vegetation communities/habitats, presented in the bi-annual and annual terrestrial ecology (Golder, 2019a) and wetland monitoring reports (David Hoare Consulting, 2019);
  - Data on flora of conservation concern presented in the 2017 GroundTruth report; and
- A revised vegetation community map was developed at a desktop-level using available Google Earth imagery and an overlay of the existing wetland delineations. Vegetation community delineations were focused specifically on the proposed footprints of

aboveground Project infrastructure. No additional confirmatory fieldwork was conducted for the vegetation map.

#### 4.2.2. Fauna Communities

##### *Mammals*

- A list of mammals that have been recorded in the study area during the long-term monitoring programme was obtained from Golder (2019a and b); and
- Historic distribution ranges in Stuart and Stuart (2007) were also consulted to identify other possible species of conservation concern that may be present in the region.

##### *Birds*

- A list of birds that have been recorded in the study area during the long-term monitoring programme was obtained from Golder (2019a and b);
- Bird data from the South African Bird Atlas Project 2 (SABAP2) was reviewed to identify possible bird species of conservation concern that may be present in the study area; and
- Marnewick *et al.*, (2015) was consulted for a description of the Steenkampsberg Important Bird Area (IBA), which encompasses the study area.

##### *Herpetofauna (Reptiles and Amphibians)*

- A list of herpetofauna that have been recorded in the study area was obtained from Golder (2019a and b) and GroundTruth (2017);
- Bates *et al.*, (2014) and Du Preez and Carruthers (2009) were reviewed to identify possible reptile and amphibian species of conservation concern that may be present in the region; and
- Additional data on species recorded in the Quarter Degree Squares (QDS) that encompass the study area were also sourced from the ReptileMAP and FrogMAP (FitzPatrick Institute of African Ornithology, 2021).

##### *Invertebrates*

- Invertebrates of conservation concern that have been recorded in the study area were based on GroundTruth (2017).

### 4.3. Baseline Assessment

#### 4.3.1. Vegetation Community Sensitivity Analysis

Habitat sensitivity was determined by subjectively assessing the ecological integrity and conservation importance of identified vegetation communities/land units. The habitat sensitivity criteria developed by Golder and presented in Table 1 were used to guide the habitat sensitivity analysis.

*Table 1: Criteria for rating habitat sensitivity*

Score	Ecological Integrity	Conservation Importance
<b>High</b>	Habitats of high ecological integrity have compositional, structural and functional characteristics that are close to the natural/sustainable state (i.e., reference	Habitats of high conservation importance or irreplaceability have one or a combination of the following attributes:



Score	Ecological Integrity	Conservation Importance
	<p>conditions). As such, they have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>• Key floral and faunal indicators are present or highly likely to be present;</li> <li>• Large habitat patch that is mostly unfragmented and has a high level of connectivity to adjacent natural habitat patches;</li> <li>• Has little to no evidence of anthropogenic disturbances (pollution, earth works, etc.); and</li> <li>• Little or no alien invasive species establishment.</li> </ul>	<ul style="list-style-type: none"> <li>• Pristine or relatively undisturbed habitat displaying high species richness;</li> <li>• Areas playing an important functional role in ecological processes at a landscape scale (e.g., high levels of connectivity, source patches, water attenuation, etc.);</li> <li>• Niche or relatively rare/unique habitat within the landscape that contributes to overall habitat heterogeneity;</li> <li>• Areas designated by provincial or national authorities as having high conservation importance, sensitivity or irreplaceability; and</li> <li>• Areas with confirmed presence or high probability of occurrence of Red List and/or protected species.</li> </ul>
<b>Moderate</b>	<p>Habitats of moderate ecological integrity have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>• Moderate levels of anthropogenic disturbance; and</li> <li>• Despite disturbances, habitat maintains much of the same functional attributes as areas in a natural/sustainable state.</li> </ul>	<p>Habitats of moderate conservation importance have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>• Intermediate levels of species richness;</li> <li>• No or low probability of Red List and/or protected species as determined by critical habitat assessments; and</li> <li>• Disturbed areas that are situated adjacent to habitat of high ecological integrity and/or conservation importance and therefore may play a role as an ecological support area.</li> </ul>
<b>Low</b>	<p>Habitats of low ecological integrity have a combination of the following attributes:</p> <ul style="list-style-type: none"> <li>• Severely modified from natural state as a consequence of anthropogenic activities, with poor species richness and all or most key floral and faunal indicators absent;</li> <li>• Highly fragmented areas, with little or no connectivity to adjacent natural habitat;</li> <li>• High incidence of alien species establishment; and</li> </ul>	<p>Habitats of low conservation importance are typically transformed or highly disturbed, with little or no ecological integrity. These areas are species poor and in their current form, play little role in ecological processes and thus cannot contribute toward biodiversity conservation.</p>

Score	Ecological Integrity	Conservation Importance
	<ul style="list-style-type: none"> <li>Successful rehabilitation may restore some degree of habitat integrity.</li> </ul>	
<b>Negligible</b>	Completely transformed or developed areas with no natural habitat remaining and limited scope for rehabilitation.	Completely transformed or developed areas with no natural habitat remaining and limited scope for rehabilitation.

#### 4.3.2. Species of Conservation Concern

Species of conservation concern were based on the national and provincial Red Lists of threatened and near threatened flora and fauna species, and the Protected status of species, as per national and provincial legislation. These included:

- Red List of South African Plants Version (SANBI, 2020);
- Red List of Mammals of South Africa, Lesotho and Swaziland (Childs *et al.*, 2016);
- Regional Red List for Birds of South Africa, Lesotho and Swaziland (Taylor, *et al.*, 2015);
- Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland (Bates *et al.*, 2014);
- IUCN Red List of Threatened Species for amphibians (IUCN, 2021-1);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Threatened or Protected Species List (Notice 389 of 2013) (NEMBA ToPS List, 2007);
- Mpumalanga Nature Conservation Act (Act No. 10 of 1998), specifically Schedule 4, 11 and 12 concerning protected and specially protected flora and fauna; and
- Mpumalanga Red List of Threatened Flora and Fauna.

#### 4.3.3. Habitat Suitability Assessments for Species of Conservation Concern

Based on the lists of species of conservation concern potentially present, a 'probability of occurrence' in the study area for each species was determined by conducting habitat suitability assessments. The following parameters were used in the assessments:

- Habitat requirements: Most threatened and endemic species have very specific habitat requirements. The presence of these habitats in the study area was evaluated;
- Habitat status: The status or ecological condition of available habitat in the area was assessed. Often a high level of habitat degradation will negate the potential presence of sensitive species; and
- Habitat linkage: Dispersal and movement between natural areas for breeding and feeding are important population-level processes. Habitat connectivity within the study area and to surrounding natural habitat and corridors was evaluated to determine the likely persistence of species of concern in the study area.

Probability of occurrence is presented in the following categories:

- Probable: the species is likely to occur on the site due to suitable habitat and resources being present on the site;
- Possible: The species may occur on the site, or move through the site (in the case of mobile species), due to potential habitat and/or resources;

- Unlikely: the species will not likely occur on the site due to lack of suitable habitat and resources; and
- Any species of conservation concern observed/documentated in the study area is listed as 'recorded'.

#### 4.3.4. Alien Invasive and Medicinal Flora Species

- Alien invasive plant species were categorised according to the National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004) and the Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 2003); and
- Flora of medicinal value were based on purported uses presented in Van Wyk, *et al.*, (2009).

### 4.4. Study Limitations

#### 4.4.1. Data Used for the Specialist Study

- The information presented in this report is based on field data collected during the original baseline study for Belfast Coal Mine and field data collected over several seasons of biannual and later annual terrestrial ecology monitoring (combined results presented in Golder 2019 a and b) and a specialist biodiversity study conducted by GroundTruth in 2017;
- No additional field work was conducted for this specific Project. This notwithstanding, considering the overall duration of the field monitoring period and the additional biodiversity studies that have been conducted in the study area, the presented field data are considered an up-to-date baseline for the study area, and germane to the assessment of proposed Project impacts; and
- The delineation of vegetation communities focused on the proposed development footprints only, and was conducted at a desktop-level using available Google Earth imagery and an overlay of the existing wetland delineations. No confirmatory field work was conducted. It is therefore limited to the spatial and resolution accuracy of the imagery and may not reflect recent land cover changes associated with on-going mining activities or farming practices in the study area.

#### 4.4.2. Assumptions, Uncertainties or Gaps in Knowledge (Study Limitations)

- With reference to the historic field work that has been conducted in the study area to-date - the absence or non-recording of a specific flora or fauna species, at a particular time, does not necessarily indicate that 1) the species does not occur there; 2) the species does not utilise resources in that area; or 3) the area does not play an ecological support role in the life-history of that species.

## 5. Results

### 5.1. Baseline Description

The study area is located in the grassland biome and according to the regional mapping of South Africa's vegetation types by Mucina and Rutherford (2011), it is dominated by Eastern Highveld Grasslands (Gm12), with elements of Eastern Temperate Freshwater Wetlands (AZf 3). These, along with the general characteristics of the grassland biome, are discussed in more detail below:

#### 5.1.1. Grassland Biome

The study area is located in the grassland biome, which covers approximately 28% of South Africa and is the dominant biome of the central plateau and inland areas of the eastern subcontinent (SANBI, 2013). Grasslands are typically situated in moist, summer rainfall regions that experience between 400 mm and 2000 mm of rainfall per year. Vegetation consists of a dominant field-layer comprising grasses and herbaceous perennials, with little- to no woody plants present.

South Africa's grassland ecosystems are parsed into five groups, with the study area forming part of the 'Mesic Highveld Grasslands' grouping (SANBI 2013). These grasslands occur at mid-altitudes and experience warm, wet summers (MAP 700-1200 mm) and cold winters. They are typically highly productive sourveld grasslands that are dominated by long-lived perennial grasses (SANBI, 2013).

Fire is common in Mesic Highveld Grasslands and, coupled with frequent winter frost, maintains these ecosystems in a relatively treeless form (SANBI, 2013). Apart from their importance as rich stores of biodiversity, grasslands are critically important water production landscapes, constituting about half of South Africa's Strategic Water Source Areas (SANBI, 2013).

#### 5.1.2. Eastern Highveld Grassland

Eastern Highveld Grasslands extend from Johannesburg in the east through to Bethel, Ermelo and Piet Retief in the west. This vegetation type is found on slightly- to moderately undulating plains, low hills and wetland depressions. Grasses are typical Highveld species from the genera *Aristida*, *Digitaria*, *Eragrostis* and *Tristachya*. Indigenous woody species are mainly restricted rocky areas and include *Celtis africana*, *Protea caffra*, *Protea welwitschii*, *Diospyros lycioides*, *Searsia magalimontana* and *Senegalia caffra* (Mucina & Rutherford, 2011).

Mucina & Rutherford (2011) note the following species, amongst several others, as important taxa in Eastern Highveld Grassland:

**Shrubs:** *Anthospermum rigidum* and *Seriphium plumosum*.

**Graminoïdes:** *Aristida aequiglumis*, *Aristida congesta*, *Aristida junciformis*, *Cynodon dactylon*, *Digitaria monodactyla*, *Eragrostis chloromelas*, *Eragrostis curvula*, *Eragrostis plana*, *Eragrostis racemosa*, *Heteropogon contortus*, *Loudetia simplex*, *Setaria sphacelata*, *Sporobolus africanus*, *Themeda triandra*, *Alloteropsis semialata* and *Monocymbium cerasiiforme*.

**Herbs:** *Berkheya setifera*, *Haplocarpha scaposa*, *Euryops gilfillanii*, *Euryops transvaalensis*, *Justicia anagalloides*, *Acalypha angusta*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Kohautia amatymbica*, *Lactuca inermis*, *Gladiolus crassifolius*, *Haemanthus humilis* and *Selago densiflora*.

**Endemic Taxa:** The geophytic herbs *Agapanthus inapertus*, *Eucomis vandermerwei* and the succulent herb *Huernia insigniflora* are endemic to this region.

### 5.1.3. Eastern Temperate Freshwater Wetlands

Eastern Temperate Freshwater Wetlands occur in patches throughout South Africa and are associated with flat landscapes or shallow depressions that periodically fill with water during the wet season, and support zoned systems of aquatic and hygrophilous vegetation (Mucina & Rutherford, 2011).

Important flora species taxa in the Eastern Temperate Freshwater Wetlands according to Mucina & Rutherford (2011), include the following:

#### *Marshes*

**Graminoides:** *Agrostis lachnantha*, *Carex acutiformis*, *Carex cernua*, *Cyperus congestus*, *Eleocharis palustris*, *Eragrostis plana*, *Eragrostis planiculmis*, *Fuirena pubescens*, *Helictotrichon turgidulum*, *Hemarthria altissima*, *Imperata cylindrica*, *Leersia hexandra*, *Paspalum dilatatum*, *Paspalum urvillei*, *Pennisetum thunbergii*, *Schoenoplectus decipiens*, *Andropogon appendiculatus*, *Andropogon eucomus*, *Aristida aequiglumis*, *Cyperus cyperoides*, *Cyperus distans*, *Setaria pallide-fusca* and *Xyris gerardii*.

**Herbs:** *Centella asiatica*, *Ranunculus multifidus*, *Berkheya radula*, *Berkheya speciosa*, *Equisetum ramosissimum*, *Falckia oblonga*, *Haplocarpha lyrata*, *Helichrysum difficile*, *Helichrysum dregeanum*, *Hydrocotyle sibthorpioides*, *Lobelia angolensis*, *Mentha aquatica*, *Rumex lanceolatus* and *Wahlenbergia banksiana*.

**Reed and sedge beds:** *Phragmites australis*, *Schoenoplectus corymbosus* and *Typha capensis*.

#### *Water bodies*

**Aquatic herbs:** *Aponogeton junceus*, *Ceratophyllum demersum*, *Lagarosiphon major*, *Lagarosiphon muscoides*, *Marsilea capensis*, *Myriophyllum spicatum*, *Nymphaea lotus*, *Nymphaea nouchali*, *Nymphoides thunbergiana*, *Potamogeton thunbergii*, *Ctricularia inflexa* and *Marsilea farinosa*.

**Endemic Taxon:** *Rorippa fluviatilis* var. *caledonica*.

### 5.1.4. Conservation Context

#### *National and Provincial Conservation Plans*

At a national level, the NEMBA Threatened Ecosystems, (2011) recognises both Eastern Highveld Grassland and Eastern Temperate Freshwater Wetlands as 'Vulnerable' ecosystems. Accordingly, the entire study area is mapped as Vulnerable. It is noted however, that this is a high-level, pre-development scale of analysis. The study area, as well as most of the surrounding landscape is characterised by a complex land cover matrix, dominated by modified habitats/land units that comprise *inter alia*; cultivated fields, alien tree plantations and mining infrastructure. Natural grassland and wetland habitats typically occur in small, elongated land parcels that are typically associated with drainage areas or rocky areas, and embedded within the overall modified landscape matrix. In many instances, these natural habitat patches are disturbed and characterised by secondary vegetation.

The character of on-site habitats is better reflected in the fine-scale mapping presented in the Mpumalanga Biodiversity Sector (2019) (MBSP, 2019) – refer to Figure 4. The MBSP (2019), which amongst other things identifies critical biodiversity areas (CBA) in the province, indicates that the majority of the study area is ‘Heavily modified’ and ‘Moderately modified – old lands’ (Figure 4). Most of the remaining land is classified as ‘Other Natural Areas’. Smaller areas of habitat classified as ‘CBA Optimal’ are present in the north and south-west of the study area, while patches of ‘CBA Irreplaceable’ habitat are present in the south-east corner (Figure 4).

With regard to the proposed Project footprints, most of the land associated with each infrastructure component, including all related alternatives/options is delineated as ‘Heavily modified’ or ‘Moderately modified – old lands’, with smaller embedded patches of ‘Other natural areas’ also present - shown in Figure 4. It is noted that an area of ‘CBA Optimal’ land is located in the north of the proposed footprint of Pit 9. This area is associated with patches of moist grassland and wetland, and dry mixed grassland – vegetation communities that may contain species of conservation concern. This area will be negatively impacted by habitat loss during construction (Figure 4). Land immediately to the west of the proposed discard dump, outside the study area, is also designated ‘CBA Optimal’.

In terms of the MBSP (2019), land designated as ‘CBA Optimal’ is optimally located to meet Mpumalanga’s various biodiversity conservation targets. Although land designated as ‘Other natural areas’ has not been identified to meet biodiversity pattern or process targets (provided CBA and ecological support areas are not lost), they are still important repositories of species and as ecological infrastructure (MBSP, 2019).

#### *Important Bird Area*

The study area falls within the Steenkampsberg Important Bird Area (IBA) – see Figure 1. This large IBA extends from Verlorein Vlei in the north, to south of the N4 Highway (Marnewick, *et al.*, 2015) Figure 1. Several bird species of conservation concern are known to occur in the IBA, with the following globally threatened taxa noted as trigger species; Southern Bald Ibis (*Geronticus calvus*), Wattled Crane (*Bugeranus carunculatus*), Blue Crane (*Anthropoides paradiseus*), Grey Crowned Crane (*Balearica regulorum*), White-winged Flufftail (*Sarothrura ayresi*), Rudd’s Lark (*Heteromirafra ruddi*), Yellow-breasted Pipit (*Anthus chloris*), Blue Korhaan (*Eupodotis caerulescens*) and the Secretarybird (*Sagittarius serpentarius*). Several other regionally threatened, range-restricted and biome-restricted species are also known to be present in the IBA (Marnewick, *et al.*, 2015). Several of these species have been recorded in the study area – refer to Section 5.1.9.2.

