

TERRESTRIAL BIODIVERSITY ASSESSMENT

PROPOSED QUARRIES AS PART OF THE UPGRADE OF PROVINCIAL ROAD R573 (K139/ MOLOTO ROAD), CITY OF TSHWANE, GAUTENG PROVINCE – QUARRY 5

Prepared for:



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April 2020

Declaration of Independence by Specialists

We, **Michelle Pretorius** and **Craig Widdows**, in our capacity as specialist ecological consultants, hereby declare that we -

- Act as independent consultants;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Have and will not have vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not;
- Based on information provided to us by the project proponent and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of our professional ability; and
- Undertake to have our work peer reviewed on a regular basis by a competent specialist in the field of study for which we are registered.



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EXECUTIVE SUMMARY

Field and Form Landscape Science, in collaboration with Malachite Ecological Services, were appointed by GA Environment (Pty) Ltd to conduct a terrestrial biodiversity assessment as part of the environmental assessment and authorisation process for the proposed construction of four (4) quarries (Quarries 4, 5, 6A and 6B), as part of the proposed Upgrading of Provincial Road R573 (K139/ Moloto Road) Section 1 from Baviaanspoort Road in the City of Tshwane (0.00km) to the Gauteng/ Mpumalanga Provincial Border (± 46.00 km) project. This report only considers Quarry 5, which is hereafter referred to as the 'project area'. The project area is located on portion 46 of the farm Boekenhoutskloofdrift 286 JR (located within the 2528DA Quarter Degree Square (QDS)) within the City of Tshwane Metropolitan Municipality, Gauteng Province, in the Dinokeng region (previously the Nokeng tsa Taemane Local Municipality).

The aim of the quarries is to serve as potential new sources of construction gravel, aggregate and crushed rock for the aforementioned road upgrade project. Quarry 5 specifically is considered as a source of crushed rock of lower quality and the project area holds significant potential for the production of G5, G6 and G7 materials produced from crushed quartzite bedrock. Proposed infrastructure is to comprise of a quarry and production area, a spoil area, a crushing area, a generator and fuel storage area, as well as temporary toilet facilities. It is foreseen that the extent of the project area will be utilised.

The project area is 19.9 hectares (ha) in extent and is located approximately 30km to the northeast of the N1/ N4 highway intersection along the R573 (Moloto Road) roadway and 14.5km to the southwest of the Moloto township near the Gauteng/ Mpumalanga provincial border. The R573 roadway borders the project area in the north. Quarry 5 is located in a region characterised by mostly undeveloped land and small holdings, interspersed with gravel roads and occasional agricultural fields, within a rural setting.

The terms of reference for the terrestrial biodiversity assessment are defined as follows:

- To provide an overview of applicable environmental legislation as well as national and regional planning guidelines to be considered in planning the project;
- To provide a broad description of the biophysical characteristics of the project area and its surroundings as applicable to the terrestrial biodiversity assessment;
- To categorise and describe the vegetation and habitat present within the project area according to relatively homogeneous habitat units and to provide an overview of vegetation structure, floral species composition (including alien species), faunal associations and the species diversity of each habitat unit;
- To identify floral and faunal Species of Conservation Concern (SCC) that could potentially occur in the project area and surrounds, to confirm their presence where possible and to identify whether suitable habitat for such species is available;
- To provide an indication of the conservation importance and ecological sensitivity of each habitat unit identified within the project area and to identify No Go areas where applicable; and
- To assess the potential impacts that may occur as a result of the proposed project and to provide site-specific mitigation measures and ongoing management measures that will be required to reduce such impacts should the proposed project be approved.

Desktop Assessment

The results of the desktop assessment in terms of the environmental setting and related conservation characteristics of the project area, are summarised in the table below.

Aspect	Conservation Characteristic
Biome	Savanna Biome
Bioregion	Central Bushveld Bioregion
Quarter Degree Square (QDS)	2528DA
Listed Threatened Ecosystems (2011)	-
Protected and Conservation Areas (PACA; 2019) and NPEAS Focus Areas (2010)	None, the project area is however located within the Seringveld Conservancy.
National Biodiversity Assessment (NBA): Terrestrial Remnant Vegetation (2018)	Remaining extent of Central Sandy Bushveld (Threat Status: Least Concern (LC); Protection Status: Poorly Protected)
Mining and Biodiversity Guidelines (2012)	-
Important Bird and Biodiversity Areas (IBA; 2015)	-
Gauteng Conservation Plan (C-Plan; 2011)	-
Gauteng Ridges v7	-
Vegetation Type (2006, 2012; NBA 2018)	Central Sandy Bushveld (Conservation Status: Vulnerable (VU))

Field Assessment

A field assessment was undertaken within the Quarry 5 project area over a period of one day on 23 March 2020 to determine the terrestrial ecological status of the project area. During the field assessment, four habitat units were identified, of which *Burkea africana* Woodland on rocky slopes and Mixed (*Combretum*-dominated) Woodland low ridge habitat covered the majority of the project area's extent. Both these habitat units provide intact, mostly untransformed habitat for a high diversity of floral species and niche faunal habitat. A high degree of connectivity exists between these niches which in turn supports ecological corridors and increased landscape permeability. Small areas of Modified Woodland habitat associated with an existing homestead and outbuilding within the project area and Open *Terminalia sericea* Woodland which extends further to the south of the project area, were also identified.

The terrestrial ecological sensitivity of each habitat was determined and these findings, as well as the development implications of the proposed project on each unit are summarised below.

Habitat Unit including approximate area	Terrestrial Ecological Sensitivity	Development Implications
<i>Burkea africana</i> woodland on rocky slopes (±17ha of 19.9ha project area)	Medium High	<p>Habitat</p> <p>Development within these areas will lead to the direct, permanent loss of good ecological condition woodland and associated rocky habitat that have not been significantly impacted in the past and is considered remnant vegetation in terms of the 2018 NBA. These habitat units currently serve as functional floral and faunal habitat and act as an important micro-habitat for reptiles and small mammals.</p> <p>SCC</p> <ul style="list-style-type: none"> No South African National Biodiversity Institute (SANBI) threatened/ Red Listed floral species were encountered. Confirmed floral SCC are <i>Boophone disticha</i> (LC; Declining), <i>Protea caffra</i> (protected under the Transvaal Nature Conservation Ordinance (No. 12 of 1983) (TNCO) and <i>Gladiolus</i> sp. (also protected under the TNCO). One <i>Sclerocarya birrea</i> subsp. <i>caffra</i> (Marula) is located 50m west of the project area and is unlikely to be impacted.
Mixed woodland on ridge (±2.8ha of 19.9ha project area)	Medium High	

		<ul style="list-style-type: none"> • Suitable habitat is available for the floral SCC <i>Hypoxis hemerocallidea</i> (LC; Declining) and <i>Searsia gracillima</i> var. <i>gracillima</i> (Near Threatened (NT)). • Faunal SCC including <i>Atelerix frontalis</i> (Southern African Hedgehog; NT), <i>Parahyaena brunnea</i> (Brown Hyaena; NT), <i>Coracias garrulus</i> (European Roller; NT) and <i>Falco biarmicus</i> (Lanner Falcon; VU) may utilise these habitat units, based on presence of suitable habitat and known distributions of these species. <p>Key mitigation measures Should development of this vegetation unit be unavoidable, the following key mitigation measures should be implemented:</p> <ul style="list-style-type: none"> • <i>Boophone disticha</i> must be rescued and relocated to suitable, similar habitat in the vicinity of the project area under the supervision of a qualified botanist and in line with a rescue and relocation procedure approved by the Gauteng Department of Agriculture and Rural Development (GDARD). • Alien and invasive floral species must be eradicated and controlled throughout all development phases of the project. • Construction and operational activities must take place in a phased approach to allow faunal species to disperse from the area. • Impacts on adjacent natural habitat must be prevented and strictly managed. • A high degree of rehabilitation must be undertaken, preferably concurrently as areas become available, and once quarrying activities have been completed in line with an approved rehabilitation plan.
<p><i>Terminalia sericea</i> Open Woodland (±0.06ha of 19.9ha project area)</p>	<p>Medium</p>	<p>Habitat Only a small portion of this habitat unit will be affected. This habitat unit is relatively intact and in a moderate ecological condition.</p> <p>SCC The portion of this habitat unit that will be affected is of limited extent but does provide suitable habitat for floral SCC such as <i>Boophone disticha</i> (LC; Declining) and <i>Hypoxis hemerocallidea</i> (LC; Declining). Faunal SCC such as <i>Atelerix frontalis</i> (NT), <i>Parahyaena brunnea</i> (NT), <i>Coracias garrulus</i> (NT) and <i>Falco biarmicus</i> (VU) may utilise the larger extent of this habitat unit beyond the boundaries of the project area.</p> <p>Key mitigation measures Strict management of edge effects, such as erosion and alien vegetation management, must take place to prevent impacts on adjacent natural habitat.</p>
<p>Modified Woodland (±0.04ha of 19.9ha project area)</p>	<p>Low</p>	<p>Habitat Only a small portion of this habitat unit will be affected. This habitat unit has been significantly impacted and is characterised by an existing homestead and outbuilding within the project area.</p> <p>SCC No SCC were recorded in this habitat unit.</p> <p>Key mitigation measures Strict management of edge effects, such as erosion and alien vegetation management must take place to prevent impacts on adjacent natural habitat.</p>

Impact Assessment

An impact assessment was undertaken for the proposed project with significance ratings provided for the envisioned pre- and post-mitigation scenarios. The results are summarised in the tables below.

Development phase	Significance prior to mitigation	Significance post mitigation
Impact 1: Loss of floral and faunal habitat		
Construction	Medium-High	Medium
Operational	High	Medium-High
Impact 2: Loss of floral diversity		
Construction	Medium-High	Medium
Operational	Medium-High	Medium
Impact 3: Loss of floral SCC		
Construction	Medium-High	Medium-Low
Operational	Medium-High	Medium-Low
Impact 4: Loss of faunal species diversity and SCC		
Construction	Medium-High	Medium
Operational	Medium-High	Medium
Impact 5: Disturbance to faunal communities		
Construction	Medium-High	Medium
Operational	High	Medium-High

The results of impact assessment indicate that the proposed project is associated with overall negative impacts on the terrestrial biodiversity of the project area, and that due to the medium-high ecological sensitivity of the project area, coupled with the nature of the proposed project, mitigation of impacts will be difficult.

Conclusion

As part of the terrestrial biodiversity assessment for the proposed project, both a desktop and a field assessment were undertaken. The findings of the desktop assessment indicated that the project area is not located within a listed threatened ecosystem, or within an area earmarked as being of high conservation importance in terms of the Gauteng C-Plan (2011) and the 2012 Mining and Biodiversity Guidelines. The project area is however located within a conservancy, indicated to comprise remnant vegetation in terms of the 2018 NBA, and located within the Central Sandy Bushveld vegetation type which has a Vulnerable conservation status according to Mucina & Rutherford (2006).

Based on the findings of the field assessment, it is evident that the habitat within the project area is largely intact, and that limited direct disturbances on the terrestrial ecology have taken place historically or are taking place currently. The project area predominantly comprises rocky niche habitat, and also provides habitat for several confirmed floral SCC (although no IUCN or SANBI Red Listed floral species were recorded), with an increased probability of several floral and faunal SCC to occur. A medium-high ecological sensitivity was therefore assigned to the majority of project area.

The development of the proposed quarry and associated infrastructure is likely to lead to the direct loss of existing terrestrial floral communities and faunal habitat within the extent of the project area, and it will not be possible to re-establish the terrestrial ecology to its current condition, post-mining in the short to medium term, partly due to the presence of site-specific floral assemblages, including characteristic geoxyllic suffrutices (underground trees) that have established over extended periods of time. The

proposed quarry project will therefore have long term negative impacts on floral and faunal communities within the project area through complete transformation and habitat loss, with impacts possibly extending beyond the project area.

It is important that the need, desirability and importance of the proposed project, as well as the location of the resource, be taken into consideration and that the principles of integrated environmental management and sustainable development be applied in determining whether the project should proceed. Although potential impacts on the terrestrial ecology may be mitigated to some degree through careful project planning, implementing adequate and strict management measures throughout all development phases and the implementation of a high degree of rehabilitation in line with an approved rehabilitation plan, all defined impacts will remain of at least medium significance after implementation of mitigation measures.

The terrestrial ecological sensitivity map developed for the project area is included below as Figure A. Further information pertaining to the terrestrial ecological assessment, as well as detailed recommendations, are included in the main body of this report.

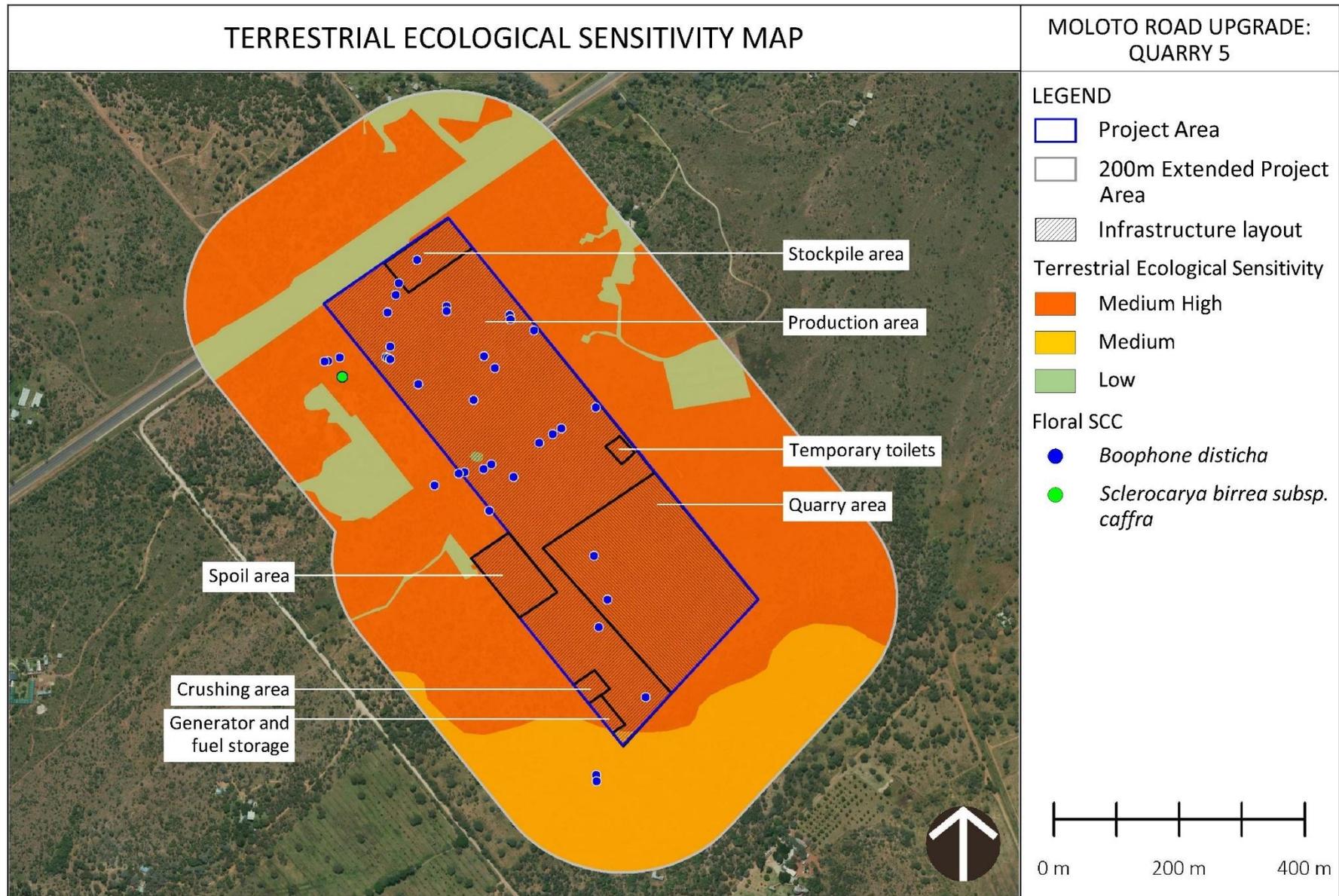


Figure A: Terrestrial ecological sensitivity map for Quarry 5, with infrastructure indicated

NEMA SPECIALIST REPORTING REQUIREMENTS

Specialist reports are required to be undertaken in line with Appendix 6 of the National Environmental Management Act (NEMA; Act No 107 of 1998) Amendments to the Environmental Impact Regulations, 2014 published on 7 April 2017¹.