#### *Protected Area Expansion Strategy*

According to the DEA (2016), the Steenkampsberg IBA in which the study area is located is also recognised as a key priority area for protected area expansion in Mpumalanga. The recognised important biodiversity features for these areas in Mpumalanga include key corridors, intact grasslands, unprotected threatened species, threatened ecosystems and areas with remaining wilderness characteristics. The proposed mining activities will result in the loss of patches of natural habitat, which will affect the amount of natural habitat in the Steenkampsberg IBA.

### *River Freshwater Ecosystem Priority Areas*

The study area is also located in a recognised freshwater priority area (FEPA) sub-catchment. These areas have been identified based on several factors associated with biodiversity targets for river and wetland ecosystem types, and the allied biota. Drainage features in the study area, like the Klein Komati River, drain into the larger Komati River.

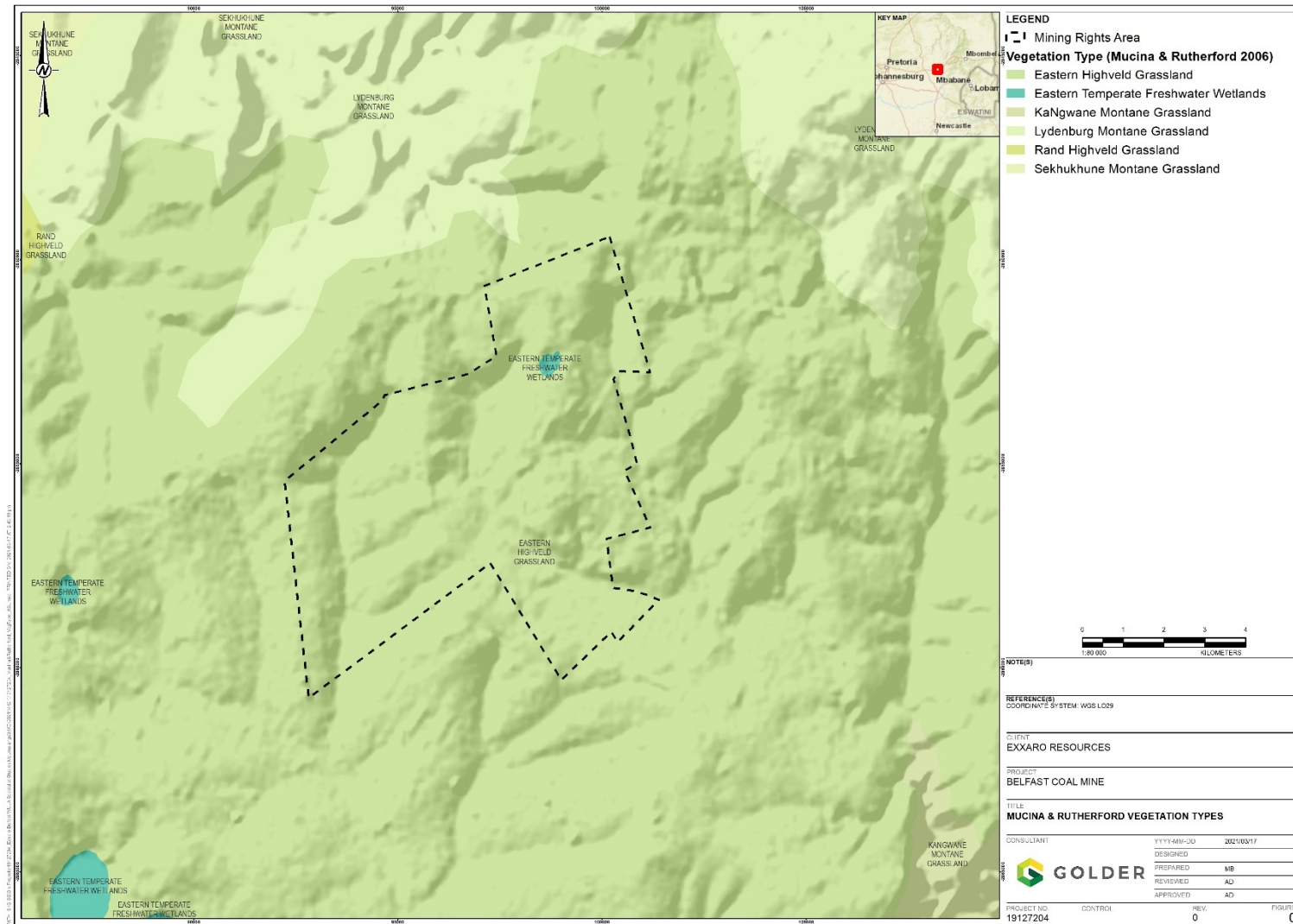


Figure 3: Study area in relation to Mucina and Rutherford's (2011) regional vegetation types.



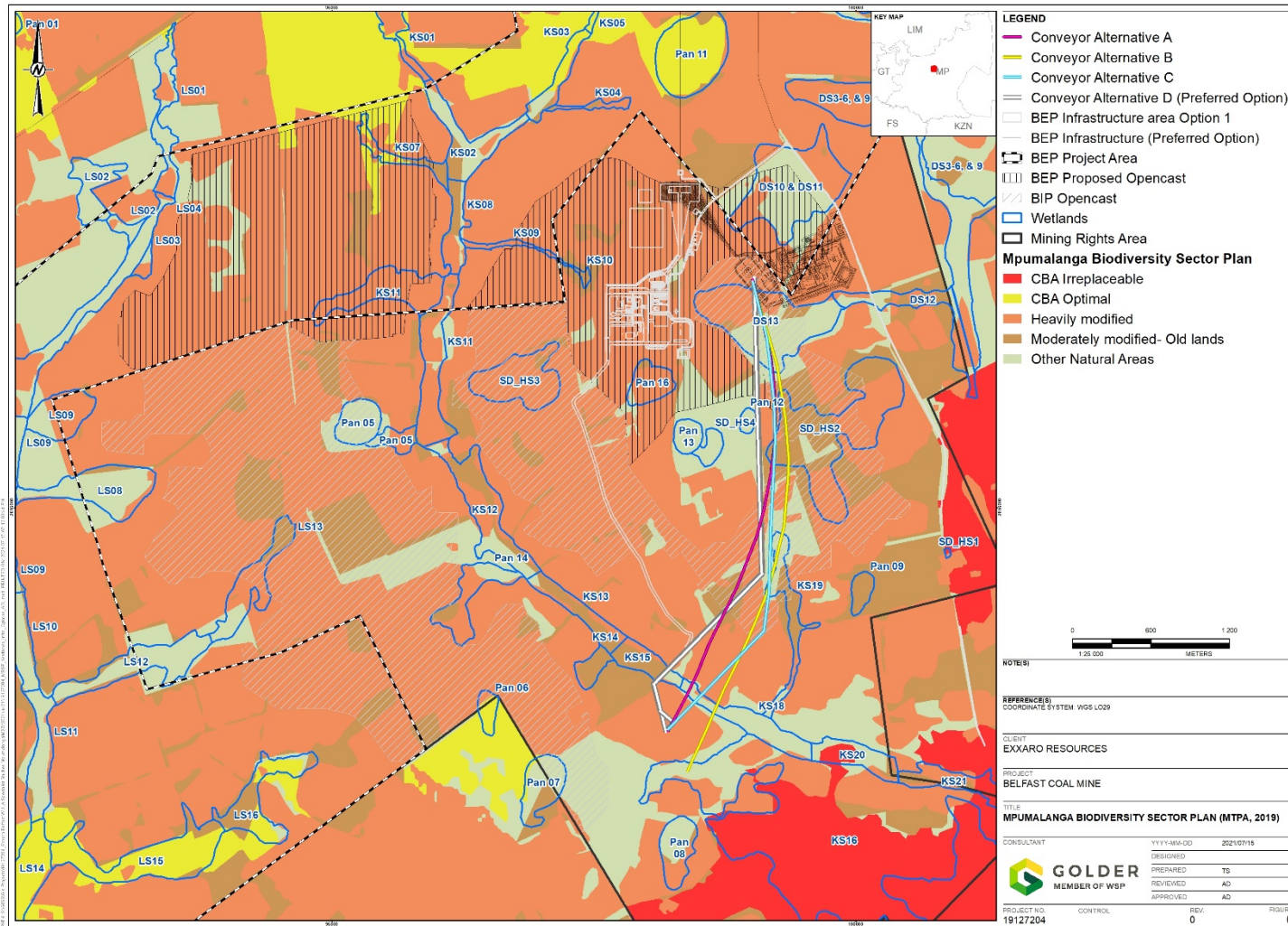


Figure 4: The Belfast Mining Rights Area in relation to the Mpumalanga Biodiversity Sector Plan (2019).

### 5.1.5. Vegetation Communities

Outside of areas that have been completely transformed / developed by mining and other anthropogenic activities, four main vegetation communities are present in the study area. All four communities are relevant to the proposed Project's aboveground infrastructure footprints.

A description of each community is presented below, along with representative photographs. A vegetation map, focusing on the proposed infrastructure footprints in the study area is shown in Figure 6. The delineation of the moist grassland and wetland community is based on existing wetland delineations and, due to its importance, is used as the primary/overlay layer in the vegetation map. For a list of flora species recorded in the study area refer to Appendix A.

#### 5.1.5.1. Moist Grassland and Wetlands

This broad vegetation community is associated with moist soils in drainage valleys, artificial dams, pans and seep zones in the study area (Figure 5). Disturbance levels vary, with some moist grassland and wetland portions modified by farming activities and others in generally good condition.

In undisturbed areas, vegetation structure is low- to short closed grassland (*sensu* Edwards 1983). Seasonally and temporally moist areas are generally grass dominated, with species like *Agrostis eriantha*, *Arundinella nepalensis*, *Eragrostis gummiflua*, *E. plana*, *Leersia hexandra*, *Paspalum dilatatum\**, *Pennisetum sphacelata* and *Setaria sphacelata* dominant or very common. In more permanently moist areas, species such as *Typha capensis* and various *Cyperaceae*, including *inter alia*; *Cyperus denudatus*, *Eleocharis* species, *Juncus effusus\**, *Juncus lomatophyllus* and *Schoenoplectus brachyceras* are common (\*denotes alien species).

Herbaceous plants include a variety of indigenous and alien forbs, such as *Bidens pilosa\**, *Centella asiatica\**, *Helichrysum aureonitens*, *Helichrysum pilosellum*, *Hypochaeris radicata\**, *Lobelia flaccida*, *Monopsis decipiens*, *Ranunculus multifidus*, *Senecio erubescens*, *Persicaria* species, *Senecio consanguineus* and *Senecio inornatus*.

Two declared alien invasive species, viz *Cirsium vulgare* and *Verbena bonariensis* are common in this vegetation community. Both these taxa are listed as NEMBA 1b invasive species and readily establish in disturbed areas. Although not overly abundant, *Acacia dealbata* (Category 2), *Eucalyptus camaldulensis* (Category 1b), *Phytolacca octandra* (Category 1b) and *Populus x canescens* (Category 2) have also been recorded in the community.

#### Sensitivity Aspects

Although areas of moist grassland and wetland exhibit varying degrees of disturbance and modification, overall the ecological integrity of this community ranges from moderate to high. The value of this community as fauna and flora habitat is also considerable, with elongated stretches providing important movement corridors for landscape scale dispersal.

Several flora species of conservation concern have been recorded in this community, including *inter alia*, *Eucomis autumnalis* and various *Dierama*, *Gladiolus* and *Watsonia* species (refer to Section 5.1.6). It is also noted that most fauna species conservation concern that have been recorded in the study area, have also been recorded in this community or have a strong habitat association with it (refer to Section 5.1.9). The conservation importance of areas of this vegetation community is

therefore high. Accordingly, these areas are considered to have a high sensitivity to ecological disturbances.



*Figure 5: Moist grassland and wetland vegetation along a stream in the study area.*

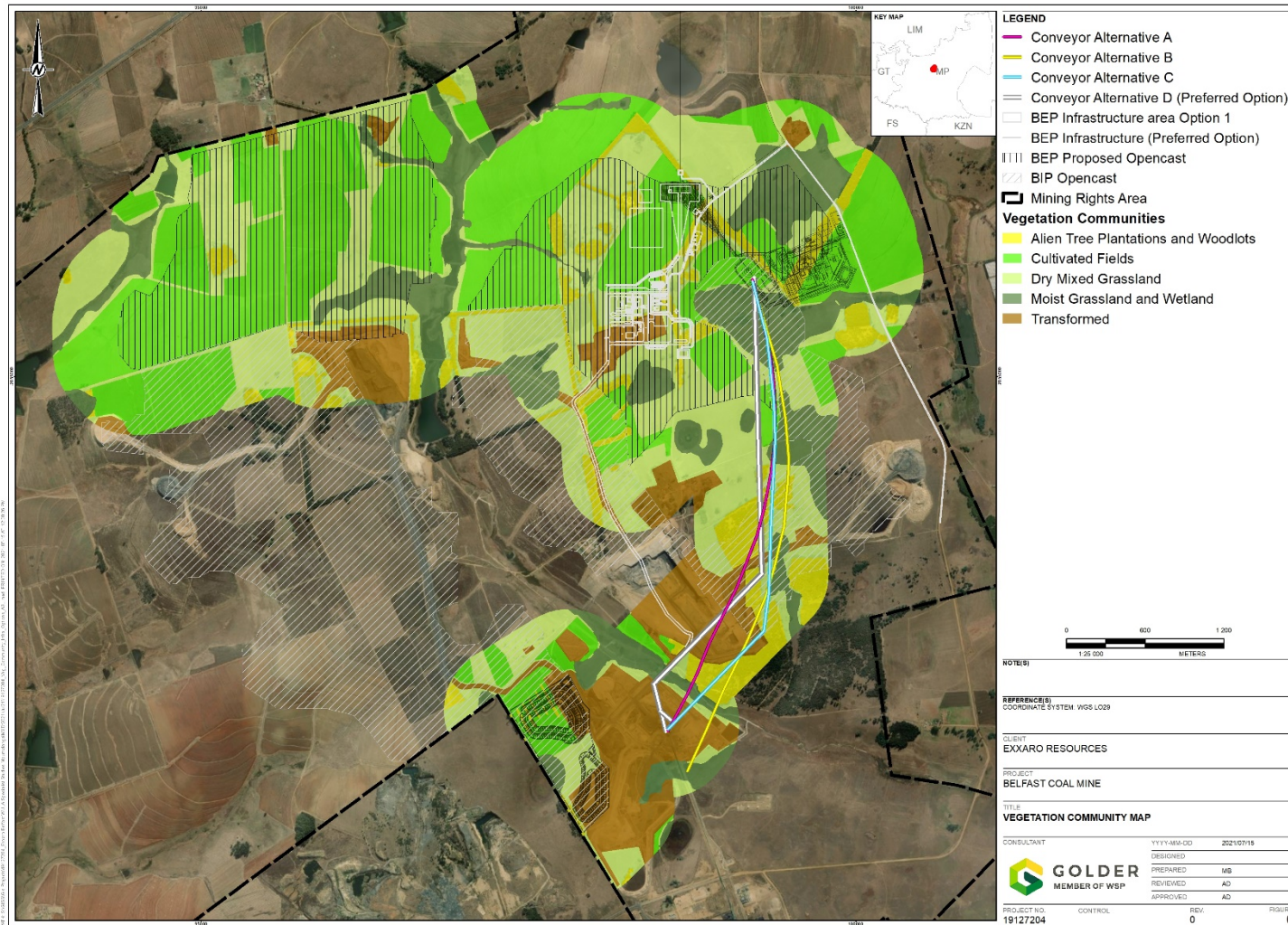


Figure 6: Map of vegetation communities in the study area.

#### 5.1.5.2. Dry Mixed Grasslands

This is broadly defined vegetation community. These grasslands range from small, fairly undisturbed grassland patches, to large secondary grassland patches that have been subject to historical disturbances, either in the form of past cultivation (incl. pasture enhancement) or high levels of livestock grazing. Structurally, these grasslands range from short open- to closed grassland (*sensu* Edwards, 1983).

In terms of composition, large areas of this community are generally species-poor and comprise subclimax vegetation characteristic of secondary succession. *Eragrostis* grass species, such as *Eragrostis chloromelas*, *E. curvula* and *E. plana* are dominant, as are several ruderal forbs (Figure 7). *Eragrostis* species typically proliferate in grasslands that have been heavily grazed and trampled, or that have elevated soil nitrogen levels resulting from either or a combination of artificial nutrient enrichment or the exclusion of fire (read Mentis and Huntley, 1982). Other common grasses recorded in this community include *Aristida junciformis*, *Digitaria eriantha* and *Eragrostis racemosa*. Common forbs include, *inter alia*; *Pollichia campestris*, *Oldenlandia herbacea*, *Richardia brasiliensis*\*, *Rumex acetosella*\* and *Selago densiflora*. In less disturbed grassland patches, flora species richness is generally higher and several additional grasses are present, such as *Alloteropsis semialata*, *Themeda triandra*, *Cymbopogon pospischilii* and *Tristachya leucothrix*.

This community also includes grassland areas that historically were actively managed (mowing and baling) as grazing pastures, but are no longer actively managed by farmers. These areas are considered to have functional attributes more aligned to disturbed/secondary grassland, than cultivated fields.

Indigenous woody species are rare in this community, with *Seriphium plumosum* the most common. Scattered alien invasive tree species such as *Acacia dealbata*, *A. mearnsii* and *Eucalyptus camaldulensis* are however, common in grassland patches that are in close proximity to alien tree plantations/woodlots.

#### Sensitivity Aspects

Although smaller, less disturbed patches of dry mixed grassland are present in the study area, most areas of this vegetation community are disturbed and generally characterised by low floristic diversity and ecological integrity. It is noted that *Boophone disticha*, which is listed as 'protected' in Mpumalanga, has been recorded in undisturbed patches of dry mixed grassland. However, overall, and depending on past disturbances characteristics of each patch, the likelihood of many other flora species of conservation concern occurring in this community is considered low to moderate.

Areas of dry mixed secondary grassland do provide important buffering, supporting and connecting habitat across the landscape for fauna, and therefore they will contribute to maintaining local populations of fauna species of conservation concern. The conservation importance of this community is rated moderate. Accordingly, these areas have a moderate sensitivity to ecological disturbances.



Figure 7: Typical dry mixed grassland in the study area, dominated by *Eragrostis* grass species.

#### 5.1.5.3. Cultivated Fields

The cultivated fields vegetation community is a modified habitat unit. Historically, maize was the main crop-type grown in cultivated fields in the study area (Figure 8). With the commencement of mining activities however, most cultivated fields have been left fallow and are characterised by ruderal weedy vegetation, dominated by alien species. Most cultivated fields outside the current mine boundary fence are still actively farmed (Pers. Obs.). This community also includes grazing pastures that are still actively managed and enhanced for livestock (mown and baled). *Digitaria eriantha* appears to be the main species cultivated in actively managed grazing pastures.

Common alien forb species that typically establish in fallow or abandoned cultivated include, *inter alia*; *Alternanthera pungens*, *Amaranthus hybridus*, *Bidens pilosa*, *Bidens bipinnata*, *Chenopodium album*, *Cirsium vulgare*, *Cosmos bipinnatus*, *Datura strumarium*, *Pseudognaphalium luteo-album*, *Schkuhria pinnata*, *Tagetes minuta* and *Verbena bonariensis*.

#### Sensitivity Aspects

Cultivated fields have a low ecological integrity. The probability of species of conservation concern being present is low, and accordingly, their conservation importance is low. Cultivated fields therefore have negligible sensitivity with regard to ecological disturbances.



Figure 8: Cultivated land under active maize production.

#### 5.1.5.4. Alien Tree Plantations and Woodlots

Alien tree plantations and woodlots are common in the study area. They typically comprise a mixture of alien *Acacia* species (wattles) - most commonly *Acacia dealbata* but also *A. mearnsii*, as well as *Eucalyptus camaldulensis* trees (Figure 9).

Many of the trees in plantations and woodlots in the study area are characterised by coppicing growth, which indicates that they have been harvested (probably by members of local communities) and are now in secondary rotation coppicing. Little indigenous flora is present in well-established plantations/woodlot, with the herbaceous layer suppressed or in some cases, largely absent. Where it does occur, it is typically dominated by alien weedy taxa, such as *inter alia*; *Biden pilosa* and *Tagetes minuta*.

#### Sensitivity Aspects

Alien tree plantations and woodlots are modified habitats, with low ecological integrity. This notwithstanding, these areas do enhance local landscape heterogeneity, and provide roosting and nesting sites for birds and refuge habitat for many medium- and large sized mammals. The probability of any flora species of conservation importance being present is low. In light of these factors, and in the context of the broader highly modified landscape matrix, the conservation importance of alien tree plantations and woodlots is rated moderate to low. These habitats have a low sensitivity with regard to ecological disturbances.



Figure 9: Alien tree plantation and woodlot in the study area.

#### 5.1.6. Flora Species of Conservation Concern

Based on literature and the findings of previous field work, at least 29 flora species of conservation concern potentially occur in the study area, of which, 11 taxa have been recorded in or immediately adjacent to the study area – these are listed in Table 2. The survey work by GroundTruth (2017) for flora species of conservation concern was focused on areas of natural habitat within the original mining footprints. As a result, most of the recorded locations for these taxa in the study area are clustered on land to the south of the currently proposed open pit expansion footprints. It will therefore be necessary to conduct follow-up surveys for flora species of conservation concern in areas of natural habitat within the proposed development footprints.

Most of the taxa in Table 2 are not listed as threatened at a national or provincial level, but are listed as ‘protected’ in Mpumalanga Province, according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998). Those that are listed as threatened and have been recorded include *Eucomis autumnalis*, which is listed as Declining on the Mpumalanga Red List, and *Khadia carolinensis*, which is listed as Vulnerable on both the national and provincial Red Lists (GroundTruth, 2017). It is noted that *Khadia carolinensis* was not recorded in the study area, but it was recorded in a grassland immediately west of the study area boundary - directly opposite the proposed location of the Discard Dump.

For a selection of photographs of flora species of conservation concern in taken in the study area refer to Figure 10 to Figure 13.



Table 2: Flora species of conservation concern occurring and potentially occurring in the study area.

Family	Scientific Name	National Red List Status	Mpumalanga Red List and Protected Status	Habitat Preferences	Probability of Occurrence
Apiaceae	<i>Alepidea peduncularis</i>	Data Deficient	Protected	Montane grassland	Possible
Asphodelaceae	<i>Aloe ecklonis</i> & ( <i>A. cf. kraussii</i> )		Protected	Grassland habitats	Recorded
Portulacaceae	<i>Anacampseros subnuda</i> subsp. <i>lubbersii</i>	Vulnerable	Vulnerable	Grassland on rhyolite boulders.	Possible
Apocynaceae	<i>Asclepias dissona</i>	Critically Endangered (Possibly Extinct)	Critically Endangered (Possibly Extinct)	Damp grassland	Unlikely. Last recorded in 1932 and possibly extinct.
Amaryllidaceae	<i>Boophone disticha</i>		Protected	Dry grassland and rocky areas	Recorded
Amaryllidaceae	<i>Brunsvigia</i> species		Protected	Mixed grassland.	Recorded
Apocynaceae	<i>Ceropegia rendallii</i>		Protected	Rocky outcrops in grassland.	Possible
Amaryllidaceae	<i>Crinum graminicola</i>		Protected	Dry grassland	Probable
Amaryllidaceae	<i>Cyrtanthus stenanthus</i>		Protected	Mixed grassland	Unlikely
Amaryllidaceae	<i>Cyrtanthus breviflorus</i>		Protected	Mixed grassland	Recorded
Amaryllidaceae	<i>Cyrtanthus tuckii</i>		Protected	Dry and moist grasslands	Possible
Iridaceae	<i>Dierama</i> species			Mixed grassland.	Recorded
Orchidaceae	<i>Disa cooperi</i>		Protected	Mixed grassland.	Probable
Orchidaceae	<i>Disa versicolor</i>		Protected	Montane grassland and rocky slopes.	Probable
Hyacinthaceae	<i>Eucomis autumnalis</i>		Declining / Protected	Moist grassland.	Recorded
Orchidaceae	<i>Eulophia cooperi</i>		Rare / Protected	Mixed grassland.	Probable
Iridaceae	<i>Gladiolus calcaratus</i>		Vulnerable / Protected	Montane grassland and moist grasslands.	Unlikely
Iridaceae	<i>Gladiolus ecklonii</i>		Protected	Moist grassland and stony areas.	Recorded
Iridaceae	<i>Gladiolus papilio</i>		Protected	Moist grasslands	Recorded

Family	Scientific Name	National Red List Status	Mpumalanga Red List and Protected Status	Habitat Preferences	Probability of Occurrence
Iridaceae	Sensitive Species 1201	Vulnerable	Vulnerable	Dolerite outcrops in grassland	Possible
Iridaceae	Sensitive Species 41	Vulnerable	Vulnerable / Protected	Moist grassland.	Possible
Iridaceae	<i>Gladiolus woodii</i>		Protected	Stony low grassland	Probable
Amaryllidaceae	<i>Haemanthus humilis</i> subsp. <i>hirsutus</i>		Protected	Grassland habitat.	Recorded
Orchidaceae	<i>Habenaria humilior</i>		Rare / Protected	Grassland habitat	Unlikely
Aizoaceae	<i>Khadia carolinensis</i>	Vulnerable	Vulnerable	Well-drained, sand-loam soils among rocky outcrops in grassland.	Recorded outside study area, but in grassland immediately adjacent to the boundary fence.
Asphodelaceae	<i>Kniphofia porphyrantha</i>		Protected		Recorded
Asphodelaceae	<i>Kniphofia typhoides</i>	Near Threatened	Near Threatened / Protected	Moist grassland and wetland habitats	Possible. Suitable habitat present
Apocynaceae	<i>Pachycarpus suaveolens</i>	Vulnerable	Vulnerable	Short annually burnt grassland	Possible. Suitable habitat present.
Apocynaceae	<i>Miraglossum davyi</i>	Vulnerable	Vulnerable	Range of grassland habitats, including Eastern Highveld Grasslands.	Possible
Amaryllidaceae	Sensitive Species 691	Vulnerable	Near Threatened	Dry and moist grassland.	Possible
Orchidaceae	<i>Schizochilus cecillii</i> subsp. <i>culveri</i>	Rare	Rare / Protected	Damp rock ledges in grassland.	Possible
Iridaceae	<i>Watsonia species</i>		Protected	Dry and moist grassland.	Recorded

Source: Golder (2019a) and GroundTruth (2017)



Figure 10: *Boophone disticha*



Figure 11: *Eucomus autumnalis*



Figure 12: *Gladiolus ecklonii*



Figure 13: *Gladiolus papilio*

### 5.1.7. Flora of Medicinal Value

Twelve flora species recorded in the study area have recognised medicinal value. These are listed in Table 3, accompanied by a description of their purported use, as per Van Wyk *et al.*, (2009).

Table 3: *Flora species of medicinal value.*

Scientific Name	Medicinal Use*
<i>Centella asiatica</i>	Used to treat leprosy, wounds and cancer.
<i>Datura stramonium</i>	Relieves asthma and acts to reduce pain. Weak infusions are used as an aphrodisiac.
<i>Eucomus autumnalis</i>	Bulb decoction used to treat lower back pain. Other treatments include, amongst others, urinary diseases, stomach aches and fevers.
<i>Gomphocarpus fruticosus</i>	Dried leaves are used to treat headaches and tuberculosis. The roots are purported to treat stomach pain and general body ache.

Scientific Name	Medicinal Use*
<i>Helichrysum</i> species	Treats a variety of afflictions, including coughs, colds, fever, headaches and infections.
<i>Hypoxis</i> species	Infusions of the corm are used to treat dizziness, bladder disorders and insanity.
<i>Pelargonium luridum</i>	Taken orally to treat diarrhoea and dysentery.
<i>Rumex crispus</i>	Used as a remedy for internal parasites, as well as vascular diseases and internal bleeding.
<i>Scabiosa columbaria</i>	Used to treat colic and heartburn.
<i>Typha capensis</i>	Decoctions used to treat venereal disease, as well as diarrhoea, dysentery and enhance male libido.
<i>Vernonia</i> species	Infusions to treat abdominal pain and colic.
Medicinal use, as per Van Wyk, <i>et al.</i> (2009).	

### 5.1.8. Declared Alien Invasive Species

At least 17 NEMBA and CARA declared alien invasive plant species have been recorded in the study area – listed in Table 4. The most prominent species are the alien wattles (*Acacia*'s) and *Eucalyptus camaldulensis*, which occur in numerous dense windrows and plantations across the study area.

In areas that have disturbed by previous farming activities and current mining activities, herbaceous alien species, such as *Cirsium vulgare* and *Verbena bonariensis* are also abundant. Although not listed as a declared alien invasive species, the pioneer weed *Bidens pilosa* is also very common at disturbed sites.

Table 4: Declared alien invasive species recorded in the study area.

Scientific name	Common Name	Growth Form	CARA Category	NEMBA Category
<i>Acacia dealbata</i>	Silver Wattle	Tree	2	2
<i>Acacia mearnsii</i>	Black Wattle	Tree	2	3
<i>Acacia elata</i>	Pepper Tree Wattle	Tree	3	1b
<i>Acacia melanoxylon</i>	Blackwood	Tree	2	2
<i>Callistemon viminalis</i>	Weeping Bottlebrush	Tree	-	1b
<i>Cirsium vulgare</i>	Spear Thistle	Herbaceous forb	1	1b
<i>Datura stramonium</i>	Common Thorn-apple	Herbaceous forb	1	1b
<i>Eucalyptus camaldulensis</i>	Saligna Gum	Tree	2	1b or 2
<i>Gleditsia triacanthos</i>	Honey Locust	Tree	2	1b
<i>Opuntia ficus-indica</i>	Sweet Prickly Pear	Cactus	1	1b
<i>Populus x canescens</i>	Grey Poplar	Tree	2	2
<i>Phytolacca octandra</i>		Herbaceous plant		1b
<i>Pinus patula</i>	Patula Pine	Tree	2	2
<i>Salix babylonica</i>	Weeping Willow	Tree	2	-
<i>Schinus molle</i>	Pepper Tree	Tree	X3	-
<i>Solanum sisymbriifolium</i>	Dense-throned Bitter Apple	Herbaceous forb	1	1b

Scientific name	Common Name	Growth Form	CARA Category	NEMBA Category
<i>Verbena bonariensis</i>	Verbena	Herbaceous forb		1b

### 5.1.9. Fauna Communities and Species of Concern

#### 5.1.9.1. Mammals

A total of 30 mammal species have been recorded in the study area to-date (Table 5). These range from small and medium-sized antelope and carnivores, to several small rodents. The most frequently recorded taxa, based on camera trap data derived during the long-term monitoring programme, were the Common Duiker (*Sylvicapra grimmia*), Black-backed Jackal (*Canis mesomelas*), Serval (*Leptailurus serval*), Porcupine (*Hystrix africaeaustalis*) and Water Mongoose (*Atilax paludinosus*) (Golder, 2020a) – a selection of archive photographs of mammals in taken in the study area is presented in Figure 14 to Figure 19.

Nine of the mammal species recorded in the study area are of conservation concern, while an additional 14 species of conservation concern potentially occur in the region based on Mpumalanga Parks and Tourism Agency (MPTA) records and mapped distribution ranges in Stuart and Stuart (2007). These are listed in Table 6, along with habitat preferences and a probability of occurrence in the study area.

Of mammals of conservation concern recorded in the study area, no population data for the study area is available. Monitoring reports indicate that the Serval is regularly recorded on-site, which suggests that there is fairly large and stable resident population of this territorial species in the study area. Conversely, monitoring reports indicate that the other mammals of conservation concern, such as the Cape Clawless Otter (*Aonyx capensis*), Spotted-necked Otter (*Hydrictis maculicollis*), Honey Badger (*Mellivora capensis*), Oribi (*Ourebia ourebi*) and the Musk Shrew (*Crocidura cf maquassiensis*) were irregularly recorded. This suggests that these taxa are generally less abundant in the landscape and/or are likely to have large home-ranges that extend beyond the study area. The presence of the larger mobile taxa in the study area is thus periodic and subject to foraging and dispersal requirements.

Table 5: Mammals recorded in the study area.

Family	Scientific Name	Common Name	National Red List (2016)	NEMBA ToPS List (2007)	Mpumalanga Status
Bovidae	<i>Sylvicapra grimmia</i>	Common Duiker	Least Concern	-	Protected
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern	-	-
Bovidae	<i>Damaliscus pygargus phillipsi</i>	Blesbok	Least Concern	-	-
Bovidae	<i>Redunca</i> species	Reedbuck species	Least Concern	-	-
Bovidae	<i>Ourebia ourebi</i>	Oribi	Endangered	Endangered	Protected
Cercopithecidae	<i>Cercopithecus pygerythrus</i>	Vervet Monkey	Least Concern	-	-
Orycteropidae	<i>Orycteropus afer</i>	Aardvark	Least Concern	-	Protected

Family	Scientific Name	Common Name	National Red List (2016)	NEMBA ToPS List (2007)	Mpumalanga Status
Felidae	<i>Caracal caracal</i>	Caracal	Least Concern	-	-
Felidae	<i>Felis silvestris lybica</i>	African Wild Cat	Least Concern	-	Near Threatened
Felidae	<i>Leptailurus serval</i>	Serval	Near Threatened	Protected	Near Threatened
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern	-	-
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	Least Concern	-	-
Herpestidae	<i>Galerella sanguinea</i>	Slender Mongoose	Least Concern	-	-
Herpestidae	<i>Atilax paludinosus</i>	Water Mongoose	Least Concern	-	-
Herpestidae	<i>Suricata suricatta</i>	Suricate	Least Concern	-	-
Mustelidae	<i>Ictonyx striatus</i>	Striped Polecat	Least Concern	-	-
Mustelidae	<i>Aonyx capensis</i>	Cape Clawless Otter	Near Threatened	Protected	Protected
Mustelidae	<i>Hydricictis maculicollis</i>	Spotted-necked Otter	Vulnerable	Protected	Protected / Near Threatened
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern	Protected	Near Threatened
Hystricidae	<i>Hystrix africaeastalis</i>	Porcupine	Least Concern	-	-
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern	-	-
Muridae	<i>Dendromus melanotis</i>	Grey Climbing Mouse	Least Concern	-	-
Muridae	<i>Mus minutoides</i>	Pygmy Mouse	Least Concern	-	-
Muridae	<i>Mastomys sp.</i>	Multimammate Mouse	Least Concern	-	-
Muridae	<i>Aethomys chrysophilus</i>	Red Veld Rat	Least Concern	-	-
Muridae	<i>Rhabdomys pumilio</i>	Four-striped Mouse	Least Concern	-	-
Pedetidae	<i>Pedetes capensis</i>	Springhare	Least Concern	-	-
Soricidae	<i>Suncus lixus or Crocidura fuscomurina</i>	Greater Dwarf Shrew / Tiny Musk Shrew	Least Concern	-	-
Soricidae	<i>Crocidura cf mariquensis/maquassiensis*</i>	Swamp Musk Shrew	Vulnerable / Near Threatened	-	Vulnerable
Viverridae	<i>Genetta maculata</i>	Large-spotted Genet	Least Concern	-	-

\**Crocidura maquassiensis* and *C. mariquensis* are very similar and can only be positively distinguished using skull measurements. The distributions of both species overlap with the study area, and sampled specimens may thus represent either/both taxa. We therefore include both as provisional records.