Legal Requirement	Relevant Section in Report
A specialist report prepared in terms of these Regulations must contain -	
(a) details of – i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix C
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Sections 2, 3 and 5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
(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;	Sections 7 and 10
(g) an identification of any areas to be avoided, including buffers;	Section 7
(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 7
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities, including identified alternatives on the environment;	Sections 6 and 7
(k) any mitigation measures for inclusion in the EMPr;	Section 8
(l) any conditions for inclusion in the environmental authorisation;	Section 8
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Sections 8 and 9
(n) a reasoned opinion – (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A

¹ The NEMA Appendix 6 requirements will be replaced by “The Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998 (NEMA) when applying for Environmental Authorisation”, which was published on 20 March 2020 and comes into effect 50 days after publication, i.e. 9 May 2020.

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ACRONYMS AND ABBREVIATIONS

°C	Degrees Celsius
ADU	Animal Demographic Unit
AVoCet	Avian Vocalization Centre
BGIS	Biodiversity Geographic Information Systems
BODATSA	Botanical Database of southern Africa
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
C-Plan	(Gauteng) Conservation Plan version 3.3.
CR	Critically Endangered
DAFF	Department of Agriculture, Forestry and Fisheries (now DEFF)
DDD	Data Deficient – Insufficient Information
DDT	Data Deficient – Taxonomically Problematic
DEA	Department of Environmental Affairs (now DEFF)
DEFF	Department of Environment, Forestry and Fisheries
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMP	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
EWT	Endangered Wildlife Trust
GBIF	Global Biodiversity Information Facility
GCA	Gauteng Conservancy Association
GC & SA	Gauteng Conservancy & Stewardship Association (GC & SA)
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
IBA	Important Bird and Biodiversity Areas
IUCN	International Union for the Conservation of Nature
LC	Least Concern
m	Metres

mamsl	meters above mean sea level
MAP	Mean Annual Precipitation
mm	Millimetre
NACSSA	National Association of Conservancies and Stewardship South Africa
NBA	National Biodiversity Assessment (2018)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act No. 10 of 2004)
NEMPAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NPAES	National Protected Areas Expansion Strategy (2008)
NT	Near Threatened
PACA	Protected and Conservation Areas
POSA	Plants of southern Africa
PRECIS	Pretoria National Herbarium Computerised Information System
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RE	Regionally Extinct
SABAP2	Southern African Bird Atlas Project 2
SAFAP	Southern African Frog Atlas Project
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Soc Limited
SARCA	Southern African Reptile Conservation Assessment
SCC	Species of Conservation Concern
TNCO	Transvaal Nature Conservation Ordinance (No. 12 of 1983)
TOPS	Threatened or Protected Species
VU	Vulnerable

1 INTRODUCTION

1.1 Project Locality and Description

Field and Form Landscape Science, in collaboration with Malachite Ecological Services, were appointed by GA Environment (Pty) Ltd to conduct a terrestrial biodiversity assessment as part of the environmental assessment and authorisation process for the proposed construction of four (4) quarries (Quarries 4, 5, 6A and 6B), as part of the proposed Upgrading of Provincial Road R573 (K139/ Moloto Road) Section 1 from Baviaanspoort Road in the City of Tshwane (0.00km) to the Gauteng/ Mpumalanga Provincial Border (± 46.00 km) project. This report only considers Quarry 5, which is hereafter referred to as the 'project area'. The project area is located on portion 46 of the farm Boekenhoutskloofdrift 286 JR (located within the 2528DA Quarter Degree Square (QDS)) within the City of Tshwane Metropolitan Municipality, Gauteng Province, in the Dinokeng region (previously the Nokeng tsa Taemane Local Municipality) (Figures 1 & 2).

The aim of the quarries is to serve as potential new sources of construction gravel, aggregate and crushed rock for the aforementioned road upgrade project. Quarry 5 specifically is considered as a source of crushed rock of lower quality and the project area holds significant potential for the production of G5, G6 and G7 materials produced from crushed quartzite bedrock (KBK Engineers (Pty) Ltd, 2020). Proposed infrastructure is to comprise of a quarry and production area, a spoil area, a crushing area, a generator and fuel storage area, as well as temporary toilet facilities. It is foreseen that the extent of the project area will be utilised. The proposed layout and aspects associated with the quarry project are detailed in Figure 3.

The project area is 19.9 hectares (ha) in extent and is located approximately 30km to the northeast of the N1/ N4 highway intersection along the R573 (Moloto Road) roadway and 14.5km to the southwest of the Moloto township near the Gauteng/ Mpumalanga provincial border. The R573 roadway borders the project area in the north (Figures 1 & 2). The project area is located in a region characterised by mostly undeveloped land and small holdings, interspersed with gravel roads and occasional agricultural fields, within a rural setting.

The purpose of this report is to define the terrestrial biodiversity and ecology of the project area and immediate surroundings, to define and map areas of increased ecological importance and to determine the perceived impacts of the proposed project, which will include quarrying and excavation activities, on the receiving environment from a floral and faunal perspective. The objective of this assessment is furthermore to provide detailed information to the various stakeholders in planning and executing the proposed project and in undertaking informed decision-making regarding environmental authorisation.

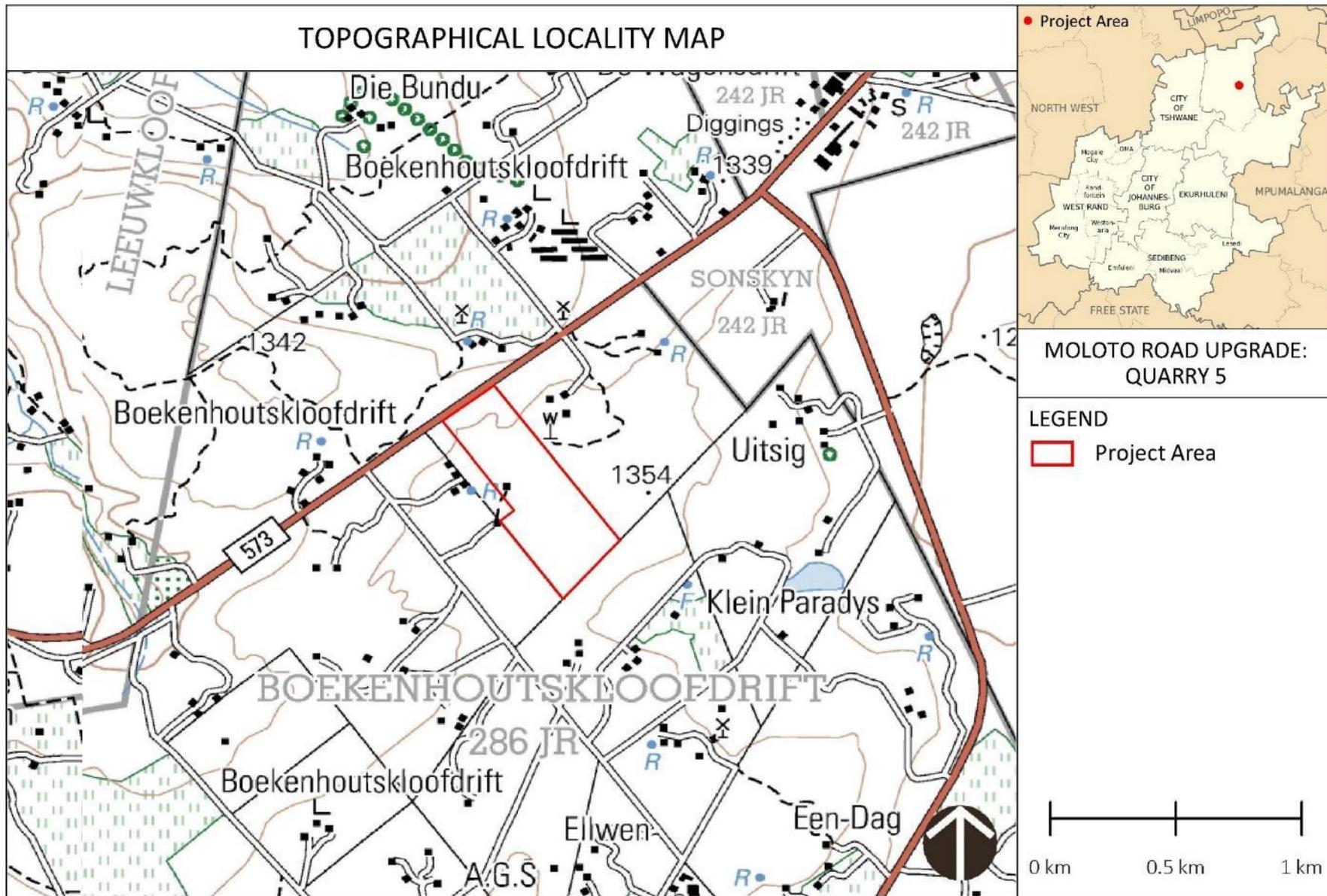


Figure 1: Topographical locality map indicating the location of the project area in relation to the surrounding region

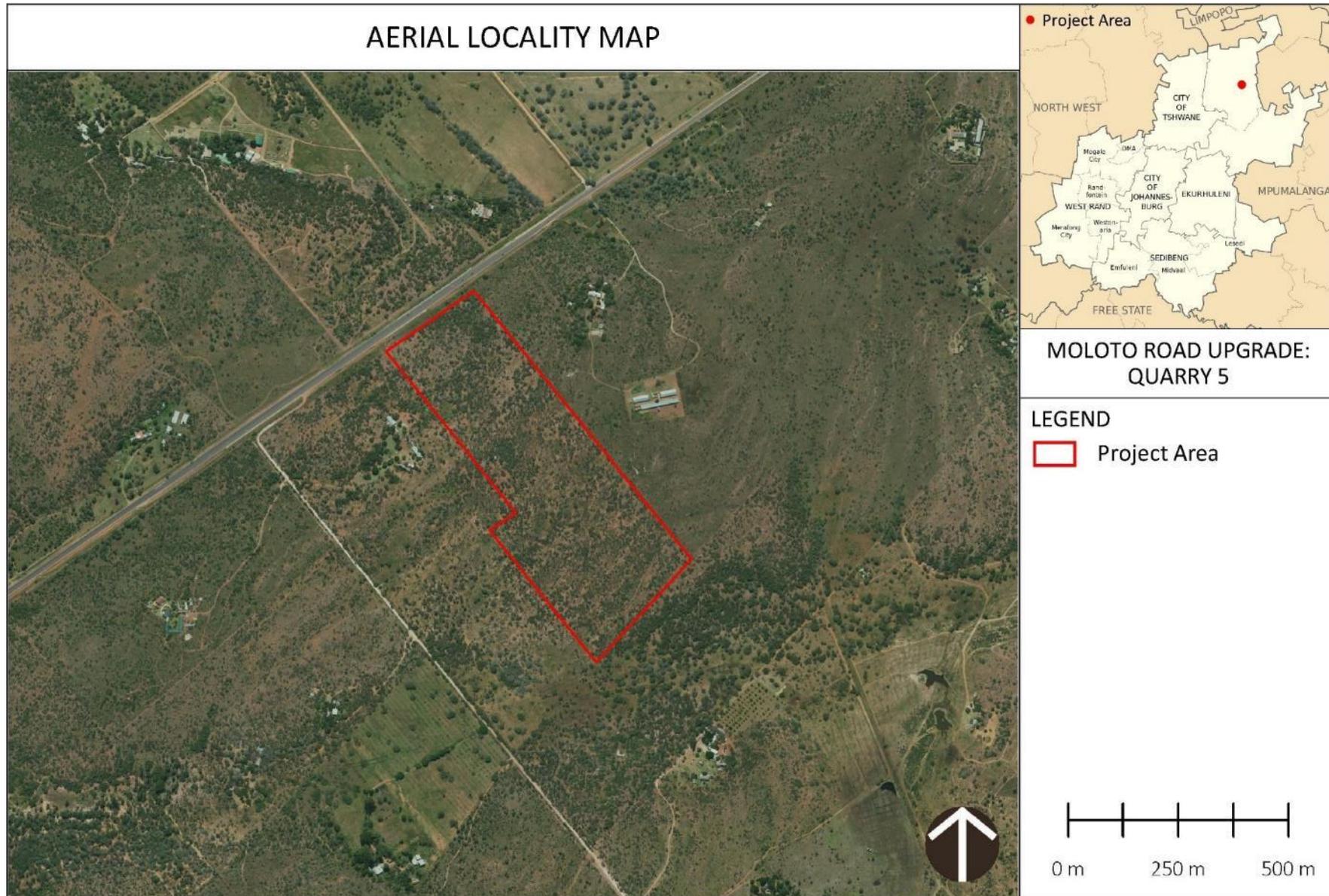


Figure 2: Aerial locality map indicating the location of the project area in relation to the surrounding region

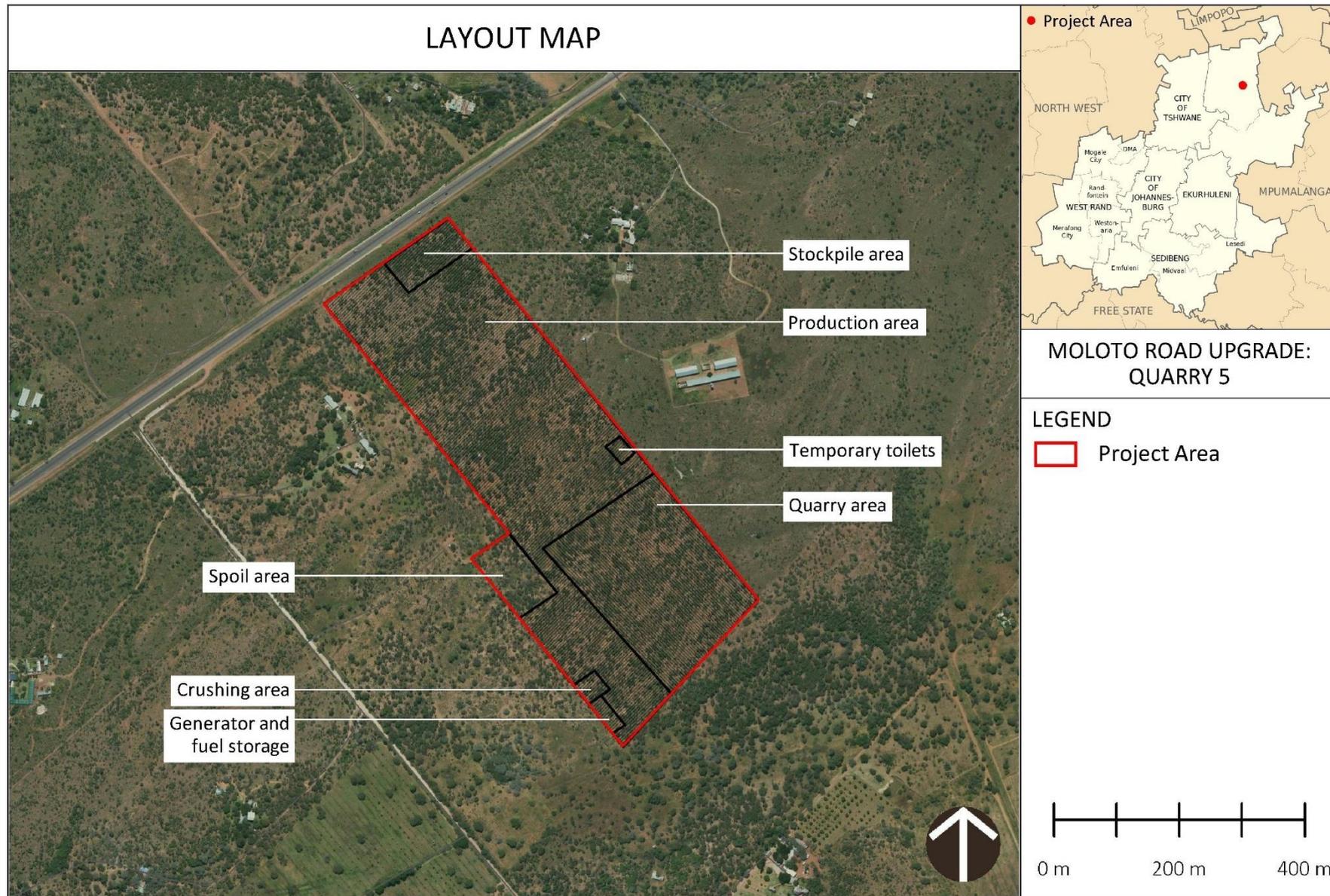


Figure 3: Proposed Quarry 5 layout

1.2 Scope of the Assessment

The scope of the terrestrial biodiversity assessment is defined as follows:

- To provide an overview of applicable environmental legislation as well as national and regional planning guidelines to be considered in planning the project;
- To provide a broad description of the biophysical characteristics of the project area and their surroundings as applicable to the terrestrial biodiversity assessment;
- To categorise and describe the vegetation and habitat present within the project area according to relatively homogeneous habitat units and to provide an overview of vegetation structure, floral species composition (including alien species), faunal associations and species diversity of each habitat unit;
- To identify floral and faunal Species of Conservation Concern (SCC) that could potentially occur in the project area and surrounds, to confirm their presence where possible and to identify whether suitable habitat for such species is available;
- To provide an indication of the conservation importance and ecological sensitivity of each habitat unit identified within the project area and to identify No Go areas where applicable; and
- To assess the potential impacts that may occur as a result of the proposed project and to provide site-specific mitigation measures and ongoing management measures that will be required to reduce such impacts should the project be approved.

1.3 Assumptions and Limitations

It is difficult to apply pure scientific methods within a natural environment without limitations or assumptions. The following assumptions and limitations are applicable to this assessment:

- The findings, results, observations, conclusions and recommendations provided in this report are based on the authors' best scientific and professional knowledge. The authors, however, accept no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document. No form of this report may be amended without the prior written consent of the authors;
- Modelled biodiversity databases have accuracy limitations and as a result, must be ground-truthed for verification. The information obtained from various databases as included in Sections 2 and 3 of this report is however considered to be useful as background to the assessment, and the data were also used to inform the field assessment, specifically where areas of increased conservation importance are indicated. All databases consulted were found to be reliable and corresponded with reasonable accuracy with the field observations;
- The presence of sensitive ecological features within 200m of project area was considered as part of the assessment in line with the GDARD Requirements for Biodiversity Assessments version 3 (GDARD, 2014), but the emphasis of the biodiversity assessment was within the defined project area as illustrated in Figures 1 & 2, as access to all properties and small holdings surrounding the project area was not readily available;
- One layout alternative, pertaining to the project boundary, is available (refer to Section 10), however the overall infrastructure layout plan and site selection processes were dependent

on the availability of the material resources required for the proposed Moloto Road Upgrades as well as on properties available for procurement. Various sites were assessed by the geotechnical specialist, however Quarry 5 was selected due to the quality of material available;

- The current assessment focuses on terrestrial biodiversity, and although the hydrological setting of the project area has also been considered, an assessment of freshwater resources, including wetlands, within the project area falls outside of the scope of this assessment;
- The results of the field assessment are based on a single site assessment, undertaken over a period of one (1) day on 23 March 2020. The assessment period falls within the November – April timeframes stipulated by the Gauteng Department of Agriculture and Rural Development (GDARD) in the GDARD Requirements for Biodiversity Assessments version 3 (2014). In order to obtain a comprehensive understanding of the dynamics and diversity of the biota on a site, biodiversity studies should ideally include investigations through the different seasons of the year coupled with extensive sampling of the area. As the current assessment relied on information gained during a single season site survey and a field assessment of limited duration, available desktop information for the area, as well as professional judgment and experience were also considered;
- Due to the complexity of natural ecosystems and seasonality of species, it is possible that some aspects pertaining to terrestrial biodiversity, including certain floral species, may have been overlooked during the field assessment, however all effort was made by the consultants to gather and convey accurate information, although the possibility exists that additional information with regard to the project area may come to light at a later stage. It is also important to note that the majority of floral SCC are also known to be extremely seasonal and only flower during specific periods of the year. Prior information on potential threatened flora that may occur in the project area was however known and special emphasis was placed in searching for such species during the field assessment;
- The faunal component of this assessment focuses on mammals, herpetofauna (amphibians and reptiles) and avifauna. Taxa outside of these groups fall outside the scope of this assessment;
- Faunal surveys should ideally be conducted over varying seasons in order to obtain a comprehensive species list due to seasonal activity variations of faunal species. Moreover, as the majority of faunal species are secretive, the availability and suitability of foraging and breeding habitats identified during the field assessment was used in conjunction with distributional data to determine the likelihood of occurrence of faunal SCC within the project area. This method is particularly effective when there are time restraints imposed on a project as it can be done irrespective of season; and
- Hand-held Garmin eTrex 20x devices were used during the field assessment and this has an accuracy of 3-6m. As a result, potential georeferencing errors, including such limitations in Global Positioning System (GPS) accuracy may result in slight discrepancies in the maps.

1.4 Reporting Conditions

The findings and recommendations provided in this report are based on the authors' best scientific and professional knowledge as well as information available at the time of compilation. No form of this report may be amended without the prior written consent of the authors.

2 LEGISLATIVE BACKGROUND

2.1 The National Environmental Management: Biodiversity Act (NEMBA; Act No. 10 of 2004)

2.1.1 National List of Ecosystems that are Threatened and in need of Protection (2011)

The NEMBA provides for the listing of threatened or protected ecosystems in one of four categories: 'Critically Endangered (CR)', 'Endangered (EN)', 'Vulnerable (VU)' and 'Protected'. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems.

According to the National List of Threatened Terrestrial Ecosystems database (2011), Quarry 5 is not situated within any listed Threatened Ecosystems.

2.1.2 Alien and Invasive Species Regulations (2014)

The NEMBA Alien and Invasive Species Regulations (2014) aim to:

- Prevent the unauthorised introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur;
- Manage and control alien and invasive species, to prevent or minimise harm to the environment and biodiversity; and
- Eradicate alien and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Categories according to the Alien and Invasive Species Regulations (2014) are as follows:

- Category 1a: Invasive species requiring compulsory control. Plants are to be removed and destroyed. Any Category 1a listed plants must be combatted or eradicated.
- Category 1b: Invasive species that require control by means of an invasive species management programme.
- Category 2: Invasive species that require a permit to carry out a restricted activity within an area, as specified in the permit. If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such a programme.
- Category 3: Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purpose of the regulation be considered to be a Category 1b Listed Invasive Species. If an Invasive Species Management Programme has been developed, a person must control the listed invasive species in accordance with such a programme.

The NEMBA Alien and Invasive Species Lists (2016) include national lists of invasive species to be read together with the Alien and Invasive Species Regulations (2014). A list of alien floral species recorded in the project area, including the applicable alien and invasive species categories, is included in Section 6.1.4 of this report.

2.1.3 Threatened or Protected Species Regulations (2015)

The NEMBA provides for listing of Threatened or Protected Species (TOPS). If a species is listed as threatened, it must be further classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). In addition to these categories, protected species are defined as “any species which is of such high conservation value or national importance that it requires national protection”. Species listed in this category may include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, referred to as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the Act are keeping, moving, having in possession, importing and exporting, and selling. No floral or faunal TOPS were recorded within the project area (refer to Sections 6.1.2 and 6.3).

2.2 National Forests Act (Act No. 84 of 1998)

An updated list of protected tree species was published under section 12(1) (d) of the National Forests Act (Act No. 84 of 1998) on 6 December 2019. In terms of section 15(1) of the National Forests Act (Act No. 84 of 1998), no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

GDARD (2014) specifically requires that surveys be undertaken to determine whether any of the following protected tree species are present on site: *Vachellia (Acacia) erioloba*, *Boscia albitrunca*, *Combretum imberbe*, *Ilex mitis* var. *mitis*, *Pittosporum viridiflorum*, *Prunus africana* and *Sclerocarya birrea* subsp. *caffra*.

One specimen of protected tree species in terms of the National Forests Act (Act No. 84 of 1998), namely *Sclerocarya birrea* subsp. *caffra* was recorded approximately 50m outside of the project area (refer to Section 6.1.2).

2.3 National Environmental Management: Protected Areas Act (NEMPAA; Act No. 57 of 2003)

The NEMPAA was promulgated in order to provide for (among other things) the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national Register of Protected Areas, and for the management of those areas in accordance with national norms and standards.

2.3.1 South African Protected Areas Database (SAPAD, 2019) and South African Conservation Areas Database (SACAD, 2019)

The primary function of protected areas is to ensure the conservation of habitats, environmental processes and species occurring within these ecosystems. The SAPAD and SACAD are Geographic Information System (GIS) inventories of all Protected and Conservation areas in South Africa. The Protected and Conservation Areas (PACA) database² also includes data on privately owned protected areas. This Register comprises of all data required for the Register of Protected Areas (legally declared) as well as data on Conservation Areas (areas responsibly managed for biodiversity conservation but not legally declared as Protected Areas). According to the most recently published SAPAD (2019) and SACAD (2019) databases, the project area is not affected or located in close proximity to protected areas or formal conservation areas (Figure 4).

It is however important to note that Quarry 5 is located within the Seringveld Conservancy³. Conservancies are defined as a registered (with the local Conservation Authority), voluntary association between land users/ landowners who co-operatively wish to manage their natural resources in an environmentally friendly manner without necessarily changing the land-use of their properties⁴. The Seringveld Conservancy is registered as such with GDARD and is also a member of the Gauteng Conservancy and Stewardship Association (GCSA), which is affiliated with the National Association of Conservancies and Stewardship South Africa (NACSSA). The NACSSA promotes conservation on private property in South Africa. The Seringveld Conservancy covers an area of approximately 18 000ha and is considered an important birding destination in the Gauteng Province (Marais & Peacock, 2008). The Seringveld also provides unique habitat for fauna such as reptiles, amphibians and invertebrates that live underground in the deep sands. The area also supports high floral species diversity, high levels of endemism and an abundance of pyrogenic geoxyllic suffrutices (underground trees), which further contribute to the uniqueness of this ecosystem (GA & SA, 2010).

The Seringveld faces several conservation challenges such as:

- Unchecked sand mining, which leads to impacts on watercourses such as the Boekenhoutspuit and the Krokodilspuit and habitat fragmentation;
- Unchecked urbanisation and development encroaching on wetlands;
- Habitat destruction and fragmentation of areas with good biodiversity due to developments including roads and subdivisions; and
- High intensity animal production such as cattle feedlots (GA & SA, 2010).

Other conservancies in the larger Dinokeng region (not shown on Figure 4) include the Cullinan, De Tweedespruit, Brandbach, Bobbejaansberg, and Buffelsdrift Conservancies, amongst others.

² available at www.egis.environment.gov.za

³ www.portal.environment.gov.za and www.conservancies.org

⁴ www.conservancies.org and www.nacssa.co.za

2.3.2 The National Protected Areas Expansion Strategy (NPAES; 2010)

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. This is particularly important in Gauteng as formally protected areas comprise approximately 5% of the province but only protect 16% of the province's species. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy (NPAES, 2008). According to the NPAES database (2010), the project area is not located within an NPAES Focus Area. The NW/ Gauteng Bushveld NPAES focus area is located less than 1km to the north (Figure 4).

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

Amendments to regulations under the CARA provides for the declaration of weeds and invader plants, with weeds regarded as alien plants with no known useful economic purpose, while invader plants may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature. Weeds are described as Category 1 plants, while invader plants are described as Category 2 and 3 plants. These regulations provide that Category 1, 2 and 3 must be controlled. A list of alien floral species recorded in the project area, including an indication of the alien and invasive species categories in terms of CARA is included in Section 6.1.4.

2.5 Transvaal Nature Conservation Ordinance (TNCO; No. 12 of 1983)

The TNCO provides for Protected and Specially Protected plant species, as per Schedule 11 and 12 respectively, whereby a permit is required to pick, donate, sell, export or remove such species. Schedule 2 of the TNCO lists Protected and Specially Protected Game. This Ordinance will be repealed in as far as it applies to the Gauteng Province once the Draft Gauteng Nature Conservation Bill, 2014 is promulgated.

Protected floral species in terms of the TNCO recorded within the project area are *Protea caffra* and *Gladiolus* sp. (refer to Section 6.1.2 and Annexure A). No protected faunal species in terms of the TNCO were recorded in the project area (refer to Section 6.3).