Figure 14: Serval (*Leptailurus serval*)



Figure 15: Black-backed Jackal (*Canis mesomelas*)



Figure 16: Water Mongoose (*Atilax paludinosus*)



Figure 17: Cape Clawless Otter (*Aonyx capensis*)



Figure 18: Porcupine (*Hystrix africaeaustalis*)

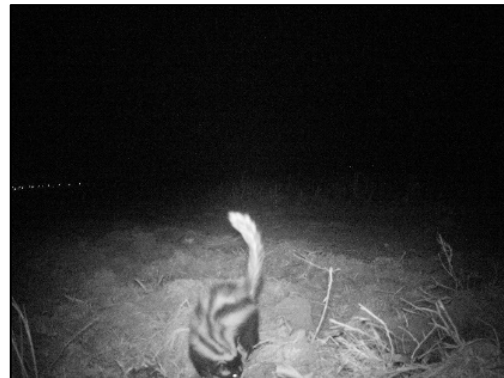


Figure 19: Striped Polecat (*Ictonyx striatus*)

Table 6: Mammals of conservation concern occurring and potentially occurring in the study area.

Family	Scientific Name	Common Name	National Red List (2016)	NEMBA ToPS List (2007)	Mpumalanga Status	Habitat Preferences*	Probability of Occurrence	Rationale
Bovidae	<i>Ourebia ourebi</i>	Oribi	Endangered	Critically Endangered	Protected / Endangered	Short open grassland, with patches of taller grass	<b>Recorded?</b>	Based on anecdotal evidence from an on-site wetland ecologist
Bovidae	<i>Pelea capreolus</i>	Grey Rhebok	Near Threatened	-	Protected	Savanna and grassland habitats in mountainous areas.	Unlikely	No suitable habitat present
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern	-	Protected	Range of habitats, including savanna	<b>Recorded</b>	-
Bovidae	<i>Redunca fulvorufula</i>	Mountain Reedbuck	Least Concern	-	Protected	Savanna and grassland habitats in mountainous areas.	Possible	Limited suitable habitat present
Canidae	<i>Vulpes chama</i>	Cape Fox	Least Concern	Protected	-	Range of habitats, including savanna	Possible	Limited suitable habitat present
Chrysochloridae	<i>Amblysomus robustus</i>	Robust Golden Mole	Vulnerable	-	Vulnerable	Sandy soils in grassland areas	Possible	Limited suitable habitat present due to agriculture and mining disturbances of soils
Chrysochloridae	<i>Amblysomus septentrionalis</i>	Highveld Golden Mole	Near Threatened	-	Near Threatened	Sandy soils in grassland areas	Unlikely	No suitable habitat present due to mining disturbances of soils
Chrysochloridae	<i>Chrysospalax villosus</i>	Rough-haired Golden Mole	Vulnerable	-	Vulnerable	Dry grassland on the fringes of wetlands	Possible	Limited suitable habitat present due to agriculture and mining disturbances of soils
Erinaceidae	<i>Atelerix frontalis</i>	South African Hedgehog	Near Threatened	Protected	Protected / Near Threatened	Range of habitats, including savanna	Unlikely	Limited suitable habitat present and sensitive species



Family	Scientific Name	Common Name	National Red List (2016)	NEMBA ToPS List (2007)	Mpumalanga Status	Habitat Preferences*	Probability of Occurrence	Rationale
Felidae	<i>Felis nigripes</i>	Black-footed Cat	Vulnerable	Protected	Near Threatened	Savanna and grassland habitats.	Possible	Suitable habitat present.
Felidae	<i>Felis silvestris lybica</i>	African Wild Cat	Least Concern	-	Near Threatened	Savanna and grassland habitats.	<b>Recorded</b>	-
Felidae	<i>Leptailurus serval</i>	Serval	Near Threatened	-	Near Threatened	Savanna and grassland habitats.	<b>Recorded</b>	-
Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyena	Near Threatened	Protected	Near Threatened	Savanna and grassland habitats.	Unlikely	High levels of disturbance
Muridae	<i>Dasymys incomtus</i>	African Marsh Rat	Near Threatened	-	Near Threatened	Wetland habitats.	Possible	Suitable habitat present.
Mustelidae	<i>Aonyx capensis</i>	Cape Clawless Otter	Near Threatened	Protected	Protected	Riparian habitats.	<b>Recorded</b>	-
Mustelidae	<i>Hydricis maculicollis</i>	Spotted-necked Otter	Vulnerable	-	Protected / Near Threatened	Riparian habitats, favouring large, open water bodies.	<b>Recorded</b>	-
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern	Protected	Protected / Near Threatened	Savanna and grassland habitats.	<b>Recorded</b>	-
Mustelidae	<i>Poecilogale albinucha</i>	African Striped Weasel	Near Threatened	-	-	Savanna and grassland habitats.	Possible	Some suitable habitat present.
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark	Least Concern	-	Protected	Savanna and grassland habitats.	<b>Recorded</b>	
Protelidae	<i>Proteles cristatus</i>	Aardwolf	Least Concern	-	Protected	Savanna and grassland habitats.	Unlikely	Limited suitable habitat present
Rhinolophidae	<i>Rhinolophus blasii</i>	Peak-saddle Horseshoe Bat	Near Threatened	-	Near Threatened	Cave roosting species, in savanna.	Unlikely	No suitable habitat present
Soricidae	<i>Crocidura maquassiensis</i>	Maquassie Musk Shrew	Vulnerable	-	Vulnerable	Moist grassland and wetland habitats.	<b>Recorded?</b>	Very similar species that can only be positively distinguished using skull measurements.
Soricidae	<i>Crocidura mariquensis</i>	Swamp Musk Shrew	Near Threatened	-	Near Threatened	Moist grassland and wetland habitats.	<b>Recorded?</b>	
Vespertilionidae	<i>Miniopterus schreibersii</i>	Schreibers's Long-fingered Bat	Near Threatened	-	Near Threatened	Roosts in caves.	Unlikely	No suitable habitat present.

\*Habitat preferences as per Skinner and Smithers (1990) and Stuart and Stuart (2007)

#### 5.1.9.2. Birds

In total, 148 bird species, including six species of conservation concern, have been recorded in the study area to-date (Appendix B). In grassland/cropland areas of the study area, frequently recorded taxa include *inter alia*, Hadedda Ibis (*Bostrychia hagedash*), Southern Fiscal (*Lanius collaris*), Black-winged Kite (*Elanus caeruleus*) and Cape Longclaw (*Macronyx capensis*), while in aquatic and wetland habitats, frequently recorded taxa include species such as the Blacksmith Lapwing (*Vanellus armatus*), Egyptian Goose (*Alopochen aegyptiaca*), Red-knobbed Coot (*Fulica cristata*) and Little Grebe (*Tachybaptus ruficollis*).

Bird species of conservation concern that have been recorded in the study area include the Greater Flamingo (*Phoenicopterus roseus*) – Near Threatened, Blue Korhaan (*Eupodotis caerulescens*) - Near Threatened, Secretarybird (*Sagittarius serpentarius*) – Vulnerable, Southern-Bald Ibis (*Geronticus calvus*) - Endangered, Sensitive Species 2 – Endangered, and Cape Vulture (*Gyps coprotheres*) – Endangered (refer to Table 7). These were mostly observed in moist grassland and wetland and dry mixed grassland habitats. No population data for these species for the study area is available. The infrequent observation of these species indicates that they move periodically through the study area to forage and are dependent on accessing resources across the broader landscape. Refer Figure 20 to Figure 22 for a selection of archive photos of these species taken in the study area.

Based on SABAP 2 records for the pentads encompassing the study area, a total of approximately 289 bird species potentially occur in the study area. Of these, an additional 18 species are species of conservation concern. These are listed, along with their conservation status, habitat preferences and probability of occurrence, in Table 7.

It is noted that according to Schedule 2 of the Mpumalanga Nature Conservation Act (Act No 10 of 1997), all bird species occurring in the province, excluding 17 very common species (listed in Schedule 2) and those listed as game birds (Schedule 3) are 'protected'.



Figure 20: Secretarybird (*Sagittarius serpentarius*)



Figure 21: Southern-Bald Ibis (*Geronticus calvus*)



Figure 22: Cape Vulture (*Gyps coprotheres*)

Table 7: Birds of conservation importance recorded and potentially occurring in the study area.

Family	Scientific Name	Common Name	National Red List (2015)	NEMBA ToPS List (2007)	Mpumalanga Status	Habitat Preferences*	Probability of Occurrence	Rationale
Accipitridae	<i>Circus ranivorus</i>	African Marsh Harrier	Endangered	Protected	Endangered	Grassland and wetland habitats.	Possible	Suitable habitat present.
Accipitridae	<i>Gyps coprotheres</i>	Cape Vulture	Endangered	Endangered	Endangered	Savanna and grassland habitats.	<b>Recorded</b>	
Alaudidae	<i>Spizocorys fringillaris</i>	Botha's Lark	Endangered	-	Endangered	Short, heavily grazed grassland.	Possible	Suitable habitat present.
Alcedinidae	<i>Alcedo semitorquata</i>	Half-collared Kingfisher	Near Threatened	-	Near Threatened	Riparian woodland and forest.	Unlikely	Limited suitable habitat present.
Anatidae	<i>Oxyura maccoa</i>	Maccaco Duck	Near Threatened	-	Near Threatened	Aquatic habitats	Possible	Suitable habitat present.
Ciconiidae	<i>Ciconia abdimii</i>	Abdim's Stork	Near Threatened	-	Near Threatened	Range of habitats, including grassland and pastures.	Possible	Suitable habitat present.
Ciconiidae	<i>Ciconia nigra</i>	Black Stork	Vulnerable	Vulnerable	Vulnerable	Moist grassland and wetland habitats.	Possible	Suitable habitat present.
Ciconiidae	<i>Mycteria ibis</i>	Yellow-billed Stork	Endangered	-	Endangered	Wetland habitats.	Possible	Suitable habitat present.
Coraciidae	<i>Coracias garrulus</i>	European Roller	Near Threatened	-	Near Threatened	Savanna habitats.	Possible	Limited suitable habitat present.
Falconidae	<i>Falco biarmicus</i>	Lanner Falcon	Vulnerable	-	Vulnerable	Open grassland and woodland.	Possible	Suitable habitat present.
Glareolidae	<i>Glareola nordmanni</i>	Black-winged Pratincole	Near Threatened	-	Near Threatened	Grassland and wetland habitats.	Possible	Suitable habitat present.
Gruidae	<i>Anthropoides paradiseus</i>	Blue Crane	Near Threatened	Endangered	Vulnerable	Grassland and wetland habitats.	Possible	Suitable habitat present.
Gruidae	Sensitive Species 2	Sensitive Species 2	Endangered	Endangered	Endangered	Grassland and wetland habitats.	<b>Recorded</b>	
Gruidae	<i>Bugeranus carunculatus</i>	Wattled Crane	Critically Endangered	Critically Endangered	Critically Endangered	Grassland and wetland habitats.	Possible	Suitable habitat present.
Heliornithidae	<i>Podica senegalensis</i>	African Finfoot	Vulnerable	-	Vulnerable	Prefers wooded streams and rivers	Unlikely	Limited suitable habitat present.

Family	Scientific Name	Common Name	National Red List (2015)	NEMBA ToPS List (2007)	Mpumalanga Status	Habitat Preferences*	Probability of Occurrence	Rationale
						flanked by riparian vegetation.		
Laridae	<i>Sterna caspia</i>	Caspian Tern	Vulnerable	-	Vulnerable	Large water bodies, both natural and artificial.	Possible	Suitable habitat present.
Otididae	<i>Lissotis melanogaster</i>	Black-bellied Bustard	Near Threatened	-	Near Threatened	Tall dense grassland and savanna.	Unlikely	Limited suitable habitat present.
Otididae	<i>Eupodotis caerulescens</i>	Blue Korhaan	Least Concern	Vulnerable	Near Threatened	Range of habitats, including grassland.	<b>Recorded</b>	
Otididae	<i>Neotis denhami</i>	Denham's Bustard	Vulnerable	Protected	Vulnerable	Range of habitats, including grassland and cultivated fields.	Possible	Suitable habitat present.
Otididae	<i>Eupodotis senegalensis</i>	White-bellied Korhaan	Vulnerable	-	Vulnerable	Tall dense grassland and savanna.	Possible	Suitable habitat present.
Phoenicopteridae	<i>Phoenicopus ruber</i>	Greater Flamingo	Near Threatened	-	Near Threatened	Wetland habitats.	<b>Recorded</b>	
Phoenicopteridae	<i>Phoenicopus minor</i>	Lesser Flamingo	Near Threatened	-	Near Threatened	Wetland habitats.	Possible	Suitable habitat present.
Sagittariidae	<i>Sagittarius serpentarius</i>	Secretarybird	Vulnerable	-	Vulnerable	Grassland and savanna habitats.	<b>Recorded</b>	
Sylviidae	<i>Lioptilus nigricapillus</i>	Bush Blackcap	Vulnerable	-	Vulnerable	Afromontane and mistbelt forest.	Unlikely	Limited suitable habitat present.
Tytonidae	<i>Tyto capensis</i>	African Grass Owl	Vulnerable	Vulnerable	Vulnerable	Wetland habitats, typically with dense stands of <i>Imperata cylindrica</i> .	Unlikely/ Possible	Limited suitable habitat present.
Threskiornithidae	<i>Geronticus calvus</i>	Southern Bald Ibis	Endangered	Vulnerable	Vulnerable	Grassland and wetland habitats.	<b>Recorded</b>	

\*Habitat preferences, as per Roberts VII Multimedia

### 5.1.9.3. Herpetofauna (Reptiles and Amphibians)

Three reptile species have been recorded in the study area, and an additional 13 species have been recorded in the QDS that encompasses the study area, based on ReptileMAP data (Table 8). None of these are of conservation concern.

Based on historic distributions presented in Bates *et al.* (2014), five reptiles of conservation concern potentially occur in the study area – these are listed in Table 9. It is further noted that according to the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) all species of reptiles, excluding the monitors (e.g., *Varanus niloticus*) and all snakes, are considered ‘protected’ in Mpumalanga Province. Data extraction records from the Mpumalanga Tourism and Parks Agency (MPTA) indicate that Northern Dwarf Chameleon (*Bradypodion transvaalense*) was historically recorded in the region (Golder, 2020a). The record of this species is surprising, as it favours forest patches along the eastern escarpment (Bates *et al.*, 2014). Its historic presence is thus considered unusual and possibly an aberration.

In terms of amphibians, eight species have been recorded in the study area, while FrogMAP data indicates that an additional ten species have been recorded in the relevant QDS (Table 8). All eighteen amphibian species are common taxa, with widespread distributions and are not considered to be of conservation concern.

Based on historic distribution ranges, the Giant Bullfrog (*Pyxicephalus adspersus*) is the only amphibian of conservation concern potentially occurring in the study area. This species is listed as ‘protected’ on the NEMBA ToPs list (2007), as well as ‘protected’ in Mpumalanga Province according to the Mpumalanga Nature Conservation Act, 1998). It is also listed as Vulnerable on the Mpumalanga Red List. Giant Bullfrog have not been recorded in the study area.

Refer to Figure 23 to Figure 25 for select archive photographs of herpetofauna taken in the study area.

Table 8: Herpetofauna recorded and potentially present in the study area.

Family	Scientific Name	Common Name	Recorded in the Study Area
<b>Reptiles</b>			
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	X
Colubridae	<i>Dasypeltis scabra</i>	Rhombic Egg-eater	
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	
Elapidae	<i>Hemachatus haemachatus</i>	Rinkhals	X
Gekkonidae	<i>Pachydactylus affinis</i>	Transvaal Gecko	
Gekkonidae	<i>Pachydactylus capensis</i>	Cape Gecko	
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	
Lamprophiidae	<i>Amplorhinus multimaculatus</i>	Many-spotted Snake	
Lamprophiidae	<i>Aparallactus capensis</i>	Black-headed Centipede-eater	
Lamprophiidae	<i>Psammophis crucifer</i>	Cross-marked Grass Snake	
Lamprophiidae	<i>Psammophylax rhombeatus</i>	Spotted Grass Snake	X
Lamprophiidae	<i>Pseudaspis cana</i>	Mole Snake	

Scincidae	<i>Trachylepis varia</i>	Variable Skink	X
Scincidae	<i>Acontias gracilicauda</i>	Thin-tailed Legless Skink	
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	
Typhlopidae	<i>Afrotyphlops bibronii</i>	Bibron's Blind Snake	
<b>Amphibians</b>			
Bufonidae	<i>Sclerophrys gutturalis</i>	Guttural Toad	X
Bufonidae	<i>Sclerophrys pusilla</i>	Flatbacked Toad	
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	X
Hyperoliidae	<i>Semnodactylus wealii</i>	Rattling Frog	
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	
Pipidae	<i>Xenopus laevis</i>	Common Platanna	X
Ptychadenidae	<i>Ptychadena porosissima</i>	Striped Grass Frog	X
Pyxicephalidae	<i>Amietia delalandii</i>	Delalande's River Frog	
Pyxicephalidae	<i>Amietia fuscigula</i>	Cape River Frog	
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Boettger's Caco	X
Pyxicephalidae	<i>Cacosternum nanum</i>	Bronze Caco	
Pyxicephalidae	<i>Strongylopus fasciatus</i>	Striped Stream Frog	
Pyxicephalidae	<i>Strongylopus grayii</i>	Clicking Stream Frog	
Pyxicephalidae	<i>Amietia angolensis</i>	Common River Frog	X
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Tremolo Sand Frog	X
Pyxicephalidae	<i>Strongylopus grayii</i>	Clicking Stream Frog	X
Pyxicephalidae	<i>Tomopterna natalensis</i>	Natal Sand Frog	
Pyxicephalidae	<i>Tomopterna tandyi</i>	Tandy's Sand Frog	

Source: Golder (2020a) and ReptileMAP and FrogMAP (FitzPatrick Institute of African Ornithology, 2021).