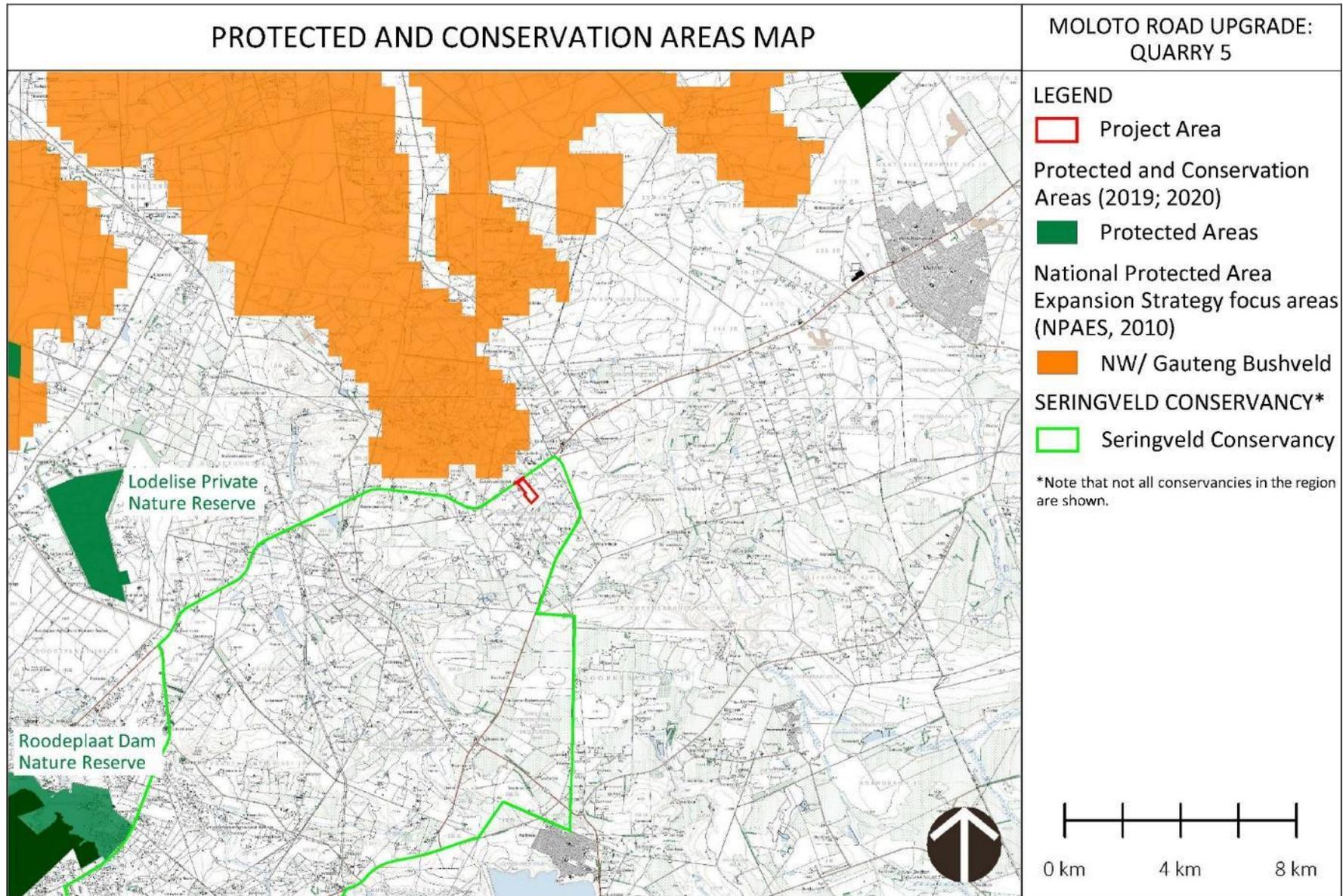


Figure 4: The location of the project area in relation to the Seringveld Conservancy and Protected and Conservation Areas

3 NATIONAL AND PROVINCIAL PLANNING FRAMEWORKS

3.1 National Biodiversity Assessment (NBA; 2018)

The most recent National Biodiversity Assessment (NBA), dated 2018, is a collaborative effort to synthesise the best available science on South Africa's biodiversity. The NBA is used to inform policy in the biodiversity sector and other sectors that rely on or impact on natural resources, such as water, agriculture, mining and human settlements. The NBA provides information to help prioritise resources for managing and conserving biodiversity and provides context and information that underpins biodiversity inputs to land use planning processes (Skowno et al., 2019).

The NBA has seven technical reports (if which only the terrestrial component is discussed within this assessment) and relies on two headline indicators:

- **Threat Status:** Degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services depends. Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Concern (LC), based on the proportion of each ecosystem type that remains in good ecological condition relative to a series of thresholds (Skowno et al., 2019).
- **Protection Level:** Addresses the extent to which ecosystems and species are protected. Ecosystem types are categorised as Not Protected, Poorly Protected, Moderately Protected or Well Protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the NEMPAA (Skowno et al., 2019).

These headline indicators provide important links for data comparison as well as providing a standardised framework that links with policy and legislation. Furthermore, comparing threat status and protection levels for terrestrial ecosystems is useful for identifying ecosystems in particular need of protection (Skowno et al., 2019).

According to the outputs of the NBA (2018) the project area is located entirely within the remaining extent of the Central Sandy Bushveld vegetation type (Figure 5), which implies that the vegetation within the project area has not previously been transformed and is therefore regarded as natural habitat comprising remnant vegetation. The threat status of this vegetation type is Least Concern in line with the NBA (2018), with the conservation status being Vulnerable (VU) in line with Mucina & Rutherford (2006). The NBA (2018) further indicates that the protection level of Central Sandy Bushveld is poor.

3.2 Mining and Biodiversity Guidelines (2012)

The Mining and Biodiversity Guidelines (2012) indicates no areas of increased biodiversity importance as applicable to mining within the project area (Figure 6).

3.3 Important Bird and Biodiversity Areas (IBA; 2015)

Various sites within the country have been identified as important for maintaining viable populations of endemic, range restricted and Threatened bird species. The primary aim of the IBA programme is to ensure the long-term conservation of important avifaunal habitats. They also provide essential benefits to people, such as food, materials, water, climate regulation and flood attenuation, as well as opportunities for recreation and spiritual fulfilment. According to BirdLife South Africa, one-third of the 112 IBAs located within South Africa are under threat by invasive alien vegetation, habitat modification/ degradation and agricultural expansion (Marnewick et al., 2015). Further to this, 52% of IBAs fall outside formally Protected Areas, further complicating avian habitat conservation.

Based on the current delineation of IBAs in South Africa, the project area is not located within identified IBAs with or in proximity to any IBA.

3.4 Gauteng Conservation Plan (C-Plan) Version 3.3 (GDARD, 2011)

The Gauteng C-Plan v3.3 focuses on the mapping of biodiversity priority areas within Gauteng, as compiled by GDARD (2011). The C-Plan v3.3 was consulted in order to determine any site-specific issues and identify areas considered to be of increased ecological or conservational importance and sensitivity within the vicinity of the project area. The Gauteng C-Plan (2011) identifies Protected Areas, Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) within the Province. CBAs are areas containing Irreplaceable and Important areas and are defined as areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses (SANBI; BGIS 2013).

ESAs are defined as areas that are important for maintaining the ecological processes on which CBAs or protected areas depend. ESAs include areas that are largely natural or near-natural landscapes which should remain in at least an ecologically functional state, and which are important for preventing degradation of CBAs and protected areas, and are particularly focussed on the maintenance of ecological processes (eg river buffers helping to moderate water flow during floods). ESAs also includes areas that are highly modified (such as cultivated areas) which nevertheless potentially retain some value for supporting ecological processes and where additional impacts on ecological processes should be avoided (City of Tshwane, 2016).

The project area is not associated with any CBAs or ESAs as identified in the Gauteng C-Plan (Figure 7), although CBA: Important and ESA areas are located to the north/ northwest and east/ southeast of the project area.

3.5 Gauteng Red List Plant Species Guidelines (2006)

The Gauteng Red List Species Guidelines (2006) aim to facilitate the conservation of the Red Listed (threatened and near threatened) plant species of Gauteng and are to be used by the Department,

applicants and any other person or organisation that is responsible for managing, or whose actions affect, areas in Gauteng where populations of Red List Plant species grow. The purpose of the guidelines is as follows:

- To promote the conservation of Red List Plant Species in Gauteng, which are species of flora that face risk of extinction in the wild;
- To promote the conservation of diverse landscapes which forms part of the overall environmental preservation of diverse ecosystems, habitats, communities, populations, species and genes in Gauteng; and
- To provide a decision-making support tool to any person or organisation that is responsible for managing, or whose actions affect, areas in Gauteng where populations of Red List Plant Species grow, whether such person or organisation be an organ of state or private entity or individual; thereby enabling the conservation of the Red List Plant Species that occur in Gauteng.

Red Listed plant species and other floral SCC that have the potential to occur within the project area or have been confirmed from the project area are included and discussed in Section 6.1.2.

3.6 Gauteng Development Guidelines for Ridges (2001, updated 2004, 2006, 2019)

The Gauteng C-Plan Version 3.3 database (2011) identifies a number of key areas which represent a high diversity of environmental parameters in relatively small areas as CBAs or Ecological Support Areas (ESAs). Designated CBA and ESA areas include the ridges and higher-altitude areas occurring in the Gauteng province, because of the relatively large topographic and geological diversity within these areas, which are critical for ensuring the long-term persistence of both species and ecosystems. These areas include the ecological gradients required to allow species and habitats to adjust to climate change impacts and are also likely to include important refuge areas (City of Tshwane, 2016).

The aforementioned is further supported by the GDARD Requirements for Biodiversity Assessments (2014) which states that all ridges must be designated as sensitive. Where the interface between the lower slopes and adjacent land is deemed important for certain species, a buffer zone of 200m must be mapped and designated as sensitive. According the GDARD: Gauteng Ridges Version 7 dataset, a Class 2 ridge as defined by GDARD is located within 1km to the north of the project area, but no ridges defined as such in the GDARD spatial data are indicated within the project area (Figure 8). Although no ridges were defined in the spatial datasets, the findings of the field assessment must be used as a more accurate representation on the occurrence of these sensitive habitats within the project area.

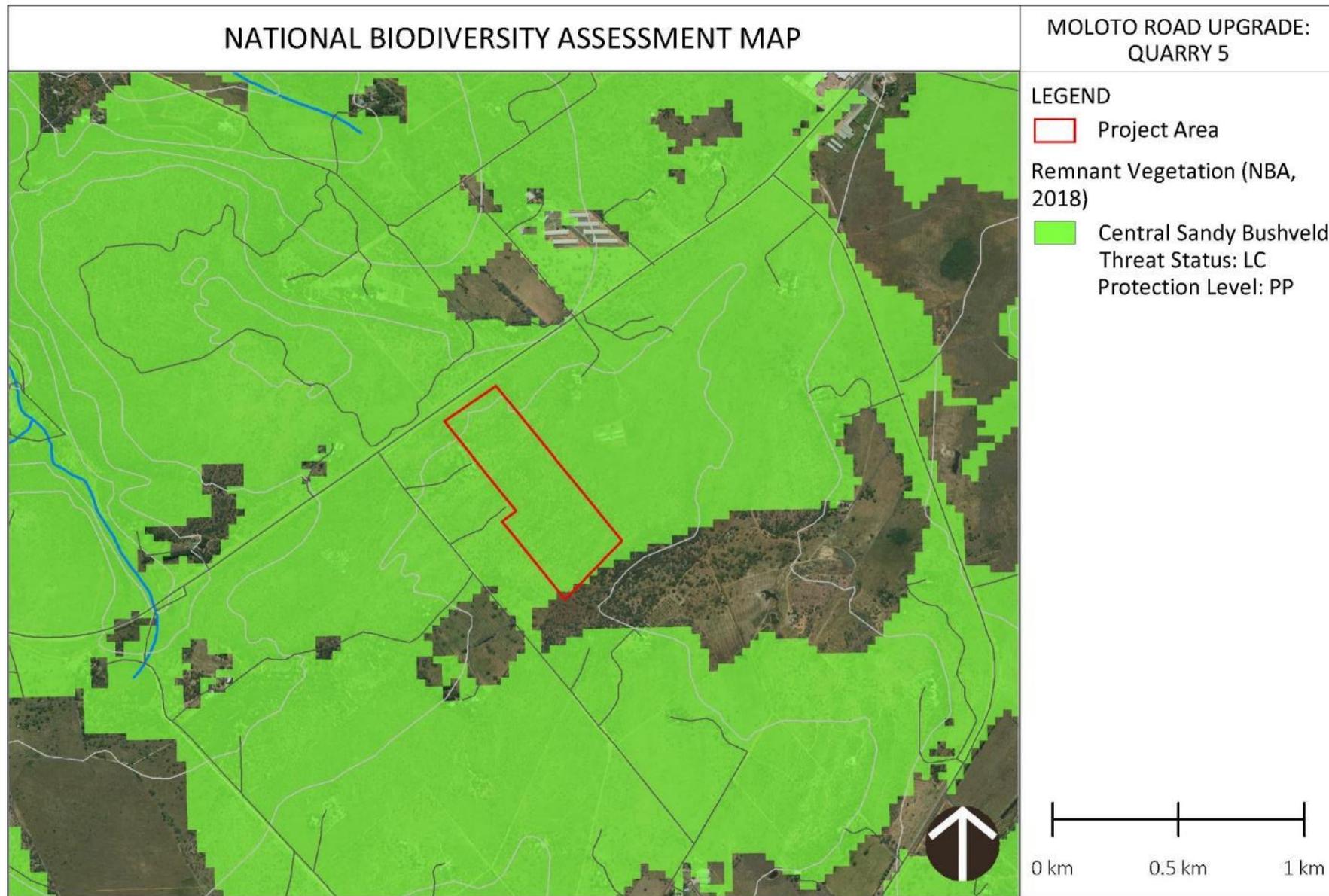


Figure 5: The location of the project area in relation to the remaining extent of terrestrial ecosystems and vegetation types (NBA, 2018)

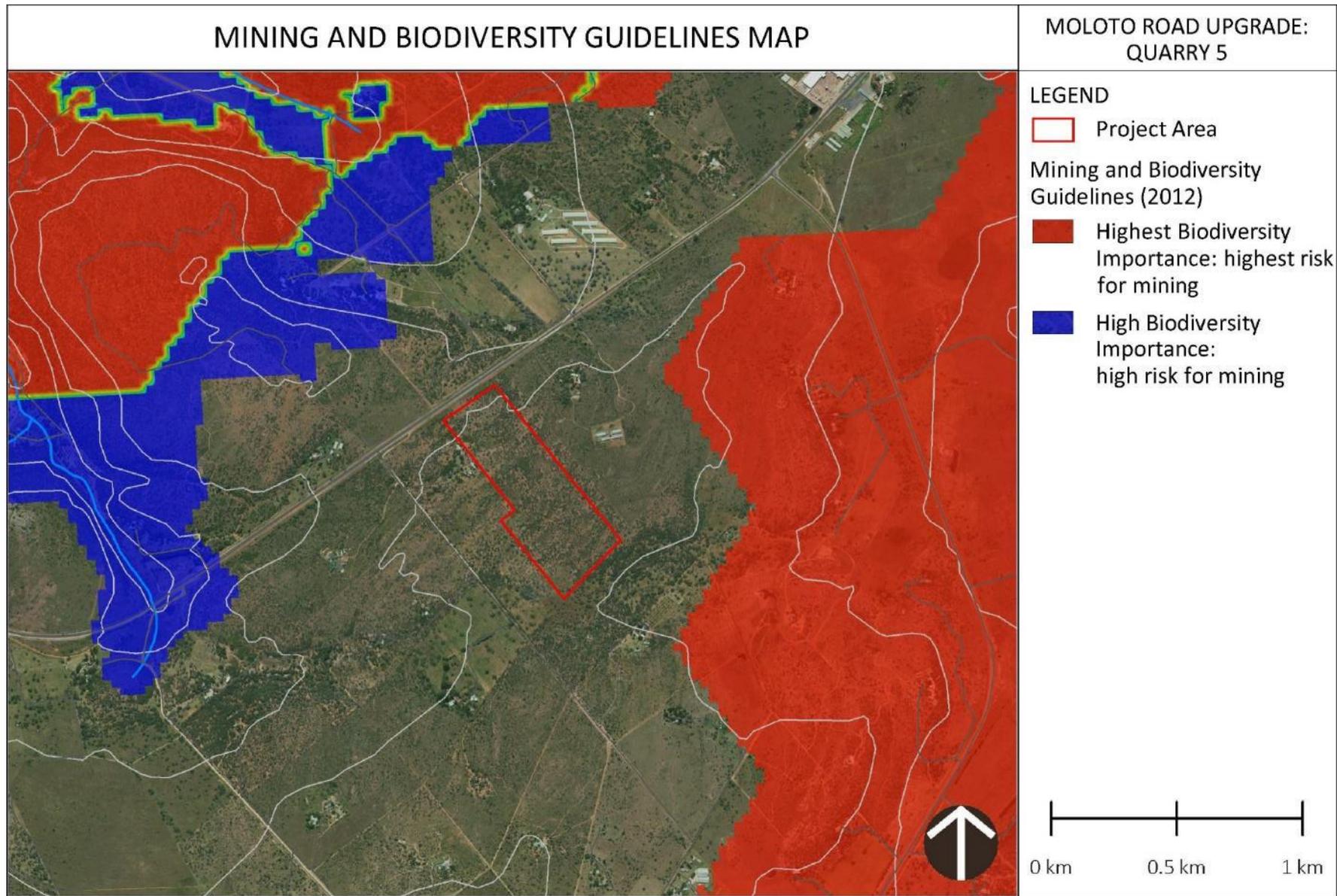


Figure 6: The location of the project area in relation to areas of increased biodiversity importance in terms of the Mining and Biodiversity Guidelines (2012)

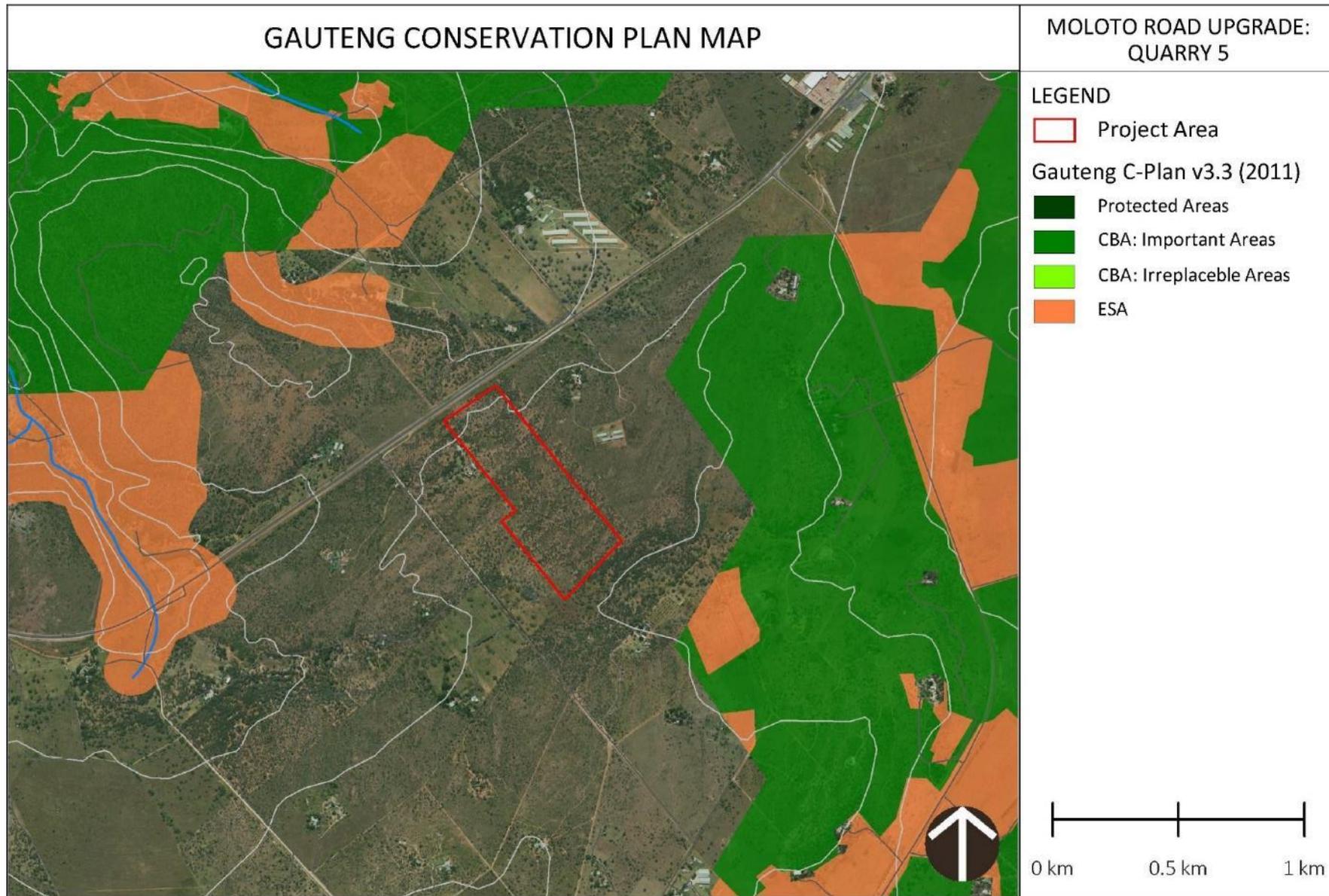


Figure 7: Location of the project area in relation to CBAs and ESAs indicated by the Gauteng C-Plan database (2011)

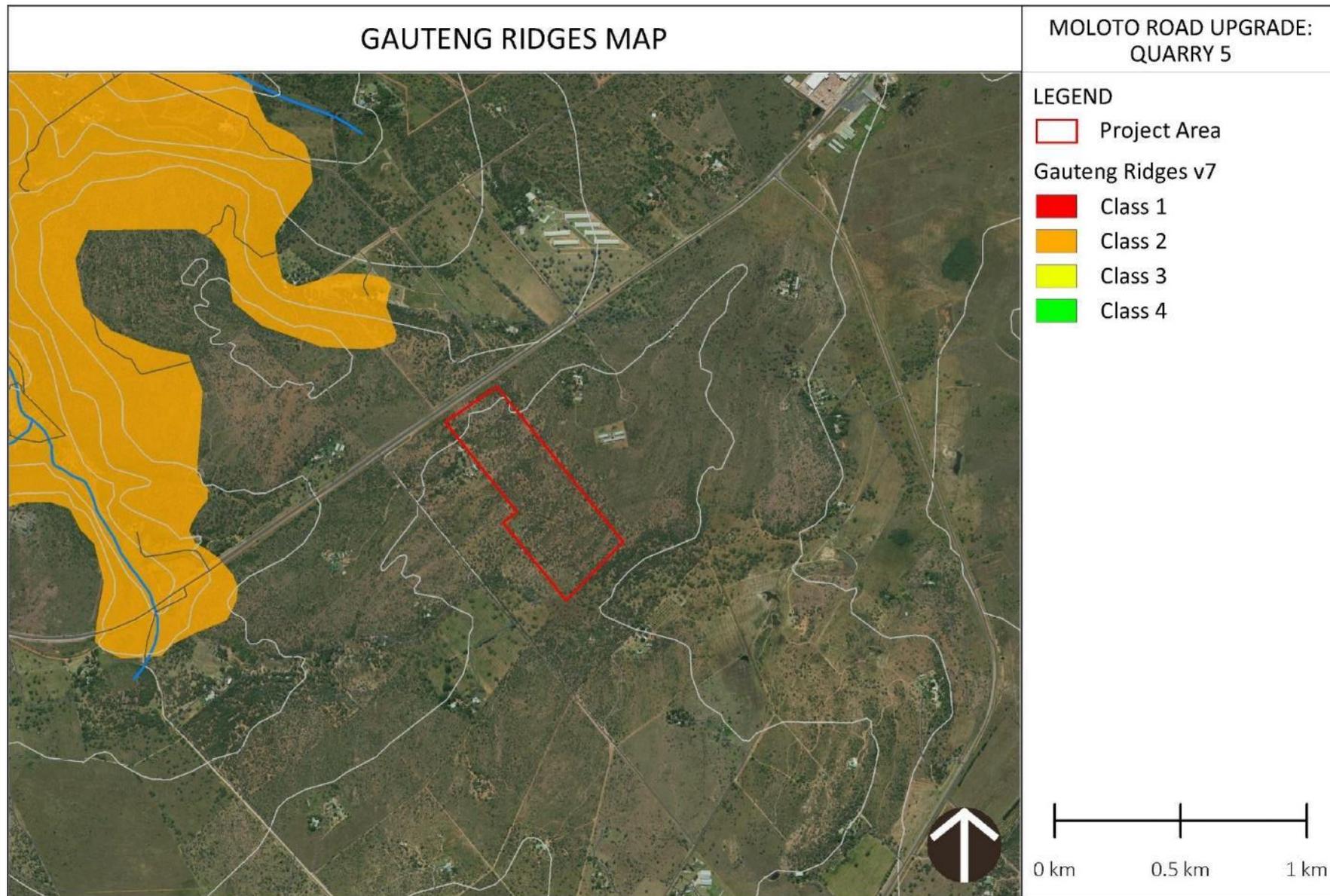


Figure 8: Location of the project area in relation to GDARD: Ridges v7

4 METHOD OF ASSESSMENT

4.1 Floral Assessment

4.1.1 Floral Desktop Assessment

Prior to undertaking the field assessment, a background and literature review was undertaken. Relevant information was obtained from the following sources:

- An overview of the regional vegetation was obtained from relevant literature such as Mucina & Rutherford (2006; 2012) and the NBA (2018), which include the most recent vegetation classification of South Africa, as well as information contained in general field guides for the region;
- An overview of the location and extent of potential ecological sensitive habitat was obtained through consideration of the Listed Threatened Ecosystem (2011), Gauteng C-Plan (2011) and ridges, the NBA (2018) terrestrial remnant vegetation and Mining and Biodiversity Guidelines (2012) databases (Refer to Sections 2 and 3 of this report);
- Other national and regional databases such as protected areas (SAPAD, 2019), conservation areas (SACAD, 2019), conservancies, land use and land cover classes (Department of Environmental Affairs (DEA), 2014), drainage lines and wetlands (NFEPA, 2011; NBA National Wetland Map 5, 2018) and relief were also used to identify areas where potential sensitive habitat occur, and also to identify areas where natural/ near-natural and untransformed vegetation are likely to be present that may provide suitable habitat for floral SCC;
- The South African National Biodiversity Institute's (SANBI) National Herbarium Pretoria (PRE) Computerised Information System (PRECIS) Information Database, SANBI's Plants of southern Africa (POSA, 2013), the Botanical Database of southern Africa (BODATSA, 2016) and the Global Biodiversity Information Facility (GBIF), as well as information obtained from GDARD were used to determine floral SCC and other floral species that have the potential to occur within the project area;
- In addition to the data sources mentioned above, recent aerial photographs were consulted prior to the field assessment in order to determine preliminary broad habitats units prior to defining these during the field assessment; and
- The SANBI Red List⁵ was used to update the conservation status of floral SCC as per Section 6.1.2 and to confirm any recent taxonomic changes.

4.1.2 Floral Field Assessment

A detailed field assessment of the project area was undertaken over a period of one day on 23 March 2020 to ground-truth the findings of the desktop assessment and to determine the ecological condition of the project area and its surrounds. The following method was followed:

- The vegetation and associated habitat present within the project area were grouped into relatively homogenous habitat units based on aerial photography, different land uses, defined vegetation types and other available information as set out in Section 4.1.1 above;

⁵ www.redlist.sanbi.org

- During the field assessment, a walkaround was undertaken for orientation purposes during which time visual observations pertaining to the various ecological attributes of the project area and associated habitat were made;
- The walkaround was following by on-foot field assessments through subjective placement of sample sites along the steepest environmental gradient possible in order to maximise species detection, whereby vegetation and plant species present within each of the habitat units were identified and the boundaries of each habitat unit refined using a handheld Garmin eTrex 20x GPS device. An attempt was made to cover all microhabitats, such as exposed rock outcrops, that holds additional species;
- Note was made of the ecological condition and sensitivity of the vegetation present within each habitat unit and existing impacts and disturbances were identified. Any special features considered to be of ecological importance were noted;
- Specific emphasis was placed on the potential occurrence of floral SCC, including those species highlighted by GDARD to occur within the 2528DA QDS, and areas providing suitable habitat for such species; and
- Species encountered were compared with regional species lists available for the expected Central Sandy Bushveld vegetation type (Mucina & Rutherford, 2006).

4.2 Faunal Assessment

4.2.1 Faunal Desktop Assessment

In addition to various ecological databases consulted as described in Section 4.1.1, the faunal component of the biodiversity assessment initially made use of a desktop component in order to extrapolate fauna whose distributions overlap with the project area. Such datasets and literature resources include:

- Mammals:
 - Stuart's Field Guide to Mammals of Southern Africa (Stuart & Stuart, 2015);
 - Monadjem et al. (2010);
 - International Union for Conservation of Nature (IUCN) distributional data (2017); and
 - MammalMap (Animal Demographic Unit (ADU) Virtual Museum).⁶
- Herpetofauna:
 - FrogMAP (a continuation of the Southern African Frog Atlas Project (SAFAP));
 - A Complete Guide to the Frogs of Southern Africa (du Preez & Carruthers, 2009);
 - ReptileMAP (ADU Virtual Museum and Southern African Reptile Conservation Assessment (SARCA));
 - Atlas and Red List of Reptiles of South Africa, Lesotho and Swaziland (Bates et al., 2014); and
 - A Guide to the Reptiles of Southern Africa (Alexander & Marais, 2007).
- Avifauna:
 - The Southern African Bird Atlas Project 2 (SABAP2) was used to obtain a detailed list of avian species occurring within the larger region;

⁶ <http://vmus.adu.org.za>

- Gauteng Biodiversity Management Red List species information; and
- The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor et al., 2015).

4.2.2 Faunal Field Assessment

The desktop findings were ground-truthed during a multi-disciplinary survey conducted within the project area over a period of one day on 23 March 2020. The techniques outlined below were employed.

- **Mammals:**
The project area was traversed and all direct and indirect mammalian signs such as spoor, scats, territorial markings, den sites, burrows and feeding signs were noted. These tracks and signs encompass all evidence of the presence of mammals within the area. These signs were confirmed by utilising available databases, field guides and literature.
- **Herpetofauna:**
Active searches for herpetofauna were conducted. Specific habitat types were selected where active sampling was focused, primarily surrounding important herpetofaunal micro-habitats, most notably rocky areas. Active searches included the overturning of rocks, searching tree hollows and leaf litter as well as searching disused animal burrows.
- **Avifauna:**
Walking transects were conducted within the vegetation units identified within the project area. Species as well as the habitat in which they were identified were noted. The use of visual identification, acoustic identification and nest identification was utilised during the study. Any Red Listed species roost sites and habitat identified within the project area were noted.