Figure 23: Spotted Grass Snake (*Psammophylax rhombeatus*)



Figure 24: Bubbling Kassina (*Kassina senegalensis*)



Figure 25: Common Platanna (*Xenopus laevis*)



Table 9: Reptiles and amphibians of conservation concern potentially occurring in the study area.

Family	Scientific Name	Common Name	National Red List (2016)	NEMBA ToPS List (2007)	Mpumalanga Status	Habitat Preferences*	Probability of Occurrence	Rationale
<b>Reptiles</b>								
Chamaeleonidae	<i>Bradypodion transvaalense</i>	Northern Dwarf Chameleon	-	-	Vulnerable	Forest patches along eastern escarpment	Possible (Historic record by MPTA)	Limited suitable habitat present.
Cordylidae	<i>Chammaesaura aenea</i>	Coppery Grass Lizard	Near Threatened	-	Near Threatened	Grassy slopes and plateau	Possible	Suitable habitat present.
Cordylidae	<i>Chammaesaura macrolepis</i>	Large-scaled Grass Lizard	Near Threatened	-	Near Threatened	Rocky grassy hillsides	Possible	Suitable habitat present.
Cordylidae	<i>Tetradactylus breyeri</i>	Breyer's Long-tailed Seps	Vulnerable	-	Vulnerable	Montane and highveld grasslands	Possible	Suitable habitat present.
Lamprophiidae	<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	Near Threatened	-	Near Threatened	Old termite mounds in grassland	Unlikely	Limited suitable habitat (termite mounds) present.
<b>Amphibians</b>								
Pyxicephalidae	<i>Pyxicephalus adspersus</i>	Giant Bullfrog	-	Protected	Vulnerable / Protected	Shallow wetlands and pans	Possible	Suitable habitat present
*Habitat preferences as per Bates et al. (2014) and Du Preez and Carruthers (2009)								

#### 5.1.9.4. Invertebrates

Two invertebrate species of conservation concern have been recorded in the study area by GroundTruth (2017), namely:

- Marsh Sylph (*Metisella meninx*) - this butterfly species favours moist grassland. It was previously listed as Vulnerable, but has subsequently been down-listed to Rare. Marsh Sylph were observed in wetland habitats in the study area by GroundTruth (2017).
- Golden Stardust Baboon Spider (*Harpactira hamiltonii*) – burrows of this baboon spider have been recorded in the study area, also by GroundTruth (2017).

About 10 other butterflies of conservation concern are known to occur in Mpumalanga. Based on distribution, habitat preference and an assessment of habitat suitability in the study area, it is considered unlikely that any of these are present.

### 5.1.10. Ecological Attributes and Processes

#### 5.1.10.1. Landscape Linkages, Corridors and Refugia

Agriculture and mining, amongst other land uses, have caused large-scale modification and fragmentation of natural grassland habitats in Mpumalanga. Where grassland habitats are present, they are typically small, isolated and often disturbed. Considering this modified landscape matrix, remaining areas of undeveloped natural and semi-natural habitat play a vital role in supporting and buffering local ecological processes. Amongst other traits, habitat patches are likely to act as movement and dispersal corridors or 'stepping stones' for certain fauna and flora.

Although the grassland and wetland habitats in the study area are small and surrounded by modified habitat (typically cultivated lands), they do provide vital habitat for fauna and flora, and connect other natural areas across the landscape – which are similarly modified and fragmented. Moreover, although wooded areas are dominated by alien tree species, these patches significantly increase landscape habitat heterogeneity and provide refuge sites for several fauna species that are likely to be nocturnal and sensitive to anthropogenic disturbances. Habitats in the broader study area, including those patches occurring within the proposed infrastructure footprints, therefore do contribute positively to landscape-scale ecological functioning.

#### 5.1.10.2. Drives of Change

##### **Grazing by Cattle**

Overgrazing is a common cause of dryland degradation, leading to one or several recognised syndromes (Scholes, 2009). It occurs when grazing herbivores (both wildlife and domestic) are kept at excessive stocking rates and/or are able to concentrate their grazing to a limited foraging area without suitable rest periods. A common syndrome that can be linked to overgrazing, at least in part, is a change in plant species composition, that in grassland habitats manifests as a reduction in palatable grasses and grass productivity (Scholes, 2009).

Cattle have been excluded from most of the study area by the erection of a large razor-wire boundary fence. Areas within the study area that fall outside the boundary fence are still currently grazed by cattle (Pers. Obs.). Both cattle grazing (defoliation) and the exclusion of cattle (no defoliation of grasses) from an area can affect grassland dynamics, leading to changes in species composition. For example, high levels of grazing (overgrazing) will result in the gradual elimination of

'palatable' grasses (Decreaser), and the establishment and dominance of 'unselected', less palatable grasses (Increaser III species). Similarly, no grazing will result in an increase in dead grass matter, which will favour hardy, shade-tolerant species. This too, will lead to changes in flora composition. Cattle grazing, or the absence thereof, is therefore likely to be an important ecosystem driver in the study area.

## **Fire**

Fire is a dominant driver of spatial and temporal heterogeneity across the grassland landscapes (Du Toit et al., 2003). Through the large-scale and periodic removal of plant material, fire influences the ratio of grass and woody species, and the general composition of plant species mixes (fire tolerant vs fire intolerant species). It therefore plays a key role in determining vegetation structure, composition and function (Du Toit et al., 2003).

Burning of grassland habitats has been observed in the study area in the past (Pers. Obs.). Whether this is part of an active management programme or the result of unauthorised fire-starting is uncertain. Be that as it may, the exclusion of fire or the modification of its frequency in grassland habitats is likely to affect grass species composition in the study area. Fire is therefore also considered an important ecosystem driver in the study area.

## **Alien Invasive Species Colonisation**

Areas in the study area that have been disturbed by past cultivation or current mining activities are dominated by alien invasive species, many of which are declared under either the NEMBA or the CARA. If not actively controlled, alien invasive species will gradually spread into adjacent grassland and wetlands, where they will shade-out and competitively exclude many indigenous herbaceous species. This will have several deleterious impacts on the integrity and function of these habitats, including *inter alia*; a loss in floristic diversity, a reduction in grass productivity for grazing, and increased exposed soils and incidences of erosion.

### **5.1.11. Description of Existing and Future Impacts On-Site**

The entire study area, as well as the proposed Project footprints, have been heavily impacted by historic and contemporary anthropogenic activities:

- Large areas comprise cultivated fields, which are regularly disturbed by ploughing and crop harvesting. Even when lying fallow, cultivated fields are colonised by dense stands of alien weeds and pioneer flora, many of which are declared invasive species under either, or both, the NEMBA and CARA;
- Alien tree plantations and woodlots are also common, and although they do retain some ecological value (mostly in the form of refuge habitat), they are a modified habitat unit that is dominated by invasive tree species. The probability that these trees will encroach into adjacent natural grassland habitats is high; and
- Numerous other anthropogenic facilities are also present in the study area and have also resulted in natural habitat loss. These include *inter alia*; farm residences and agriculture structures (barns), gravel access roads and tracks, and permanent mining infrastructure.

All these features have reduced the overall extent of natural habitat in the landscape, and compromised the ecological integrity and functioning of remaining natural habitat patches.

It must be noted that portions of some of the proposed Project infrastructure footprints (e.g., conveyor routes and opencast shaft option 2) are located on land that will be mined in the near future, as part of the authorised Belfast Implementation Project (BIP), i.e., the BIP opencast pit areas. As such, these areas will not comprise the vegetation communities described in Section 5.1.5 of this report, but rather land that has undergone post-mining rehabilitation. In the impact assessment, these areas are referred to as ‘Post-Mining Rehabilitated Land’.

## 5.2. Summary of Site Sensitivity Assessment

Table 10 provides comment on the general sensitivity of habitats occurring or potentially impacted by proposed Project activities. Habitat sensitivity is shown in Figure 26.

Table 10: Sensitivity of Affected Habitats

Vegetation Community	Sensitivity Aspects	Impacts in Relation to Proposed Project
Moist Grassland and Wetlands	<ul style="list-style-type: none"> <li>• Functional natural habitat type;</li> <li>• Despite fragmentation and disturbances caused by <i>inter alia</i> farming activities, this habitat type is functionally very important, as it provides habitat for a variety of fauna and flora, and contributes significantly to landscape connectivity; and</li> <li>• High sensitivity with regard to ecological disturbances.</li> </ul>	All proposed infrastructure will negatively impact areas of Moist Grassland and Wetlands.
Dry Mixed Grassland	<ul style="list-style-type: none"> <li>• Variable habitat type, displaying a range of disturbance levels.</li> <li>• Despite non-pristine state, these grasslands do provide important buffering and supporting habitat; and</li> <li>• Moderate sensitivity with regard to ecological disturbances.</li> </ul>	All proposed infrastructure will negatively impact areas of Dry Mixed Grassland.
Cultivated Fields	<ul style="list-style-type: none"> <li>• Degraded, and highly modified habitat unit; and</li> <li>• Negligible sensitivity with regard to ecological disturbances.</li> </ul>	A large proportion of all proposed infrastructure will be located over cultivated fields.
Alien Tree Plantations and Woodlots	<ul style="list-style-type: none"> <li>• Modified habitat type;</li> <li>• Despite dominance of declared alien invasive tree species, wooded areas increase local habitat heterogeneity and provide refuge habitat for fauna; and</li> <li>• Low sensitivity with regard to ecological disturbances.</li> </ul>	Several areas of alien tree plantations and woodlots will be cleared for proposed infrastructure.

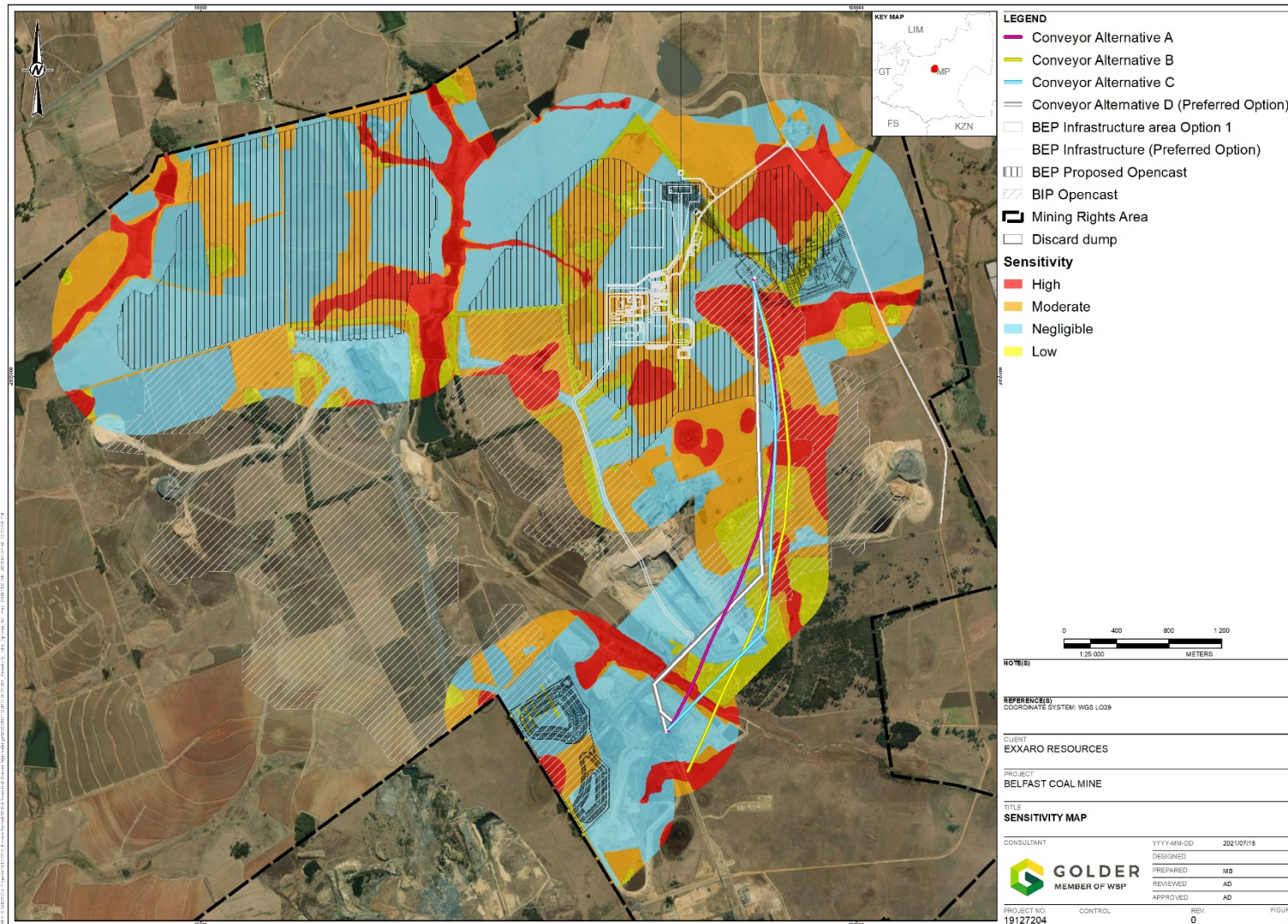


Figure 26: Ecological sensitivities of affected vegetation communities

### 5.3. Impact Assessment Methodology

All impacts have been evaluated using a semi-quantitative risk assessment methodology (i.e., a screening level assessment in accordance with the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This system derives an environmental impact level on the basis of the magnitude, duration, scale, probability and significance of the impacts (Table 11), based on a clear understanding pre and post mitigatory measures being implemented. The methodology used in the impact assessment was provided by Nsovo Environmental Consulting.

Table 11: Magnitude definition for ecological impact assessment

#### **Status of Impact**

The impacts are assessed as either having a:  
negative effect (i.e. at a 'cost' to the environment),  
positive effect (i.e. a 'benefit' to the environment), or  
Neutral effect on the environment.

#### **Extent of the Impact**

- (1) Site (site only),
- (2) Local (site boundary and immediate surrounds),
- (3) Regional (within the City of Johannesburg),
- (4) National, or
- (5) International.

#### **Duration of the Impact**

- The length that the impact will last for is described as either:
- (1) immediate (<1 year)
  - (2) short term (1-5 years),
  - (3) medium term (5-15 years),
  - (4) long term (ceases after the operational life span of the project),
  - (5) Permanent.

#### **Magnitude of the Impact**

- The intensity or severity of the impacts is indicated as either:
- (0) none,
  - (2) Minor,
  - (4) Low,
  - (6) Moderate (environmental functions altered but continue),
  - (8) High (environmental functions temporarily cease), or
  - (10) Very high / Unsure (environmental functions permanently cease).

#### **Probability of Occurrence**

- The likelihood of the impact actually occurring is indicated as either:
- (0) None (the impact will not occur),
  - (1) improbable (probability very low due to design or experience)
  - (2) low probability (unlikely to occur),
  - (3) medium probability (distinct probability that the impact will occur),
  - (4) high probability (most likely to occur), or
  - (5) Definite.

### Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.

$$S=(E+D+M) \times P$$

### The significance ratings are given below

(<30) low (i.e., where this impact would not have a direct influence on the decision to develop in the area),

(30-60) medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),

(>60) high (i.e., where the impact must have an influence on the decision process to develop in the area).

## 5.4. Impact Assessment

Although all species occurring within an area of interest form a component of the overall biodiversity and ecological value, it is neither practical nor necessary to manage or mitigate potential effects of a project on a species-specific basis. Since most species are generally linked to particular vegetation communities or ecosystems, the application of management measures at a landscape or ecosystem level is more feasible and effective in terms of species conservation, than attempting to conserve or manage at the species/individual level. Areas of remnant natural habitat are therefore included as receptors for the impact assessment - refer to Table 12 .

The outcomes of the impact assessment for each proposed infrastructure component and their allied alternatives/options and for the respective Project phases (i.e., the Construction Phase, Operational Phase, and Closure and Decommissioning Phase) are provided in Section 5.4.1 to Section 5.4.6. Also included are the proposed mitigation measures for reducing the significance of potential ecological impacts. It is recommended that these are included in the proposed Project's environmental management programme (EMP).

Table 12: Terrestrial ecology receptors for impact assessment.

Project Component	Impact	Important Receptors in Study Area
Vegetation clearing and earth works associated with the construction of proposed Project infrastructure.	Habitat loss and modification	Moist Grassland and Wetland Dry Mixed Grassland
	Habitat fragmentation	All fauna communities
	Establishment and spread of alien invasive species	Moist Grassland and Wetland Dry Mixed Grassland
	Mortality and disturbance of fauna	All fauna communities
	Loss of flora species of conservation concern	All flora listed as threatened and/or 'protected'
Vegetation clearing and earth works during the construction phase and ongoing disturbances during subsequent phases.	Loss and disturbance of fauna of conservation concern	All fauna listed as threatened and/or 'protected'

### 5.4.1. Habitat Loss and Modification

Issue	Mitigation Measures	Impact Rating Criteria			Significance
		Nature	Extent	Duration	
<b>Construction Phase</b>					
<b>Habitat Loss and Modification</b>					
<p>Habitat loss and modification refers to the removal or degradation of natural habitat. In terrestrial ecosystems this occurs through vegetation clearing and earth works during construction. The development of proposed Project infrastructure will result in the loss of habitat in the study area, including areas of moist grassland and wetland and dry mixed grassland. Table 13 below presents the approximate extent of habitat loss for each of the identified vegetation communities, per proposed Project aboveground infrastructure components and options.</p> <p><b>Note:</b></p> <ul style="list-style-type: none"> <li>Some proposed Project infrastructure will be located on land that will be mined as they are part of the authorised Belfast Implementation Project (BIP), prior to the development of these proposed facilities – shown in Figure 6. These areas will thus not comprise the vegetation communities described and mapped in Section 5.1.5, but rather opencast pit areas that have undergone rehabilitation (termed Post-Mining Rehabilitated Land);</li> <li>Habitat loss associated with the clearing and development of the entire proposed Discard Dump footprint has already been approved under the existing authorisation for the BIP, and therefore has been excluded from the calculations in Table 13;</li> <li>The entire Opencast Shaft Option 1 footprint is located within the footprint of the proposed opencast pits for this project (i.e., the Belfast Expansion Project). This option has therefore also not been assessed for habitat loss.</li> </ul> <p><b>Conveyor Options</b></p> <ul style="list-style-type: none"> <li>The entire route of the proposed Opencast Shaft Option 1 conveyor will traverse across Post-Mining Rehabilitated Land (Table 13). This proposed conveyor option will therefore not result in habitat loss or modification;</li> <li>Although the four proposed conveyor options for Opencast Shaft Option 2 will traverse across large areas of Post-Mining Rehabilitated Land, some habitat loss and modification of non-mined vegetation communities will occur (Table 13). For all four conveyor options this impact is thus rated of high significance prior to mitigation. With effective mitigation, this can be further reduced to medium significance.</li> </ul> <p><b>Opencast Shaft Option 2</b></p> <p>The footprint of Opencast Shaft Option 2 covers small areas of non-mined vegetation communities, as well as post-mining rehabilitated land. As such, some habitat loss and modification will occur as a result of the development of this facility (Table 13). Prior to mitigation, this impact is rated of high significance. With effective mitigation, this impact can be reduced to a medium significance.</p>					



Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Opencast Pits</b>							
The development of the proposed opencast pits will result in substantial habitat loss and modification (Table 13), including a small area designated as CBA Optimal. Prior to mitigation, this impact is rated of high significance with a score of 85. With effective mitigation, which includes limiting the extent of clearing to the minimum required for mining and implementing concurrent rehabilitation, this impact can be reduced to a medium significance, with a score of 52.							
All Conveyor Alternatives	Before mitigation	Negative	2	5	6	5	65 (high)
	After mitigation	Negative	1	4	2	4	36 (medium)
Opencast Shaft Option 2	Before mitigation	Negative	2	5	6	5	65 (high)
	After mitigation	Negative	1	4	4	4	36 (medium)
Opencast Pits	Before mitigation	Negative	2	5	10	5	85 (high)
	After mitigation	Negative	1	4	8	4	52 (medium)
<b>Mitigation Measures</b>							
<i>Minimisation</i>							
<ul style="list-style-type: none"> <li>• Vegetation clearing should be restricted to the proposed infrastructure footprints only, with no clearing permitted outside of these areas;</li> <li>• Wherever possible, moist grassland and wetland habitats should be avoided;</li> <li>• The footprints to be cleared should be clearly demarcated prior to construction to prevent unnecessary clearing outside of these areas;</li> </ul>							
<i>Rehabilitation</i>							
<ul style="list-style-type: none"> <li>• Removed topsoil should be stockpiled and used to rehabilitate disturbed areas;</li> <li>• A suitable rehabilitation programme should be developed and implemented for all areas that were disturbed during construction and operations. The programme should include: <ul style="list-style-type: none"> <li>○ Concurrent rehabilitation, if possible;</li> <li>○ Contouring, stabilisation and active revegetation of all disturbed areas using locally-occurring indigenous grass species that are known to be common in Eastern Highveld Grassland.</li> </ul> </li> </ul>							

Table 13: Approximate extent of habitat loss of each of vegetation community.

Proposed Infrastructure Component/Option	Moist Grassland and Wetlands	Dry Mixed Grassland	Alien Tree Plantations and Woodlots	Cultivated Fields	Post-Mining Rehabilitated Land
Conveyor Alternative A	0.83 ha	0.42 ha	0.55 ha	0.03 ha	6.40 ha
Conveyor Alternative B	1.02 ha	0.21 ha	1.21 ha	-	7.34 ha
Conveyor Alternative C	0.79 ha	0.34 ha	1.20 ha	0.04 ha	7.12 ha
Conveyor Alternative D	0.39 ha	1.47 ha	0.62 ha	0.37 ha	4.45 ha
Opencast Shaft Option 1 - Conveyor	-	-	-	-	4.32 ha
Opencast Shaft Option 2	-	0.10 ha	3.42 ha	11.69 ha	8.57 ha
Opencast Pits	51.18 ha	167.86 ha	54.02 ha	336.77 ha	-

#### 5.4.2. Habitat Fragmentation

Issue	Mitigation Measures	Impact Rating Criteria				Significance
		Nature	Extent	Duration	Magnitude	
<b>Construction Phase</b>						
<b>Habitat Fragmentation</b>						
<p>Habitat fragmentation occurs when habitat loss and modification cause the breakup of available natural habitat into smaller, discontinuous and often isolated habitat patches. The ecological properties of remaining habitat patches are altered as a consequence, which negatively affects various important landscape-scale ecological processes, such as fauna movement and dispersal. The proposed open pits and aboveground linear structures will cause additional fragmentation of the study area, isolating and fragmenting remaining natural habitat patches. This will negatively affect, amongst other things, the ability of fauna to move and disperse across the immediate landscape.</p>						
<b>Conveyor Options</b>						
<p>All conveyor alternatives from Opencast Shaft Option 2 traverse in a southerly direction before turning west and crossing the Klein-Komati River. Conveyor alternative D will cross the Klein-Komati River at the existing haul road crossing point, whereas conveyor alternatives A, B and C will cross the river at new locations, downstream of the existing haul road. As such, the degree of habitat fragmentation from conveyor alternative D will be less than that resulting from the other proposed alternatives. Prior to mitigation, conveyor alternatives A, B and C are rated as having a high impact significance, while after mitigation, they will have a medium impact significance. In comparison, conveyor alternative D will have a medium significance prior to mitigation and a low impact significance after mitigation.</p>						

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Opencast Shaft Option 2</b>							
The development of Opencast Shaft Option 2 will result in habitat fragmentation. Before mitigation, impact significance is rated medium significance. With mitigation, impact significance is reduced to low significance.							
<b>Opencast Pits</b>							
The opencast pits will constitute large areas of transformation that will result in the fragmentation of habitat. Prior to mitigation, habitat fragmentation is rated an impact of high significance. With effective mitigation, impact significance can be reduced to medium.							
Conveyor Alternatives A, B & C	Before mitigation	Negative	2	4	10	5	80 (high)
	After mitigation	Negative	1	3	8	3	36 (medium)
Conveyor Alternative D	Before mitigation	Negative	2	4	6	5	60 (medium)
	After mitigation	Negative	1	3	4	3	24 (low)
Opencast Shaft Option 2	Before mitigation	Negative	2	5	6	4	52 (medium)
	After mitigation	Negative	1	4	4	3	27 (low)
Opencast Pits	Before mitigation	Negative	2	5	10	5	85 (high)
	After mitigation	Negative	1	4	8	4	52 (medium)
<b>Mitigation Measures</b>							
<i>Minimisation</i>							
<ul style="list-style-type: none"> <li>Maintain, as far as possible, natural habitat corridors and connectivity, as per the proposed mitigation measures for 'habitat loss and modification.'</li> <li>Movement across linear infrastructure should be facilitated by providing suitably sized gaps in fencing and/or culverts/passage ways under conveyors and roads for fauna.</li> </ul>							
<i>Rehabilitation</i>							
<ul style="list-style-type: none"> <li>All areas that were disturbed during construction and operations should be contoured, stabilised and actively revegetated using locally-occurring indigenous grass species that are known to be common in Eastern Highveld Grassland.</li> </ul>							

### 5.4.3. Establishment and Spread of Alien Invasive Species

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Construction Phase</b>							
<b>Establishment and Spread of Alien Invasive Species</b>							
<p>Disturbances caused by vegetation clearing and earth works can create conditions conducive to the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity. Several declared invasive species (e.g., <i>Cirsium vulgare</i> and <i>Verbena bonariensis</i>), as well as numerous other weeds (e.g., <i>Conyza</i> species and <i>Bidens pilosa</i>) occur in the study area. It is likely that these will rapidly colonise areas that have been disturbed by construction activities.</p> <p>Widespread vegetation clearing and earth works for all infrastructure components will occur during the construction phase. This will facilitate the establishment and spread of alien invasive vegetation. Prior to mitigation, this impact is rated medium for all infrastructure components. With effective mitigation, which includes the implementation of an active alien invasive species control programme, this impact can be reduced to a low significance.</p>							
All Infrastructure	Before mitigation	Negative	2	4	8	4	56 (medium)
	After mitigation	Negative	1	3	4	3	24 (low)
<b>Mitigation Measures</b>							
<i>Minimisation</i>							
<p>An alien invasive species control programme must be developed or the existing programme expanded to include the active control of alien invasive species that may establish as a result of proposed Project activities. It is recommended that the new or updated programme include:</p> <ul style="list-style-type: none"> <li>• A combined approach using both chemical and mechanical control methods;</li> <li>• Periodic follow-up treatments, informed by regular monitoring; and</li> <li>• Monitoring should take place in all disturbed areas, as well as adjacent undisturbed areas.</li> </ul>							
<i>Rehabilitation</i>							
<ul style="list-style-type: none"> <li>• Rehabilitate all sites that were disturbed during the construction phase, as well as old cultivated fields that will be left fallow, as per the rehabilitation programme; and</li> <li>• Rehabilitate all disturbed footprints during the closure and rehabilitation phases, as per the rehabilitation programme.</li> </ul>							
<b>Operational Phase</b>							
<b>Establishment and Spread of Alien Invasive Species</b>							
<p>The potential establishment and spread of alien invasive vegetation will continue to be an impact of concern during the operational phase. Prior to mitigation, this impact is rated medium for all infrastructure components. With effective mitigation this impact can be reduced to a low significance.</p>							

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
All Infrastructure	Before mitigation	Negative	2	4	6	4	48 (medium)
	After mitigation	Negative	1	3	2	2	12 (low)
<b>Mitigation Measures</b>							
<i>Minimisation</i>							
<ul style="list-style-type: none"> <li>Continue implementing the alien invasive species control programme. Control should include regular follow-up treatments, as informed by the findings of ongoing monitoring</li> </ul>							
<b>Decommissioning and Closure</b>							
<b>Establishment and Spread of Alien Invasive Species</b>							
Disturbances caused by decommissioning and closure activities will further facilitate the potential establishment and spread of alien invasive vegetation. Prior to mitigation, this impact is rated medium for all infrastructure components. With effective mitigation this impact can be reduced to a low significance.							
All Infrastructure	Before mitigation	Negative	2	4	8	4	56 (medium)
	After mitigation	Negative	1	3	4	3	24 (low)
<b>Mitigation Measures</b>							
<i>Minimisation</i>							
Alien invasive species control should be conducted annually during the decommissioning and closure phase, and biennially (every two years) after closure until such a time as monitoring indicates that 1) disturbed areas have successfully rehabilitated, and 2) alien invasive species population are no longer problematic on-site.							
<i>Rehabilitation</i>							
Rehabilitate all disturbed footprints during the decommissioning and closure phase, as per the rehabilitation programme.							

#### 5.4.4. Mortality and Disturbance of Fauna

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Construction Phase</b>							
<b>Mortality and Disturbance of Fauna</b>							
<p>Large or mobile fauna will move off to avoid disturbances caused by construction activities. However, smaller and less mobile species may be trapped, injured and killed during vegetation clearing and earth works. Susceptible fauna includes, amongst others, burrowing mammals (e.g., moles, rodents), nesting birds, reptiles and amphibians. Other common causes of fauna death, injury or disturbance include; vehicle collisions along access roads; hunting and snaring by workers; trapping of fauna in fences, excavations and trenches; and, sensory disturbances caused by excessive noise, blasting, dust and artificial lighting.</p> <p>Numerous fauna species have been recorded in the study area, and it is likely that these will be negatively impacted by proposed construction activities. Prior to mitigation, this impact is rated medium for all infrastructure components. With effective mitigation, which includes several mechanisms of avoidance and minimisation, this impact can be reduced to a low significance.</p>							
All Infrastructure	Before mitigation	Negative	2	4	8	4	56 (medium)
	After mitigation	Negative	1	2	4	2	14 (low)
<b>Mitigation Measures</b>							

Issue	Mitigation Measures	Impact Rating Criteria				Significance
		Nature	Extent	Duration	Magnitude	
<b><i>Avoidance and Minimisation</i></b>						
<u>Death / injury during vegetation clearing and earth works</u>						
<ul style="list-style-type: none"> <li>• An ECO should be on-site during vegetation clearing to monitor and manage any wildlife-human interactions. The ECO should be trained in <i>inter alia</i>, snake handling and species identification;</li> <li>• As appropriate, barrier should be erected to prevent fauna gaining access to construction and operational areas where they have a high probability of being killed or injured.</li> </ul>						
<u>Vehicle-wildlife collisions</u>						
<ul style="list-style-type: none"> <li>• A low-speed limit (recommended 20-40 km/h) should be enforced on site to reduce wildlife collisions.</li> </ul>						
<u>Hunting, snaring and poisoning</u>						
<ul style="list-style-type: none"> <li>• The handling, poisoning and killing of on-site fauna by mine workers and contractors must be strictly prohibited; and</li> <li>• Employees and contractors should be made aware of the presence of, and rules regarding fauna through suitable induction training and on-site signage.</li> </ul>						
<u>Noise, vibrations and lights</u>						
<ul style="list-style-type: none"> <li>• General noise abatement equipment should be fitted to machinery and vehicles;</li> <li>• Noise shields, including earth berms, should be constructed around sites of noise origin;</li> <li>• Dust suppression using water bowsers should be undertaken on all mine roads and other sites where dust entrainment occurs;</li> <li>• Plan the lighting requirements of facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination. Possible options include: <ul style="list-style-type: none"> <li>○ Zoning of areas of high and low lighting requirements;</li> <li>○ Using motion-activated lights as opposed to permanent lights; and</li> <li>○ Reducing height and angle of lights.</li> </ul> </li> </ul>						
<b>Operational Phase</b>						
<b>Mortality and Disturbance of Fauna</b>						
<p>Potential causes of fauna death, injury or disturbance to fauna during the operational phase include vehicle collisions along access roads; hunting and snaring by workers; trapping of fauna in fences, excavations and trenches; and, sensory disturbances caused by excessive noise, blasting, dust and artificial lighting.</p> <p>During the operational phase, prior to mitigation, this impact is rated medium significance. With effective mitigation, this impact can be reduced to a low significance for all infrastructure components.</p>						

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
All Infrastructure	Before mitigation	Negative	2	3	6	4	44 (medium)
	After mitigation	Negative	1	2	4	2	14 (low)
<b>Mitigation Measures</b>							
<i>Refer to mitigation measures discussed for the construction phase.</i>							
<b>Decommissioning and Closure</b>							
<b>Mortality and Disturbance of Fauna</b>							
<p>Potential causes of fauna death, injury or disturbance to fauna during the decommissioning and closure phase include vehicle collisions along access roads; hunting and snaring by workers; trapping of fauna in fences, excavations and trenches; and, sensory disturbances caused by excessive noise, blasting, dust and artificial lighting.</p> <p>During the decommissioning and closure phase, prior to mitigation, this impact is rated medium significance. With effective mitigation, this impact can be reduced to a low significance for all infrastructure components.</p>							
All Infrastructure	Before mitigation	Negative	2	3	6	4	44 (medium)
	After mitigation	Negative	1	2	4	2	14 (low)
<b>Mitigation Measures</b>							
<i>Refer to mitigation measures discussed for the construction phase.</i>							



#### 5.4.5. Loss of Flora of Conservation Concern

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Construction Phase</b>							
<b>Loss of Flora of Conservation Concern</b>							
Vegetation clearing and earth works can result in the direct destruction of flora species of conservation concern. In the study area, these include several provincially 'protected' flora species which may be present in areas of moist grassland and wetland and dry mixed grassland. All proposed Project infrastructure impact these vegetation communities to various extents.							
<b>Note:</b>							
<ul style="list-style-type: none"> <li>The development of the Discard Dump footprint has been approved under the existing authorisation for the Belfast Implementation Project (BIP), and it is assumed that flora species of conservation concern occurring in this footprint have been relocated as part of the BIP search and rescue programme;</li> <li>The entire Opencast Shaft Option 1 footprint is located within the footprint of the proposed open cast pit for this project. This option has therefore not been separately assessed for the loss of flora of conservation concern.</li> </ul>							
Prior to mitigation, this impact is rated of medium significance for all infrastructure components. With effective mitigation, which includes the search and rescue of flora species of conservation concern under the correct permit, this impact can be reduced to a low significance.							
All Conveyor Alternatives	Before mitigation	Negative	2	1	10	3	39 (medium)
	After mitigation	Negative	1	1	4	1	6 (low)
Opencast Shaft Option 2	Before mitigation	Negative	2	1	10	3	39 (medium)
	After mitigation	Negative	1	1	4	1	6 (low)
Opencast Pits	Before mitigation	Negative	2	1	10	4	52 (medium)
	After mitigation	Negative	1	1	4	2	6 (low)
<b>Mitigation Measures</b>							