4.3 Floral and Faunal Species of Conservation Concern

Prior to the field assessment, a record of floral and faunal SCC and the habitat requirements of these species was acquired from various SANBI and other databases for the 2528DA QDS, with further floral and avifaunal SCC lists for the QDS obtained from GDARD. Throughout the terrestrial biodiversity assessment, special attention was paid to the identification of any of these SCC as well as identification of suitable habitat that could potentially sustain such species.

4.3.1 IUCN and SANBI Red List Categories

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria. This scientific system is designed to measure species' risk of extinction, with the purpose of highlighting those species that are most urgently in need of conservation action.

The assessments contained in the national Red Lists are regional or national assessments, which mean that if a species is not endemic to South Africa, only that part of the species' distribution range falling within South Africa was evaluated in the assessment. Therefore, a species' status on the national Red Lists may differ from its global status on the IUCN Red List. Non-IUCN, national Red List categories for species not in danger of extinction, but considered of conservation concern are also included, with the IUCN equivalent of these categories being Least Concern (LC).

Red Listed/ threatened species are those species that are currently facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species.

SCC are species that have a high conservation importance and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining, Data Deficient – Insufficient Information (DDD) and Data Deficient – Taxonomically Problematic (DDT). Descriptions of the various National Red List Categories are included in the table below.

National Red List Categories – Version 2017.1 (SANBI, 2017).

Category	Definition
Extinct (EX)	A species is Extinct when there is no reasonable doubt that the last individual has died.
Extinct in the Wild (EW)	A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalised population (or populations) well outside the past range.
Regionally Extinct (RE)	A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
Critically Endangered, Possibly Extinct (CE PE)	Possibly Extinct is a special tag associated with the category CR, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
Critically Endangered (CR)	A species is CR when the best available evidence indicates that it meets at least one of the five IUCN criteria for CR, indicating that the species is facing an extremely high risk of extinction.
Endangered (EN)	A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
Vulnerable (VU)	A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
Near threatened (NT)	A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable, and is therefore likely to become at risk of extinction in the near future.
*Critically Rare	A species is Critically Rare when it is known to occur at a single site, but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
*Rare	A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows: <ul style="list-style-type: none"> • Restricted range: Extent of Occurrence (EOO) <500 km², OR • Habitat specialist: Species is restricted to a specialised microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km², OR • Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR • Small global population: Less than 10 000 mature individuals.
*Declining	A species is Declining when it does not meet or nearly meet any of the five IUCN criteria and does not qualify for CR, EN, VU or NT, but there are threatening processes causing a continuing decline of the species.
Least Concern (LC)	A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least

Category	Definition
	Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.
Data Deficient - Insufficient Information (DDD)	A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required and that future research could show that a threatened classification is appropriate.
Data Deficient - Taxonomically Problematic (DDT)	A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.

*Categories marked with * are non-IUCN, national Red List categories for species not in danger of extinction, but considered to be of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

4.3.2 Other

For the purpose of this assessment, other species of conservation importance are included under the term 'SCC', namely those species listed as protected or threatened under the NEMBA TOPS regulations (2015), protected tree species listed under the National Forests Act (Act No. 84 of 1998), as well as specially protected and protected species as listed under the TNCO (No. 12 of 1983) as outlined in Sections 2.1.3, 2.2 and 2.5, respectively.

4.4 Terrestrial Ecological Sensitivity Analysis and Criteria

The terrestrial biodiversity sensitivity analysis will be compiled by assessing the current ecological condition of each identified habitat unit and its associated biodiversity value. This includes the interaction between each habitat unit's ecological sensitivity to the proposed development and the ecological structure of these habitats. The ecological sensitivity classes of each habitat unit identified during the field assessment will be determined by considering aspects such as:

- the occurrence of confirmed or potential floral or faunal SCC or any other significant species within the habitat unit;
- the presence of unique landscapes and associated faunal habitat, including watercourses, ridges and rocky outcrops, or the presence of an ecologically intact habitat unit or faunal migration corridor within a transformed region;
- the conservation status, threatened status and biodiversity priority values of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases and the presence of remnant vegetation in line within the recently published NBA (2018);
- floral and faunal diversity compared to that of surrounding areas, and comparison of site conditions with published distribution data, available floristic databases and descriptions of the applicable vegetation types;
- the degree to which habitat integrity is intact, based on observed disturbances, existing impacts and level of habitat transformation observed;
- the perceived conservation value of the habitat unit; and
- the resilience of the habitat unit and its ability to recover after disturbance.

A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation or development within each of the defined habitat units. The various sensitivity classes and conservation objectives are presented in the table below.

Table 1: Habitat sensitivity ratings, descriptions and associated conservation objectives

Sensitivity Class	Sensitivity Class Description	Development Implication and Conservation Objectives
High	<ul style="list-style-type: none"> Ecologically sensitive habitat with intact or primary vegetation and elevated niche and species diversity. Intact or primary vegetation occurring within listed Threatened Ecosystems or CBA areas. Confirmed or high potential for floral or faunal SCC occurrence. High degree of connectivity with surrounding habitats. Conservation of habitat unit is vital to achieving conservation targets and maintaining on site biodiversity attributes. 	<p>Implication</p> <ul style="list-style-type: none"> High ecological sensitivity habitat units are often protected by national or provincial legislation and development guidelines and frameworks. Development within high ecological sensitivity habitat units is undesirable and generally not supported. Impacts are difficult to mitigate or mitigation is not possible. <p>Objective</p> <ul style="list-style-type: none"> The biodiversity of the habitat unit must be conserved and implementation of the no-go alternative considered.
Medium High	<ul style="list-style-type: none"> Ecologically sensitive habitat that is intact but not of exceptionally high value or unique. The habitat unit experienced some degree of disturbance, although largely limited in nature. SCC may occur, but are not restricted to the habitat unit and occur in the surrounding region. Conservation of habitat unit may contribute towards achieving conservation targets and maintaining on site biodiversity attributes. 	<p>Implication</p> <ul style="list-style-type: none"> Development within medium high ecological sensitivity habitat units is undesirable. Impacts are difficult to mitigate. The habitat unit must be managed to prevent fragmentation and degradation. <p>Objective</p> <ul style="list-style-type: none"> The biodiversity of the habitat unit must be conserved as far as possible through limiting development and disturbance.
Medium	<ul style="list-style-type: none"> Habitat unit has undergone some disturbance, but is still functional and provide important ecosystem goods and services. Habitat unit is associated with moderate niche diversity, but does not constitute unique habitat. The habitat unit is required to ensure the functioning of adjacent habitats and larger ecological corridors. 	<p>Implication</p> <ul style="list-style-type: none"> Low impact development with limited impact on the receiving ecosystem could be considered. Appropriate mitigation measures must be implemented. It is still recommended that certain portions of the natural habitat be maintained, particularly where these form part of ecological corridors. Impacts on adjacent habitat units of increased ecological sensitivity must be prevented. <p>Objective</p> <ul style="list-style-type: none"> The biodiversity of the habitat unit must be conserved while optimising development potential.
Medium Low	<ul style="list-style-type: none"> Habitat unit is mostly disturbed and the area in general has lowered or limited conservation value. 	<p>Implication</p> <ul style="list-style-type: none"> Development within these habitat units could be considered. Small sections could be considered for conservation or excluded from

	<ul style="list-style-type: none"> Habitat that is associated with lowered species diversity when compared to surrounds. Limited suitable habitat for SCC is present within the habitat unit and it is unlikely to contribute to achieving conservation targets. 	<p>development, particularly where such areas are connected to unique ecological features.</p> <ul style="list-style-type: none"> Appropriate mitigation measures must be implemented, specifically in managing of edge effects. <p>Objective</p> <ul style="list-style-type: none"> Development within these habitat units must be optimised while managing edge effects.
Low	<ul style="list-style-type: none"> Habitat unit has been significantly impacted with little conservation value and little to no natural habitat remaining. Species diversity is low or predicted to be low, and dominated by species with generalist and adaptable habitat requirements. Limited suitable and no permanent habitat for SCC is present within the habitat unit and the unit does not contribute to achieving conservation targets. 	<p>Implication</p> <ul style="list-style-type: none"> Most types of development can proceed within these habitat units, with little to no impact on habitat with conservation value. Edge effects must be managed to prevent impacts on surrounding natural habitat. <p>Objective</p> <ul style="list-style-type: none"> Development within these habitat units must be optimised.

4.5 Impact Assessment

Direct and indirect impacts identified through the terrestrial biodiversity assessment have been assessed in terms of the following criteria:

Nature of Impact, which includes a description of what causes the effect, what will be affected and how it will be affected.

Extent of the Impact, whereby a value between 1 and 5 will be assigned as appropriate:

- (1) Site (site only)
- (2) Local (site boundary and immediate surrounds)
- (3) Regional
- (4) National
- (5) International

Duration, where 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 (consequences) of the Impact, where the intensity or severity of the impact is indicated as either:

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate (environmental functions altered but continue)
- (8) High (environmental functions temporarily cease)
- (10) Very high/ unsure (environmental functions permanently cease)

Probability of Occurrence, which describes the likelihood of the impact actually occurring. 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)
- (5) Definite

Significance of the Impact

Based on the ratings outlined 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 as follows:

- (0 - 19) Low: The perceived impact will not have a noticeable negative influence on the environment and is unlikely to require management intervention that would incur significant cost.
- (20 - 39) Medium Low: The perceived impact is considered acceptable, and application of recommended mitigation measures recommended.
- (40 - 59) Medium: The perceived impact is likely to have a negative effect on the receiving ecosystem and is likely to influence the decision to approve the activity. Implementation of mitigation measures is required, as is routine monitoring to ensure effectiveness of recommended mitigation measures.
- (60 - 79) Medium High: The perceived impact will have a significant impact on the receiving ecosystem, and will likely have an influence on the decision-making process. Strict implementation of mitigation measures as provided is required, and strict monitoring and high levels of compliance and enforcement in respect of the impact in question are required.
- (80 – 100) High: The impact on the receiving ecosystem is considered of high significant and likely to be irreversible. Alternatives to the proposed activity are to be investigated as impact will have an influence on the decision-making process.

Other aspects considered include:

- The status of the impact, which 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.
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the degree to which the impact can be mitigated.

5 GENERAL CHARACTERISTICS OF THE PROJECT AREA

The biophysical attributes of the project area and surrounding region are discussed in the sections below.

5.1 Climate

Quarry 5 is located within a summer rainfall region with very dry winters. A cool dry season occurs from May to mid-August, a hot dry season from mid-August to about October and a hot wet season from about November to April. The regional Mean Annual Precipitation (MAP) is between 500 and 700mm, and frost is fairly infrequent. Mean monthly maximum and minimum temperatures for the region is 35.3°C and -3.1°C for November and June, respectively (Mucina & Rutherford, 2006).

5.2 Geology, Soils and Topographic Setting

According to KBK Consulting (Pty) Ltd (2020), Quarry 5 is located within a geologically complex area, with at least one fault line located in proximity to the site. The project area is characterised by extensive areas of low bedrock outcrop, which consists primarily of the Waterberg Group quartzitic sandstone, with limited shale bedrock also present. Soils are largely sandy and often contain quartzite or sandstone gravel, cobbles and boulders.

No topographical extremes are present within the project area and the elevation varies between 1333 meters above mean sea level (mamsl) in the north and 1343 mamsl in the south, with higher lying areas up to 1360 mamsl towards the centre of the project area.

5.3 Surface Water

The project area is situated within quaternary catchments A23B and B31B, with the main drainage lines to the east and west of the project area being the Elands River and Boekenhoutspruit, respectively. No drainage lines, wetlands or other freshwater features are indicated by the NFEPA and National Wetland Map 5 (NBA, 2018) databases to be located within or in close proximity to Quarry 5 (Figure 9).

5.4 Land Cover

According to the DEA Land Cover database (2014), the dominant land cover types within the Quarry 5 project area is woodland/ open bush and thicket/ dense bush. Small areas of grassland are also shown, with land cover by low shrubs indicated along the northern boundary of the project area (Figure 10).

5.5 National Vegetation Types

The project area is located within the Savanna Biome (Rutherford & Westfall, 1994; Rutherford, 1997). Acocks (1988) described the regional vegetation as Sourish Mixed Bushveld, whereas it is classified by Low & Rebelo (1998) as Mixed Bushveld. The project area further falls within the Central Bushveld Bioregion (Mucina & Rutherford, 2006) and within the Central Sandy Bushveld (VU) vegetation type as defined by Mucina & Rutherford (2006).

The location of the project area in relation to this vegetation type are illustrated in Figure 11, and the main characteristics of the vegetation type are summarised in the table below.

Table 2: Main characteristics of the Central Sandy Bushveld vegetation type

Vegetation Type	SVcb12 Central Sandy Bushveld
Landscape	Low undulating areas, sometimes between mountains, and along sandy plains and catenas.
Characteristic vegetation	Tall, deciduous <i>Terminalia sericea</i> and <i>Burkea africana</i> woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved <i>Combretum</i> woodland on shallow rocky or gravelly soils. Species of <i>Vachellia</i> , <i>Senegalia</i> , <i>Ziziphus</i> and <i>Euclea</i> are found on flats and lower slopes on eutrophic sands and some less sandy soils. <i>V. tortilis</i> may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands.
Conservation	Vulnerable , with a conservation target of 19%. Less than 3% statutorily conserved spread thinly across many nature reserves including the Doorndraai Dam and Skuinsdraai Nature Reserves. An additional 2% is conserved in other reserves. About 24% transformed, including about 19% cultivated and 4% urban and built-up areas. Much of the unit in the broad arc south of the Springbokvlakte is heavily populated by rural communities. Several alien plants are widely scattered but often at low densities; these include <i>Cereus jamacaru</i> , <i>Eucalyptus</i> species, <i>Lantana camara</i> , <i>Melia azedarach</i> , <i>Opuntia ficus-indica</i> and <i>Sesbania punicea</i> . Erosion very low to high, especially in some places northeast of Groblersdal.
Species	<p>Important Taxa (d – dominant)</p> <ul style="list-style-type: none"> • Tall Trees: <i>Senegalia (Acacia) burkei</i> (d), <i>Vachellia (Acacia) robusta</i>, <i>Sclerocarya birrea</i> subsp. <i>caffra</i>. Small Trees: <i>Burkea africana</i> (d), <i>Combretum apiculatum</i> (d), <i>C. zeyheri</i> (d), <i>Terminalia sericea</i> (d), <i>Ochna pulchra</i>, <i>Peltophorum africanum</i>, <i>Searsia leptodictya</i>. • Tall Shrubs: <i>Combretum hereroense</i>, <i>Grewia bicolor</i>, <i>G. monticola</i>, <i>Strychnos pungens</i>. • Low Shrubs: <i>Agathisanthemum bojeri</i> (d), <i>Indigofera filipes</i> (d), <i>Felicia fascicularis</i>, <i>Lasiosiphon sericocephalus</i>. • Geoxylic Suffrutex: <i>Dichapetalum cymosum</i> (d). • Woody Climber: <i>Asparagus buehneri</i>. • Graminoids: <i>Brachiaria nigropedata</i> (d), <i>Eragrostis pallens</i> (d), <i>E. rigidior</i> (d), <i>Hyperthelia dissoluta</i> (d), <i>Panicum maximum</i> (d), <i>Perotis patens</i> (d), <i>Antheophora pubescens</i>, <i>Aristida scabrivalvis</i> subsp. <i>scabrivalvis</i>, <i>Brachiaria serrata</i>, <i>Elionurus muticus</i>, <i>Eragrostis nindensis</i>, <i>Loudetia simplex</i>, <i>Schmidtia pappophoroides</i>, <i>Themeda triandra</i>, <i>Trachypogon spicatus</i>. • Herbs: <i>Dicerocaryum senecioides</i> (d), <i>Barleria macrostegia</i>, <i>Blepharis integrifolia</i>, <i>Crabbea angustifolia</i>, <i>Evolvulus alsinoides</i>, <i>Geigeria burkei</i>, <i>Hermannia lancifolia</i>, <i>Indigofera daleoides</i>, <i>Justicia anagalloides</i>, <i>Kyphocarpa angustifolia</i>, <i>Lophiocarpus tenuissimus</i>, <i>Waltheria indica</i>, <i>Xerophyta humilis</i>. • Geophytic Herb: <i>Hypoxis hemerocallidea</i>. • Succulent Herb: <i>Aloe greatheadii</i> var. <i>davyana</i>. <p>Biogeographically Important Taxa (Central Bushveld endemics)</p> <ul style="list-style-type: none"> • Graminoid: <i>Mosdenia leptostachys</i>. • Herb: <i>Oxygonum dregeanum</i> subsp. <i>canescens</i> var. <i>dissectum</i>.

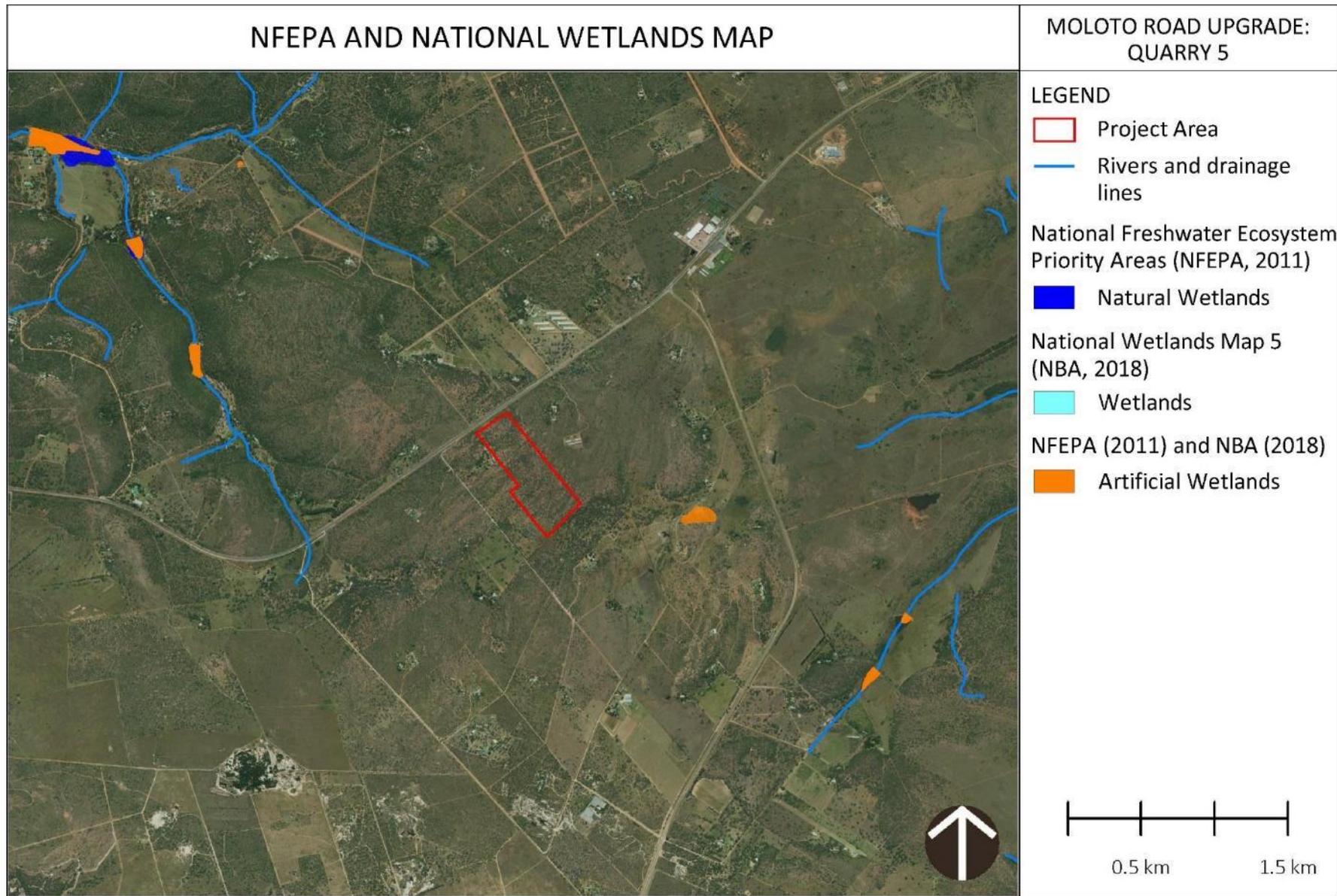


Figure 9: Freshwater features and drainage lines in the vicinity of the project area

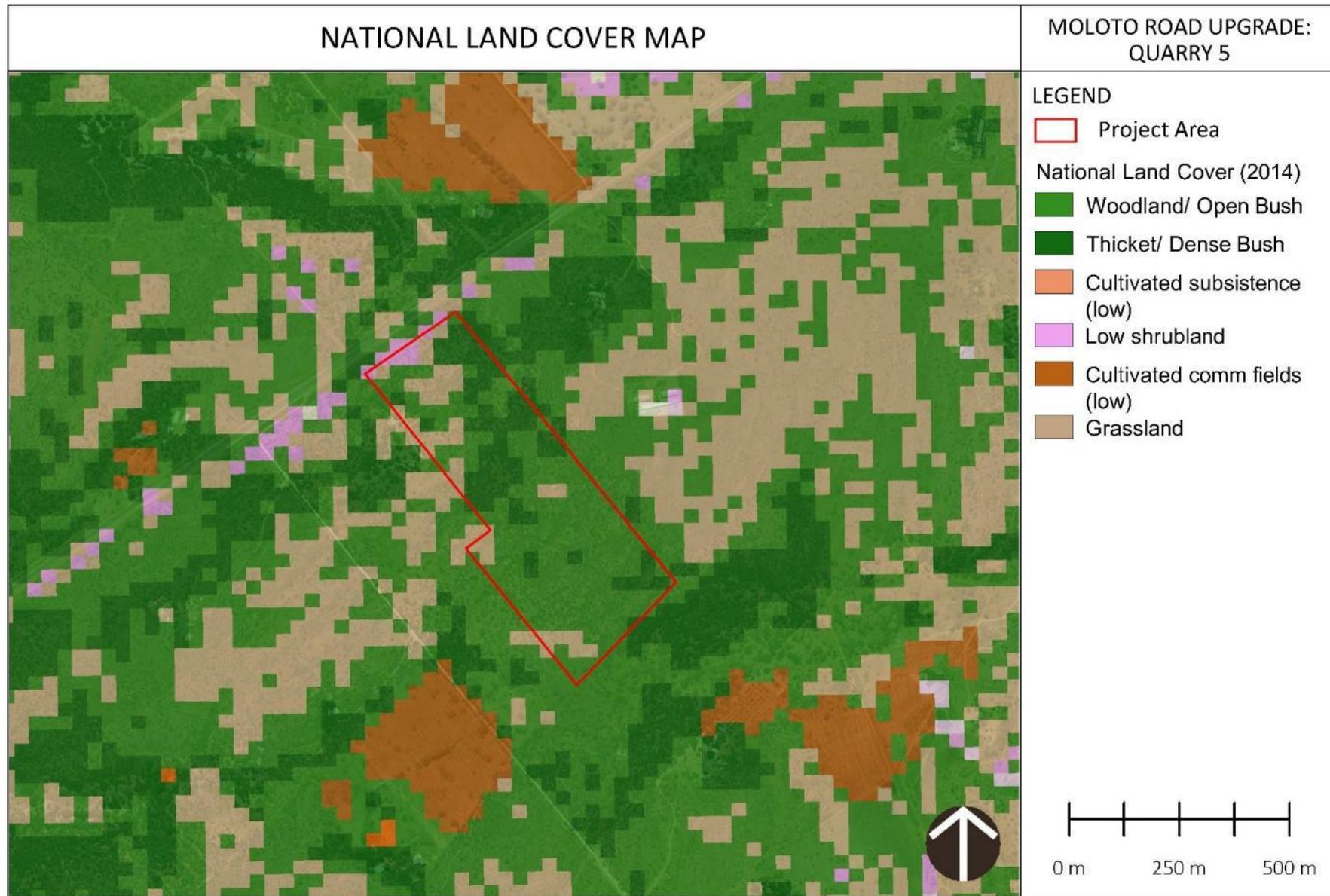


Figure 10: Land cover types associated with the project area

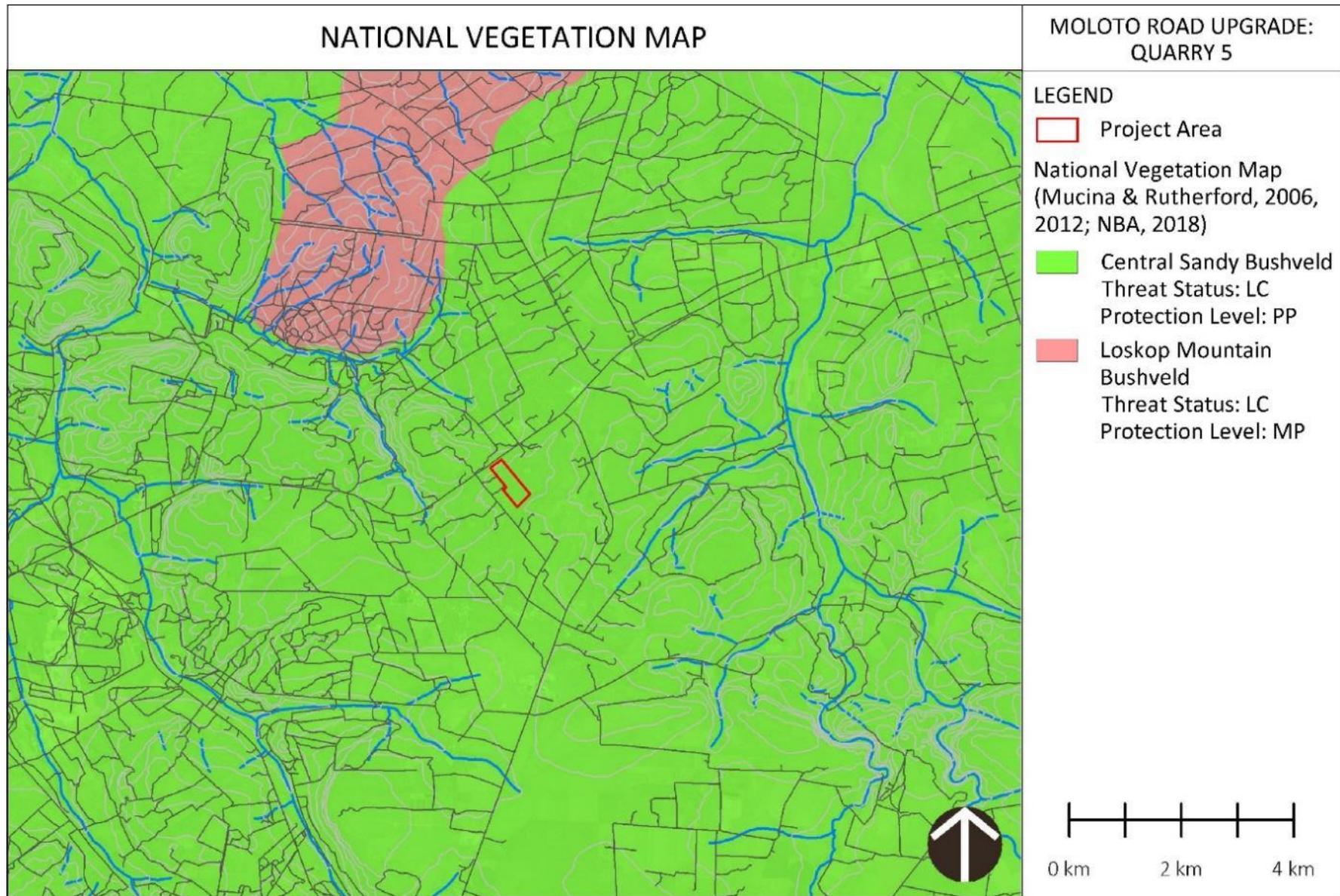


Figure 11: Vegetation types associated with the project area and surrounds

6 RESULTS OF THE TERRESTRIAL BIODIVERSITY ASSESSMENT

6.1 Results of the Floral Assessment

6.1.1 Habitat Units

Two broad habitat units were identified within the project area, based primarily on floral species composition and vegetation structure, faunal species' habitat provision, the topographical position of the habitat unit in the landscape, as well as the degree of anthropogenic impact and disturbance within the unit. These habitat units are:

- *Burkea africana* Woodland on rocky slopes, which occurs within the majority of the project area; and
- The Mixed Woodland habitat unit which occur within the northern portion of the project area on a low rocky ridge/ outcrop.

Two further habitat units, which are not well represented within the project area, were identified within the surrounding region, and within a 200m extended project area, namely:

- The *Terminalia sericea* Open Woodland habitat unit which occurs to the southwest of the project area on deep sandy soils; and
- The Modified habitat unit which includes all areas currently or historically impacted by anthropogenic activities.

Figure 12 below illustrates the location and extent of each habitat unit in relation to the project area boundaries and the sections that follow provide a description of each habitat unit.