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<i>Avoidance and Minimisation</i>							
<ul style="list-style-type: none"> <li>• A grid survey of natural habitat patches within the proposed open pit footprint should be conducted during the wet/growing season prior to vegetation clearing to ensure that there are no flora species of conservation concern present;</li> <li>• If flora species of conservation concern are encountered, a suitable <i>ex situ</i> conservation plan should be developed under consultation with the relevant authority. This is likely to include the relocation of plants (under permit) to an adjacent area of natural vegetation that is unlikely to be disturbed in the future; and</li> <li>• No flora species of conservation concern should be disturbed without the necessary permit in place.</li> </ul>							

#### 5.4.6. Loss and Disturbance of Fauna of Conservation Concern

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<b>Construction Phase</b>							
<b>Loss and Disturbance of Fauna of Conservation Concern</b>							
<p>Habitat modification and fragmentation during the construction phase may render remaining habitat patches less acceptable to sensitive fauna of conservation concern, such as <i>inter alia</i>, the Serval, Spotted-necked Otter, Musk Shrew, Southern Bald Ibis, Secretarybird and Sensitive Species 2. Moreover, sensory disturbances from on-going mining activities (e.g., blasting, high levels of machinery and vehicle activity) may disturb these species to the extent that they no longer use habitats in close proximity to mining activities. Both factors may result in a reduction in local populations and/or a reduction in their use of on-site habitats.</p> <p>The loss and disturbance of fauna of conservation concern associated with all proposed Project infrastructure/activities during the construction phase is rated a high impact before mitigation, but can be reduced to a medium impact with the implementation of the recommended mitigation measures.</p>							
All Infrastructure	Before mitigation	Negative	2	4	10	4	64 (high)
	After mitigation	Negative	2	3	8	3	39 (medium)
<b>Mitigation Measures</b>							
<i>See recommended mitigation measures for 'Mortality and disturbance of fauna'.</i>							
<b>Operational Phase</b>							
<b>Loss and Disturbance of Fauna of Conservation Concern</b>							
<p>Sensory disturbances from on-going mining activities (e.g., blasting, high levels of machinery and vehicle activity) during the operational phase may disturb these species to the extent that they no longer use habitats in close proximity to mining activities. Both factors may result in a reduction in local populations and/or a reduction in their use of on-site habitats.</p> <p>The loss and disturbance of fauna of conservation concern associated with all proposed Project infrastructure/activities during the operational phase is rated a high impact before mitigation, but can be reduced to a medium impact with the implementation of the recommended mitigation measures.</p>							
All Infrastructure	Before mitigation	Negative	2	4	10	4	64 (high)
	After mitigation	Negative	2	3	8	3	39 (medium)
<b>Mitigation Measures</b>							

Issue	Mitigation Measures	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
<i>See recommended mitigation measures for 'Mortality and disturbance of fauna'.</i>							

## 5.5. Monitoring Requirements

The following monitoring measures are proposed:

- The existing wetland monitoring programme at Belfast Cola Mine should be continued. This should focus specifically on conducting surveys during the wet/growing season, when most flora species are productive and flowering;
- The existing terrestrial ecology monitoring programme should also be continued, but should focus specifically on the presence of fauna species of conservation concern that were frequently recorded in the study area, prior to mining. These include:
  - Serval (*Leptailurus serval*),
  - Secretarybird (*Sagittarius serpentarius*), Southern-Bald Ibis (*Geronticus calvus*) and Sensitive Species 2; and
- On-going monitoring of alien invasive species populations should be conducted and focused on all locations where mining activities have disturbed moist grassland and wetland, and dry mixed grassland habitats. The findings of monitoring should be used to inform the scope and nature of alien invasive species control.

## 5.6. Cumulative Impacts

The study area is characterised by a mosaic of natural and modified habitats, with the latter form the most extensive and dominated by cultivated fields. This pattern is consistent across the broader landscape surrounding the study area. Remaining areas of undeveloped natural and semi-natural habitat are therefore critically important in supporting and buffering local landscape-scale ecological processes.

The cumulative impact of the progressive loss and disturbance of natural habitat associated with the expansion of the open pits and development of other Project infrastructure, is likely to negatively affect the ability of the immediate landscape to maintain the ecological supporting role that contributes to the ecosystem dynamics of the broader landscape. This may negatively affect the long-term viability of local populations of flora and fauna species of conservation concern. The application of the mitigation measures will reduce the Project's impact on landscape ecology dynamics, yet some residual impacts will remain.

## 6. Conclusions and Recommendations

Despite the modified and fragmented nature of habitat within the study area, grassland and wetland patches are important habitat for flora and fauna, and are likely to play an important functional role in maintaining the ecosystem dynamics and connectivity of the broader landscape. Despite being dominated by alien species, alien tree plantations and woodlots increase overall landscape heterogeneity and provide refuge habitat for fauna species.

Accordingly, the sensitivity of on-site habitats with regard to possible ecological disturbances, ranges across the spectrum from Low (alien tree plantations and woodlots), to Moderate (dry mixed grassland) and High (moist grassland and wetlands).

Several negative impacts on terrestrial ecology associated with the proposed Project have been identified. Of these, the loss and modification of natural habitat resulting from vegetation clearing and earth works during construction, is the primary impact of concern, and will in turn, cause several additional impacts. These include habitat fragmentation (i.e., the disruption of landscape connectivity), the disturbance and/or loss of flora and fauna species of conservation concern, the killing or injuring of general fauna, and the spread of alien invasive species. It is noted that some proposed infrastructure components, such as the conveyor alternatives, are sited across land that will be soon be cleared for open cast mining associated with the authorised Belfast Implementation Project. As such, most of the proposed conveyor will traverse across already modified land that has undergone post-mining rehabilitation.

Several management measures have been identified to mitigate the significance of the identified impacts. It is important that these are included in the EMPr for the proposed Project and that they are actively implemented during the appropriate Project phases. Key mitigation measures include, *inter alia*:

- Limit vegetation clearing to the minimum area required for construction and operations;
- Avoid clearing in moist grassland and wetland habitats, as far as possible;
- Rehabilitate all disturbed areas and conduct ongoing alien invasive species control; and
- Conduct surveys for Red List and protected flora in the proposed Project development footprints, and implement a relocation programme, prior to initiation of any construction activities.

Of proposed infrastructure alternatives, the entire footprint of proposed Opencast Shaft Option 1 is located within a proposed opencast pit. This alternative, along with its proposed conveyor option 1, were therefore not considered further with respects to habitat loss. Opencast Shaft Option 2 and its proposed conveyor alternatives were considered. Conveyor Alternative D is the preferred option from a terrestrial ecology perspective. Unlike the other proposed alternatives, conveyor alternative D crosses the Klein-Komati River at an existing haul road crossing point. As such, habitat fragmentation resulting from this will have less of an impact than that of the other alternatives, which require new downstream crossing points.

Provided that the mitigation measures detailed in Section 5.4.1 to Section 5.4.6 and the monitoring requirements listed in Section 5.5 of this report are adhered to, the Project may be authorised from a terrestrial ecology perspective.

## 6.1. Conditions for Inclusion in the Environmental Authorisation

The following condition is considered important for inclusion in the Project's environmental authorisation:

- A targeted survey for flora species of conservation concern within natural habitat patches within the proposed development footprints, prior to any vegetation clearing. The findings of the survey should be used to inform a suitable *ex situ* conservation plan, under consultation with the relevant authority (SANBI and/or MPTA). This is likely to include the relocation of plants (under permit) to an adjacent area of natural vegetation that is unlikely to be disturbed in the future.

## 7. References

Bates, M., Branch, W., Bauer, A., Burger, M., Marais, J., Alexander, G. and De Villiers, M. (eds.) (2014) Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Pretoria: Suricata 1, South African Biodiversity Institute.

Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T. (Eds). The 2016 Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Conservation of Agricultural Resources Act (CARA) (Act No. 43 of 1983).

David Hoare Consulting (2019). Wetland Vegetation Monitoring 2019. Exxaro Belfast Implementation Project, near Belfast, Mpumalanga. Lynnwood Ridge.

DEA (Department of Environmental Affairs) (2016). National protected Areas Expansion Strategy for South Africa. Department of Environmental Affairs, Pretoria, South Africa.

Dippenaar-Schoeman, A. (2014) Field Guide to the Spiders of South Africa. Cape Town: LAPA Publishers.

Du Preez, L. and Carruthers, V. (2009) A Complete Guide to the Frogs of Southern Africa. Cape Town: Struik Nature.

Edwards, D. (1983). A broad-scale structural classification of vegetation for practical purposes. *Bothalia*. 14, 3 & 4; 705-712.

EWT (Endangered Wildlife Trust) (2016) Red List of Mammals of South Africa, Lesotho and Swaziland. Excel Spreadsheet.

FitzPatrick Institute of African Ornithology (2021). FrogMAP Virtual Museum. Accessed at <http://vmus.adu.org.za/?vm=FrogMAP> on 2021-03-18

FitzPatrick Institute of African Ornithology (2021). ReptileMAP, Virtual Museum. Accessed at <http://vmus.adu.org.za/?vm=ReptileMAP> on 2021-03-18.

Golder (2019a) Belfast Wet Season Terrestrial Flora and Fauna Monitoring. Exxaro Coal Mpumalanga (Pty) Ltd.

Golder (2019b) Belfast Dry Season Terrestrial Flora and Fauna Monitoring. Exxaro Coal Mpumalanga (Pty) Ltd.

GroundTruth (2017). Relocation and Offset Strategy for the Exxaro Belfast Coal Mine Project, Mpumalanga. Project Ref. No. GTB0106.

IUCN (International Union for the Conservation of Nature). (2020-3). Red List of Threatened Species. Accessed at <https://www.iucnredlist.org/> on 2021-03-18

Marnewick, M., Retief, E., Theron, N., Wright, D. and Anderson, T. (2015) Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.



Mentis, M.T. and Huntley, B.J. (1982). A description of the Grassland Biome Project. South African National Scientific Programmes. Report No. 62. CSIR. Pretoria.

Mpumalanga Nature Conservation Act (Act No. 10 of 1998)

Mucina, L. and Rutherford, M.C. (eds) (Reprint 2011) The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute (SANBI), Pretoria.

NEMBA Threatened Ecosystems National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - National list of threatened terrestrial ecosystems for South Africa (2011). South Africa.

NEMBA ToPS List National Environmental Management: Biodiversity Act (Act No. 10 of 2004) - Lists of critically endangered, endangered, vulnerable and protected species. (2013). South Africa.

National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004). Alien and invasive species lists, 2016.

Roberts VII Multimedia Birds of Southern Africa.

SABAP 2 (South African Bird Atlas Project 2) (2021). Available from: <http://sabap2.birdmap.africa>

SANBI (2021) Red List of South African Plants. South African National Biodiversity Institute. Available from: <http://redlist.sanbi.org/> [Accessed 18 March 2021].

SANBI (2013). Grassland Ecosystem Guidelines: landscape interpretation for planners and managers. Compiled by Cadman, M., de Villiers, C., Lechmere-Oertel, R. and McCulloch, D. South African National Biodiversity Institute, Pretoria.

Scholes, R. (2009) Syndromes of dryland degradation in southern Africa. *African Journal of Range and Forage Science*, 26 (3), pp. 113–125.

Skinner, J. and Smithers, R. (1990) The Mammals of the Southern African Subregion. Second Edi. Pretoria.

SABAP 2 (South African Bird Atlas Project 2) (2021). Available from: <http://sabap2.birdmap.africa> [Accessed 28 January 2021].

Stuart, C. and Stuart, T. (2007) Field Guide to Mammals of Southern Africa. Fourth Edi. Cape Town: Struik Nature.

Taylor, M.R., Peacock, F. and Wanless, R.W. (Eds) (2015). The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa. Johannesburg.

Van Wyk, B., Van Oudtshoorn, B. and Gericke, N. (2009) Medicinal Plants of South Africa. Second Edi. Pretoria: Briza Publications.

---

Report Compiled by:

Andrew Zinn (*Pr.Sci.Nat.*)

Terrestrial Ecologist

Hawkhead Consulting

## Appendix A: Flora species recorded in the Study Area

Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Acacia elata</i> *	Alien - NEMBA Category 1b
<i>Acacia dealbata</i> *	Alien - NEMBA Category 2
<i>Acacia mearnsii</i> *	Alien - NEMBA Category 2
<i>Acacia melanoxylon</i> *	Alien - NEMBA Category 2
<i>Acalypha angustata</i>	Indigenous
<i>Agrostis eriantha</i>	Indigenous
<i>Agrostis lachnantha</i>	Indigenous
<i>Agrostis montevidensis</i>	Indigenous
<i>Alloteropsis semialata</i>	Indigenous
<i>Aloe ecklonis (A. cf. kraussii)</i>	Indigenous - Protected (Mpumalanga)
<i>Alternanthera pungens</i> *	Alien
<i>Amaranthus hybridus</i> *	Alien
<i>Amaranthus thunbergii</i>	Indigenous
<i>Amaryllidaceae</i>	Indigenous
<i>Andropogon appendiculatus</i>	Indigenous
<i>Andropogon eucomus</i>	Indigenous
<i>Andropogon schirensis</i>	Indigenous
<i>Anthospermum aethiopicum</i>	Indigenous
<i>Anthospermum rigidum</i>	Indigenous
<i>Argyrobium sp.</i>	Indigenous
<i>Aristida congesta subsp. congesta</i>	Indigenous
<i>Aristida junciformis</i>	Indigenous
<i>Arundinella nepalensis</i>	Indigenous
<i>Asclepias fruticosus</i>	Indigenous
<i>Aster harveyanus</i>	Indigenous
<i>Becium obovatum</i>	Indigenous
<i>Berkheya cirsiifolia</i>	Indigenous
<i>Berkheya radula</i>	Indigenous
<i>Bidens bipinnata</i> *	Alien
<i>Bidens pilosa</i> *	Indigenous
<i>Boophone disticha</i>	Indigenous - Protected (Mpumalanga)
<i>Brachiaria eruciformis</i>	Indigenous
<i>Brachiaria serrata</i>	Indigenous
<i>Bromus catharticus</i> *	Alien
<i>Bromus species</i> *	Alien
<i>Brunsvigia species</i>	Indigenous - Protected (Mpumalanga)
<i>Calamagrostis epigeios</i>	Indigenous
<i>Callistemon viminalis</i> *	Alien - NEMBA Category 1b
<i>Carex species</i>	Indigenous
<i>Centella asiatica</i>	Indigenous
<i>Chaetacanthus setiger</i>	Indigenous
<i>Cheilanthes species</i>	Indigenous
<i>Chenopodium album</i> *	Alien
<i>Chironia purpurea</i>	Indigenous
<i>Chloris gayana</i>	Indigenous
<i>Chlorophytum fasciculatum</i>	Indigenous
<i>Ciclospermum leptophyllum</i> *	Alien

Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Cirsium vulgare</i> *	Alien - NEMBA Category 1b
<i>Coleochloa species</i>	Indigenous
<i>Commelina africana</i>	Indigenous
<i>Commelina benghalensis</i> *	Alien
<i>Conyza canadensis</i> *	Alien
<i>Conyza podocephala</i>	Indigenous
<i>Conyza scabrifa</i>	Indigenous
<i>Cosmos bipinnatus</i> *	Alien
<i>Cotula species</i>	Indigenous
<i>Crabbea acaulis</i>	Indigenous
<i>Crepis hypochoeridea</i> *	Alien
<i>Crinum species</i>	Indigenous
<i>Cucumis species</i>	Indigenous
<i>Cymbopogon pospischilii</i>	Indigenous
<i>Cynodon dactylon</i>	Indigenous
<i>Cyperus cf. difformis</i>	Indigenous
<i>Cyperus compressus</i>	Indigenous
<i>Cyperus denudatus</i>	Indigenous
<i>Cyperus esculentus</i> *	Alien
<i>Cyperus rigidifolius</i>	Indigenous
<i>Cyperus sexangularis</i>	Indigenous
<i>Cyperus species</i>	Indigenous
<i>Cyperus textilis</i>	Indigenous
<i>Cyrtanthus breviflorus</i>	Indigenous - Protected (Mpumalanga)
<i>Datura stramonium</i> *	Alien - NEMBA Category 1b
<i>Dianthus mooiensis</i>	Indigenous
<i>Dierama species</i>	Indigenous - Protected (Mpumalanga)
<i>Digitaria diagonalis</i>	Indigenous
<i>Digitaria eriantha</i>	Indigenous
<i>Digitaria sanguinalis</i> *	Alien
<i>Diospyros lycioides</i>	Indigenous
<i>Eleocharis dregeana</i>	Indigenous
<i>Eleocharis sp. cf. caduca</i>	Indigenous
<i>Eleusine coracana</i>	Indigenous
<i>Elionurus muticus</i>	Indigenous
<i>Eragrostis capensis</i>	Indigenous
<i>Eragrostis chloromelas</i>	Indigenous
<i>Eragrostis curvula</i>	Indigenous
<i>Eragrostis gummiflua</i>	Indigenous
<i>Eragrostis nindensis</i>	Indigenous
<i>Eragrostis plana</i>	Indigenous
<i>Eragrostis planiculmis</i>	Indigenous
<i>Eragrostis racemosa</i>	Indigenous
<i>Eragrostis trichophora</i>	Indigenous
<i>Erythrina zeyheri</i>	Indigenous
<i>Eucalyptus camaldulensis</i> *	Alien NEMBA Category 1b
<i>Eucalyptus cf sideroxylon</i> *	Alien

Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Eucomis autumnalis</i>	Indigenous – Protected & Declining (Mpumalanga)
<i>Euphorbia species</i>	Indigenous
<i>Flaveria bidentis*</i>	Alien NEMBA Category 1b
<i>Fuirena pubescens</i>	Indigenous
<i>Geranium incanum</i>	Indigenous
<i>Gerbera sp.</i>	Indigenous
<i>Gladiolus ecklonii</i>	Indigenous - Protected (Mpumalanga)
<i>Gladiolus papilio</i>	Indigenous - Protected (Mpumalanga)
<i>Gladiolus sp.</i>	Indigenous
<i>Gleditsia triacanthos*</i>	Alien – NEMBA Category 1b
<i>Gnaphalium vestitum</i>	Indigenous
<i>Gomphocarpus fruticosus</i>	Indigenous
<i>Gnidia capitata</i>	Indigenous
<i>Haemanthus humilis subsp. hirsutus</i>	Indigenous - Protected (Mpumalanga)
<i>Haplocarpha scaposa</i>	Indigenous
<i>Harpochloa falx</i>	Indigenous
<i>Helichrysum aureonitens</i>	Indigenous
<i>Helichrysum callicomum</i>	Indigenous
<i>Helichrysum krebsianum</i>	Indigenous
<i>Helichrysum pilosellum</i>	Indigenous
<i>Helichrysum rugulosum</i>	Indigenous
<i>Helichrysum setosum</i>	Indigenous
<i>Helichrysum species</i>	Indigenous
<i>Helictotrichon turgidulum</i>	Indigenous
<i>Hemarthria altissima</i>	Indigenous
<i>Hemizygia pretoriae</i>	Indigenous
<i>Heteropogon contortus</i>	Indigenous
<i>Hibiscus aethiopicus</i>	Indigenous
<i>Hibiscus sp.</i>	Indigenous
<i>Hibiscus trionum</i>	Indigenous
<i>Hyparrhenia dregeana</i>	Indigenous
<i>Hypericum lalandii</i>	Indigenous
<i>Hypochaeris radicata*</i>	Alien
<i>Hypoxis species</i>	Indigenous
<i>Indigofera species</i>	Indigenous
Iridaceae	Indigenous
<i>Isolepis species</i>	Indigenous
<i>Juncus effusus*</i>	Alien
<i>Juncus lomatophyllus</i>	Indigenous
<i>Juncus oxycarpus</i>	Indigenous
<i>Khadia carolinensis</i>	Indigenous - Vulnerable
<i>Kniphofia porphyrantha</i>	Indigenous - Protected (Mpumalanga)
<i>Kyllinga alba</i>	Indigenous
<i>Kyllinga erecta</i>	Indigenous
<i>Kyllinga pulchella</i>	Indigenous
<i>Lactuca inermis</i>	Indigenous
<i>Ledebouria cooperi</i>	Indigenous

Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Leersia hexandra</i>	Indigenous
<i>Lepidium africanum</i>	Indigenous
<i>Limosella major</i>	Indigenous
<i>Lobelia flaccida</i>	Indigenous
<i>Mariscus species</i>	Indigenous
<i>Medicago laciniata</i>	Alien
<i>Miscanthus junceus</i>	Indigenous
<i>Monopsis decipiens</i>	Indigenous
<i>Nemesia fruticans</i>	Indigenous
<i>Nidorella anomala</i>	Indigenous
<i>Oenothera rosea*</i>	Alien
<i>Oldenlandia herbacea</i>	Indigenous
<i>Opuntia ficus-indica*</i>	Alien – NEMBA Category 1b
<i>Oxalis corniculata*</i>	Alien
<i>Oxalis obliquifolia</i>	Indigenous
<i>Panicum schinzii</i>	Indigenous
<i>Paspalum dilatatum*</i>	Alien
<i>Paspalum distichum*</i>	Alien
<i>Paspalum notatum*</i>	Alien
<i>Paspalum urvillei*</i>	Alien
<i>Pelargonium luridum</i>	Indigenous
<i>Pennisetum clandestinum*</i>	Alien – NEMBA Category 1b
<i>Pennisetum sphacelatum</i>	Indigenous
<i>Pentanisia angustifolia</i>	Indigenous
<i>Persicaria lapathifolia*</i>	Alien
<i>Persicaria species</i>	Alien
<i>Pinus patula*</i>	Alien NEM:BA Category 2
<i>Phragmites australis</i>	Indigenous
<i>Phytolacca octandra*</i>	Alien NEM:BA Category 1b
<i>Plantago lanceolata*</i>	Alien
<i>Plantago major*</i>	Alien
<i>Plectranthus species</i>	Alien
<i>Pollichia campestris</i>	Indigenous
<i>Populus x canescens*</i>	Alien NEM:BA Category 2
<i>Pseudognaphalium luteo-album*</i>	Alien
<i>Pseudognaphalium oligandrum*</i>	Alien
<i>Pteridophyta</i>	Indigenous
<i>Pycnostachys reticulata</i>	Indigenous
<i>Pycneus macranthus</i>	Indigenous
<i>Pycneus nitidus</i>	Indigenous
<i>Pygmaeothamnus zeyheri</i>	Indigenous
<i>Ranunculus multifidus*</i>	Alien
<i>Raphanus raphanistrum*</i>	Alien
<i>Rhynchosia totta</i>	Indigenous
<i>Richardia brasiliensis*</i>	Alien
<i>Rubus sp.*</i>	Alien
<i>Rumex acetosella*</i>	Alien

Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Rumex crispus</i> *	Alien
<i>Salix babylonica</i> *	Alien
<i>Scabiosa columbaria</i>	Indigenous
<i>Schinus molle</i> *	Alien
<i>Schistostephium crataegifolium</i>	Indigenous
<i>Schkuhria pinnata</i> *	Alien
<i>Schoenoplectus brachyceras</i>	Indigenous
<i>Schoenoplectus corymbosus</i>	Indigenous
<i>Schoenoplectus decipiens</i>	Indigenous
<i>Scirpoides burkei</i>	Indigenous
<i>Selago densiflora</i>	Indigenous
<i>Senecio consanguineus</i>	Indigenous
<i>Senecio erubescens subsp. crepidifolia</i>	Indigenous
<i>Senecio glandulosa-pilosa</i>	Indigenous
<i>Senecio inaequidens</i>	Indigenous
<i>Senecio isatideus</i>	Indigenous
<i>Senecio pentactinus</i>	Indigenous
<i>Senecio purpurea</i>	Indigenous
<i>Senecio species</i>	Indigenous
<i>Senecio venosus</i>	Indigenous
<i>Seriphium plumosum</i>	Indigenous
<i>Setaria nigrirostris</i>	Indigenous
<i>Setaria pallida-fusca</i>	Indigenous
<i>Setaria sphacelata var. torta</i>	Indigenous
<i>Setaria verticillata</i>	Indigenous
<i>Sisymbrium turczaninowii</i>	Indigenous
<i>Solanum nigrum</i> *	Alien
<i>Solanum sisymbriifolium</i>	Alien - NEMBA Category 1b
<i>Sonchus dregeanus</i> *	Alien
<i>Sonchus oleraceus</i> *	Alien
<i>Sonchus wilmsii</i>	Indigenous
<i>Sporobolus africanus</i>	Indigenous
<i>Stiburus alopecuroides</i>	Indigenous
<i>Tagetes minuta</i> *	Alien
<i>Taraxacum officinale</i> *	Alien
<i>Tephrosia capensis</i>	Indigenous
<i>Tephrosia capensis</i>	Indigenous
<i>Teucrium trifidum</i>	Indigenous
<i>Themeda triandra</i>	Indigenous
<i>Trifolium species</i>	Alien
<i>Tristachya leucothrix</i>	Indigenous
<i>Typha capensis</i>	Indigenous
<i>Verbena bonariensis</i> *	Alien - NEMBA Category 1b
<i>Verbena tenuisecta</i> *	Alien
<i>Vernonia natalensis</i>	Indigenous
<i>Vernonia oligocephala</i>	Indigenous
<i>Vernonia species</i>	Indigenous



Scientific Name	Notes (Incl. Origin, Declared Invasive Status & Conservation Status)
<i>Wahlenbergia species</i>	Indigenous
<i>Watsonia species</i>	Indigenous - Protected (Mpumalanga)
<i>Xanthium strumarium*</i>	Alien - NEMBA Category 1b
Master List from David Hoare Consulting (2019), updated with data from Golder monitoring reports (2015-2020) and GroundTruth (2017).	

## Appendix B: Bird species recorded in the Study Area

Common Name	Scientific Name
African (Ethiopian) Snipe	<i>Gallinago nigripennis</i>
African Black Duck	<i>Anas sparsa</i>
African Darter	<i>Anhinga rufa</i>
African Fish Eagle	<i>Haliaeetus vocifer</i>
African Harrier-Hawk	<i>Polyboroides typus</i>
African Hoopoe	<i>Upupa africana</i>
African Jacana	<i>Actophilornis africanus</i>
African Pipit	<i>Anthus cinnamomeus</i>
African Sacred Ibis	<i>Threskiornis aethiopicus</i>
African Spoonbill	<i>Platalea alba</i>
African Stonechat	<i>Saxicola torquatus</i>
African Swampphen	<i>Porphyrio madagascariensis</i>
African Wattled Lapwing	
Amethyst Sunbird	<i>Chalcomitra amethystina</i>
Amur Falcon	<i>Falco amurensis</i>
Ant-eating Chat	<i>Myrmecocichla formicivora</i>
Banded Martin	<i>Riparia cincta</i>
Barn Swallow	<i>Hirundo rustica</i>
Black Crake	<i>Amaurornis flavirostra</i>
Black Sparrowhawk	<i>Accipiter melanoleucus</i>
Black-headed Heron	<i>Ardea melanocephala</i>
Black-headed Oriole	<i>Oriolus larvatus</i>
Black-shouldered Kite	<i>Elanus caeruleus</i>
Blacksmith Lapwing	<i>Vanellus armatus</i>
Blue Korhaan	<i>Eupodotis caerulescens</i>
Bokmakierie	<i>Telophorus zeylonus</i>
Brown-throated Martin	<i>Riparia paludicola</i>
Burchell's Coucal	<i>Centropus burchelli</i>
Cape Canary	<i>Serinus canicollis</i>
Cape Crow	<i>Corvus capensis</i>
Cape Longclaw	<i>Macronyx capensis</i>
Cape Robin-chat	<i>Cossypha humeralis</i>
Cape Shoveler	<i>Anas smithii</i>
Cape Sparrow	<i>Passer melanurus</i>
Cape Turtle Dove	<i>Streptopelia capicola</i>
Cape Vulture	<i>Gyps coprotheres</i>
Cape Wagtail	<i>Motacilla capensis</i>
Cape Weaver	<i>Ploceus capensis</i>
Cape White-eye	<i>Zosterops capensis</i>

Common Name	Scientific Name
Capped Wheatear	<i>Oenanthe pileata</i>
Common Buzzard	<i>Buteo buteo</i>
Common Fiscal	<i>Lanius collaris</i>
Common Greenshank	<i>Tringa nebularia</i>
Common House Martin	<i>Delichon urbicum</i>
Common Moorhen	<i>Gallinula chloropus</i>
Common Quail	<i>Coturnix coturnis</i>
Common Sandpiper	<i>Actitis hypoleucos</i>
Common Waxbill	<i>Estrilida astrild</i>
Crowned Lapwing	<i>Vanellus coronatus</i>
Dark-capped Bulbul	<i>Pycnonotus tricolor</i>
Dederic Cuckoo	<i>Chrysococcyx caprius</i>
Egyptian Goose	<i>Alopochen aegyptiaca</i>
Fan-tailed Widowbird	<i>Euplectes axillaris</i>
Flappet Lark	<i>Mirafra rufocinnamomea</i>
Fork-tailed Drongo	<i>Dicrurus adsimilis</i>
Giant Kingfisher	<i>Megaceryle maximus</i>
Glossy Ibis	<i>Plegadis falcinellus</i>
Golden-breasted Bunting	<i>Emberiza flaviventris</i>
Great Egret	<i>Ardea alba</i>
Greater Striped Swallow	<i>Cecropis cucullata</i>
Green Wood-hoopoe	<i>Phoeniculus purpureus</i>
Green-backed Heron	<i>Butorides striata</i>
Grey Crowned Crane	<i>Balearica regulorum</i>
Grey Heron	<i>Ardea cinerea</i>
Grey-headed Bush Shrike	<i>Malaconotus blanchoti</i>
Grey-headed Gull	<i>Chroicocephalus cirrocephalus</i>
Groundscraper Thrush	<i>Psophocichla litsitsirupa</i>
Hadedda Ibis	<i>Bostrychia hagedash</i>
Helmeted Guineafowl	<i>Numida meleagris</i>
House Sparrow	<i>Passer domesticus</i>
Jackal Buzzard	<i>Bueto rufofuscus</i>
Karoo Thrush	<i>Turdus simthi</i>
Kurricane Thrush	<i>Turdus libonyanus</i>
Lanner Falcon	<i>Falco biarmicus</i>
Laughing Dove	<i>Streptopelia senegalensis</i>
Lazy Cisticola	<i>Cisticola aberrans</i>
Lesser Striped Swallow	<i>Ceropsis abyssincia</i>
Levaillant's Cisticola	<i>Cisticola tinniens</i>
Little Bee-eater	<i>Merops pusillus</i>

Common Name	Scientific Name
Little Grebe	<i>Tachybaptus ruficollis</i>
Little Sparrow Hawk	<i>Accipiter minullus</i>
Little Swift	<i>Apus affinis</i>
Long-crested Eagle	<i>Lophaetus occipitalis</i>
Long-tailed Widowbird	<i>Euplectes progne</i>
Malachite Kingfisher	<i>Alcedo cristata</i>
Mallard	<i>Anas platyrhynchos</i>
Marsh Owl	<i>Asio capensis</i>
Marsh Sandpiper	<i>Tringa stagnatilis</i>
Marsh Warbler	<i>Acrocephalus palustris</i>
Namaqua Dove	<i>Oena capensis</i>
Natal Spurfowl	<i>Pternistis natalensis</i>
Neddicky	<i>Cisticola fulvicapilla</i>
Pied Crow	<i>Corvus albus</i>
Pied Kingfisher	<i>Ceryle rudis</i>
Pied Starling	<i>Lamprotornis bicolor</i>
Pin-tailed Whydah	<i>Vidua macroura</i>
Purple Heron	<i>Ardea purpurea</i>
Red Collared Widowbird	<i>Euplectes ardens</i>
Red-billed Quelea	<i>Quelea quelea</i>
Red-billed Teal	<i>Anas erythrorhyncha</i>
Red-chested Cuckoo	<i>Cuculus solitarius</i>
Red-eyed Dove	<i>Streptopelia semitorquata</i>
Red-footed Falcon	<i>Falco vespertinus</i>
Red-knobbed Coot	<i>Fulica cristata</i>
Red-throated Wryneck	<i>Jynx ruficollis</i>
Red-winged Francolin	<i>Scleroptila levaillantii</i>
Reed Cormorant	<i>Phalacrocorax africanus</i>
Rock Kestrel	<i>Falco rupicolus</i>
Ruff	<i>Philomachus pugnax</i>
Rufous-naped Lark	<i>Mirafraga africana</i>
Sand Martin	<i>Riparia riparia</i>
Secretarybird	<i>Sagittarius serpentarius</i>
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>
Southern Bald Ibis	<i>Geronticus calvus</i>
Southern Bou Bou	<i>Laniarius ferrugineus</i>
Southern Grey-headed Sparrow	<i>Passer diffusus</i>
Southern Masked Weaver	<i>Poloceus velatus</i>
Southern Pochard	<i>Netta erythrophthalma</i>
Southern Red Bishop	<i>Euplectes orix</i>

Common Name	Scientific Name
Speckled Mousebird	<i>Colius striatus</i>
Speckled Pigeon	<i>Columba guinea</i>
Speckled Weaver	<i>Polceus ocularis</i>
Spike-heeled Lark	<i>Chersomanes albofasciata</i>
Spotted Eagle-owl	<i>Bubo africanus</i>
Spotted Thick-knee	<i>Burhinus capensis</i>
Spur-winged Goose	<i>Plectropterus gambensis</i>
Squacco Heron	<i>Ardeola ralloides</i>
Steppe Buzzard	<i>Buteo vulpinus</i>
Striped Pipit	<i>Anthus lineiventris</i>
Swainson's Spurfowl	<i>Pternistis swainsonii</i>
Tawny-flanked Prinia	<i>Prinia subflava</i>
Three-banded Plover	<i>Charadrius tricollaris</i>
Western Cattle Egret	<i>Bubulcus ibis</i>
Western Osprey	<i>Pandion haliaetus</i>
Whiskered Tern	<i>Chlidonias hybrida</i>
White Stork	<i>Ciconia ciconia</i>
White-backed Duck	<i>Thalassornis leuconotus</i>
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>
White-faced Whistling Duck	<i>Dendrocygna viduata</i>
White-winged Widowbird	<i>Euplectes macrourus</i>
Wing-snapping Cisticola	<i>Cisticola ayresii</i>
Yellow-billed (Intermediate) Egret	<i>Egretta intermedia</i>
Yellow-billed Duck	<i>Anas undulata</i>
Yellow-billed Kite	<i>Milvus parasitus</i>
Yellow-crowned Bishop	<i>Euplectes orix</i>
Yellow-fronted Canary	<i>Crithagra mozambica</i>
Zitting Cisticola	<i>Cisticola juncidis</i>