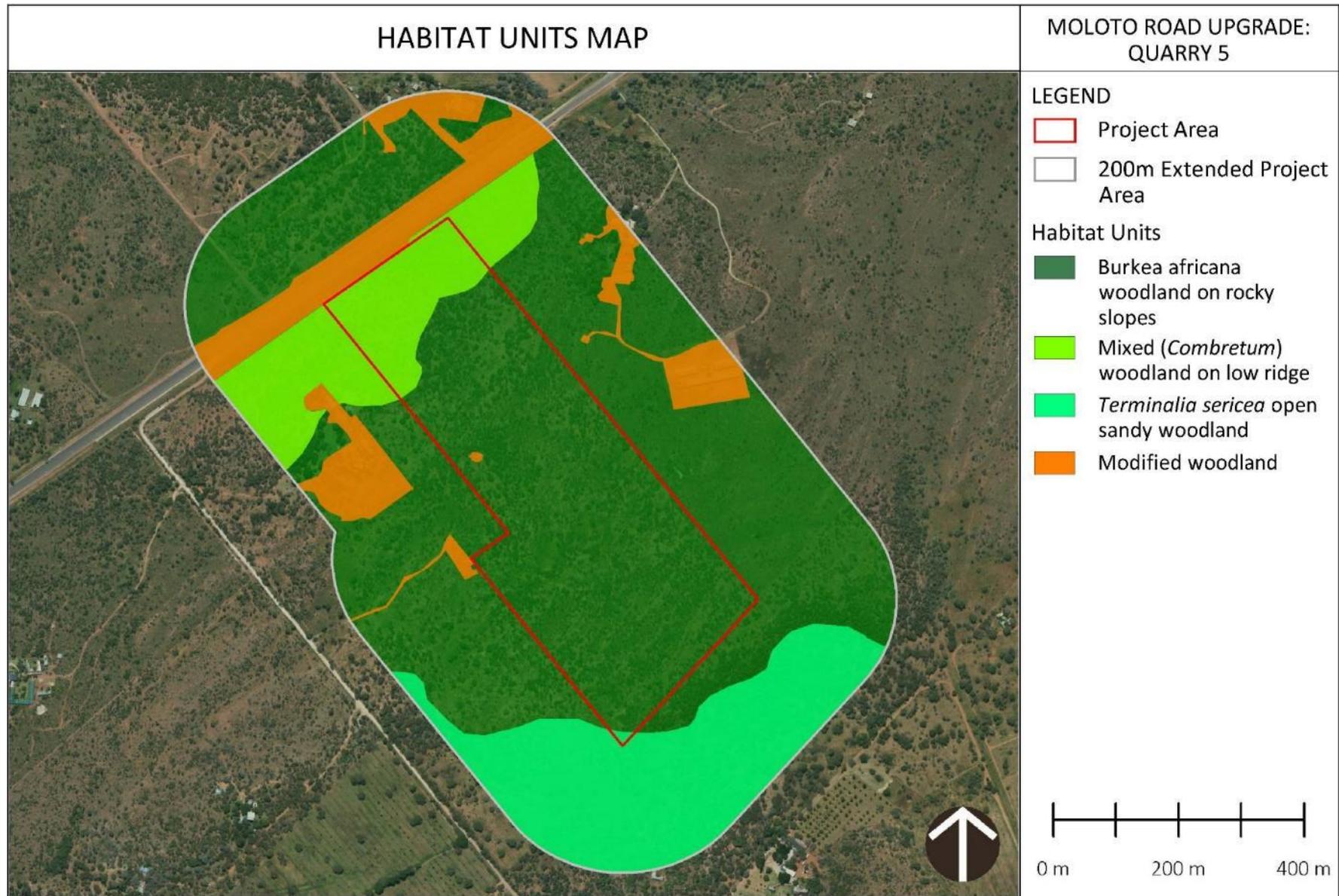


Figure 12: Habitat units identified within the Quarry 5 project area during the field assessment

6.1.1.1 *Burkea africana* Woodland on Rocky Slopes

The *Burkea africana* woodland habitat unit (Figure 13) occurs within the majority of the project area and the immediate surrounds. This habitat is characterised by rocky slopes and rocky outcrops which run roughly parallel, interspersed by sandy soils. The slow-growing, deciduous tree species *Burkea africana* is the dominant woody species in this habitat unit.



Figure 13: Representative photographs of the *Burkea africana* Woodland habitat unit

This habitat unit occurs on rocky substrate on a gradual, south-facing slope. The woody layer is well developed, with *Burkea africana* being the characteristic tree species of this habitat unit and occurring throughout this habitat unit in deep sandy soil between parallel rocky outcrops. Other trees present in a lower abundance include *Terminalia sericea*, *Ochna pulchra*, *Strychnos pungens*, *Vangueria infausta* and *Englerophytum magalismsontanum*. Large shrubs include *Afrocanthium gilfillanii*, *Searsia zeyheri*, *Lopholeana coriifolia*, *Protea caffra*, *Diplorrhynchus condylocarpon*, *Asparagus suaveolens* and *Dodonaea viscosa* var. *angustifolia*. *Xerophyta retinervis*, *Pellaea calomelanos*, *Rhynchosia monophylla* and *Searsia magalismsontana* are common along the rocky areas.

The herbaceous layer has a lower cover than the tree layer and comprises of forb species such as *Commelina africana*, *Bulbostylis* spp., *Sida cordifolia*, *Cleome* spp., *Oldenlandia herbacea*, *Fadogia homblei*, *Hebenstretia angolensis*, *Polydora poskeana* and *Bulbine angustifolia*. Prominent geoxylic suffrutices occurring throughout this habitat unit include *Parinari capensis* and *Pygmaeothamnus zeyheri*. The grass layer comprises species such as *Aristida congesta*, *Schizachyrium sanguineum*, *Diheteropogon amplexans*, *Eragrostis gummiflua*, *E. racemosa* and *Loudetia simplex*.

The overall abundance and diversity of alien species within the *Burkea africana* Woodland habitat unit is low, with *Lantana camara* and *Catharanthus roseus* being most commonly encountered. A low number of *Jacaranda mimosifolia* and *Grevillea robusta* was also recorded.

Floral SCC recorded within this habitat unit were *Protea caffra* and *Gladiolus* sp., both of which are listed as protected under the TNCO (No. 12 of 1983) and *Boophane disticha*, which is listed by SANBI as being of Least Concern nationally, but which is indicated as Declining in the Gauteng Province (GDARD, 2017).

6.1.1.2 Mixed Woodland on Low Ridge

The Mixed Woodland habitat unit (Figure 14) is located on a low rocky ridge system in the north of the project area adjacent to the R573 roadway. The deep sandy soils between parallel rocky outcrops as noted within the *Burkea africana* habitat unit on the remainder of the project area, is not present in this unit, and the habitat unit is therefore not characterised by indicative Seringveld tree species such as *Burkea africana* and *Terminalia sericea*.



Figure 14: Representative photographs of the Mixed Woodland habitat unit

The tree component of this habitat unit is instead dominated by *Combretum* spp., including *C. molle*, *C. apiculatum* and *C. zeyheri*. Other prominent woody species include *Diplorrhynchus condylocarpon*, *Mudulea sericea*, *Strychnos pungens*, *Mundulea sericea*, *Ochna pulchra*, *Lanena discolor*, *Ozoroa paniculosa* and *Englerophytum magalismsontanum*.

Shrubs recorded include *Afrocanthium gilfillanii*, *Indigofera melanadenia*, *Asparagus suaveolens* and *Cryptolepis oblongifolia*, while forbs recorded include *Xerophyta retinervis*, *Crabbea acaulis*, *Ledebouria* sp., *Senecio venosus*, *Oldenlandia herbacea*, *Pavonia burchellii*. *Polydora posekana*, *Kyphocarpa angustifolia* and succulent species such as *Aloe greatheadii* subsp. *davyana* and *Kalanchoe thyrsiflora*. The grass layer is relatively sparse with the dominant grass species being *Aristida congesta*, *Schizachyrium sanguineum*, *Diheteropogon amplexans* and *Cymbopogon caesius*. Grasses present in lower abundance include *Eragrostis curvula*, *Panicum maximum*, *Tristachya biseriata* and *Loudetia simplex*.

NEMBA and CARA listed alien and invasive species such as *Opuntia ficus-indica*, *Cereus jamacaru*, *Lantana camara* and *Catharanthus roseus* occur in low abundance within the Mixed Woodland habitat unit, with ruderal alien species noted including *Acanthospermum australe*, *Ageratum conyzoides*, *Richardia brasiliensis*, *Zinnia peruviana* and *Tagetes minuta*.

Floral SCC recorded in this habitat unit include *Boophone disticha*, which, although nationally listed as having a conservation status of Least Concern (LC), is indicated as Declining, both nationally and within the Gauteng Province where it is listed as being of conservation concern (GDARD, 2017). *Protea caffra*, a tree species protected in terms of the TCNO (No 12 of 1983) was recorded throughout this habitat unit. One specimen of *Sclerocarya birrea* subsp. *caffra*, a protected tree species in terms of the National Forests Act (Act No. 84 of 1998), was also recorded within this habitat unit, approximately 50m to the west of the project area where it is unlikely to be affected by the proposed project.

6.1.1.3 Terminalia sericea Open Sandy Woodland

The *Terminalia sericea* Open Sandy Woodland habitat unit (Figure 15) occurs to the south of the project area within the 200m extended project area, and outside of the rocky habitat within the project area itself.

The *Terminalia sericea* Open Sandy Woodland habitat unit has an open woodland structure, with the tree layer dominated by deciduous *Terminalia sericea* trees. Other tree species present include *Burkea africana*, *Senegalia (Acacia) caffra* and *Faurea saligna*. The forb layer includes species such as *Nidorella hottentotica*, *Polydora poskeana*, *Polycarpaea corymbosa*, *Hilliardiella oligocephala*, *Helichrysum* spp., *Cleome maculata*, *Leonotis nepetifolia* and *Sesamum triphyllum*. The grass layer is dominated by *Aristida congesta* and other *Aristida* spp., *Eragrostis curvula*, *Cymbopogon caesius*, *Pogonarthria squarrosa*, *Perotis patens* and *Melinis repens*.



Figure 15: Representative photographs of the *Terminalia sericea* Woodland habitat unit

A number of alien species occur in this habitat unit including the NEMBA listed invasive species *Catharanthus roseus* as well as ruderal weeds such as *Bidens bipinnata*, *Zinnia peruviana*, *Tagetes minuta*, *Richardia brasiliensis* and *Acanthospermum australe*.

6.1.1.4 Modified Woodland

The Modified Woodland habitat unit include those areas where the habitat has been altered due to current and historic anthropogenic impacts. Such areas include access roads and existing farmsteads and related infrastructure, mostly within the areas immediately surrounding the project area. A small outbuilding of limited extent is present within the project area itself. These areas are characterised by alien and introduced floral species or are devoid of vegetation.

6.1.2 Floral Species of Conservation Concern (SCC)

An assessment was undertaken considering the occurrence of any floral SCC including suitable habitat to support floral SCC. The floral SCC listed in the table below are indicated by the SANBI POSA and BODATSA databases, as well as through an enquiry to GDARD, to occur within the 2528DA QDS. GDARD (2019) indicated that no known locations of floral SCC occur within 5km of the project area.

Habitat requirements of each species listed were obtained from SANBI⁷ and GDARD (2017). Floral SCC encountered within the Quarry 5 project area are highlighted.

Table 3: Floral SCC listed for the 2528DA QDS (POSA, 2013; BODATSA, 2016, GDARD, 2020) and probability of occurrence/ confirmed occurrence within the Quarry 5 project area.

Species	Threat status	Habitat	Possibility of occurring within the project area
<i>Andromischus umbraticola</i> subsp. <i>umbraticola</i>	NT	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld in the south.	Medium – habitat is available for this species in the project area.

⁷ www.redlist.sanbi.org

<i>Argyrobium megarrhizum</i>	NT	Mixed bushveld.	Low – limited suitable habitat is available for this species in the project area.
<i>Boophone disticha</i>	LC* (Decreasing)	Dry grassland and rocky areas.	Confirmed to occur scattered throughout the project area
<i>Eucomis authumnalis</i>	LC* (Decreasing)	Damp, open grassland and sheltered places from the coast to 2450 m.	Low – limited habitat is available for this species in the project area.
<i>Frithia humilis</i>	EN	Very shallow soils derived from coarse sediments, Irrigasie Formation of the Ecca group.	Low – no suitable habitat is available for this species in the project area.
<i>Habenaria bicolor</i>	NT	Well-drained grasslands at around 1600 m in South Africa.	Low – no suitable habitat for this species is available within the project area.
<i>Holothrix randii</i>	NT	Grassy slopes and rock ledges, usually southern aspects.	Low – limited habitat is available for this species in the project area.
<i>Hypoxis hemerocallidea</i>	LC* (Decreasing)	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant.	High – suitable habitat is available for this species within the project area.
<i>Ilex mitis</i> var. <i>mitis</i>	LC* (Decreasing)	Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes.	Low – no suitable habitat for this species is available within the project area.
<i>Searsia gracillima</i> var. <i>gracillima</i>	NT	Rocky quartzitic outcrops in bushveld.	High – suitable habitat is available for this species in the project area.

*Previously indicated by the SANBI Red List as Declining, but since the 2017 updates to the SANBI Red List, indicated to be of Least Concern. These species are however indicated by GDARD (2017) as Declining within the Gauteng Province and is included in the Orange List.

In addition to the above, it is of interest to note that the Seringveld sandveld forms part of the known habitat of the aardvark (*Orycteropus afer*), although the extent to which they still exist in the region is uncertain (GA & SA, 2010). The extremely rare underground aardvark cucumber (*Cucumis humifructus*), that is listed as Vulnerable (VU) and is entirely dependent on aardvarks for dispersal and recruitment, is historically known from the area. This plant species is however presumed to be locally extinct in the Gauteng Province⁸, although still included on the Red List of Plant Species for Gauteng (GDARD, 2017). *C. humifructus* was not recorded from the project area, and is unlikely to be present, due to the probable absence of *C. afer* within the project area.

The occurrence of floral SCC within the project area as recorded during the field assessment can be summarised as follows (refer to Figures 16 & 20):

- IUCN Red Listed floral species: none.
- SANBI Red Listed floral species: *Boophone disticha* was recorded throughout the project area in moderate abundance. This species is listed as Least Concern (LC) in terms of the SANBI Red List and is not a nationally threatened/ Red Listed species. It is indicated to be Declining on a

⁸ www.redlist.sanbi.org

national level and within the Gauteng Province specifically, where it is included in the provincial Orange List (GDARD, 2017). It is therefore recommended that the species be rescued and relocated to similar suitable habitat in the vicinity of the project area prior to commencement of construction. No buffer zones are applicable in line within the Gauteng Red List Plant Species Guidelines (2006) and no permits are required, however GDARD requires a brief relocation plan to be submitted and approved, together with an indication of measures to be implanted to ensure long-term relocation success. The rescue and relocation process should be overseen by a qualified botanist.

- NEMBA TOPS species: none.
- National Forests Act (Act No. 84 of 1998) protected tree species: one specimen of *Sclerocarya birrea* subsp. *caffra*, located outside of the project around 50m to the west.
- TNCO (No. 12 of 1983) protected floral species: *Protea caffra*, which occurs throughout the project area and surroundings and one specimen of *Gladiolus* sp were recorded. Although *Gladiolus* sp. can be relocated, it is not practical to relocate *Protea caffra* and GDARD does not require relocation of these species. As these two species are not nationally or provincially threatened/ Red Listed, near threatened or Orange listed in the Gauteng Province, no permits are therefore required to destroy these species. As such, the locations of these species are not indicated on Figure 20.

Certain floral SCC recorded from the project area and discussed above are illustrated in Figure 16 below.



Figure 16: Floral SCC recorded in the project area. A) *Sclerocarya birrea* subsp. *caffra*; B) *Boophone disticha*; and C) *Gladiolus* sp.

In addition to the floral SCC confirmed from the project area, two other floral SCC have a high probability of occurring within the project area, namely *Hypoxis hemerocallidea* (LC, Declining) and *Searsia gracillima* var. *gracillima* (NT). These two species were not recorded during the field assessment.

6.1.3 Medicinal Floral Species

Many floral species encountered within the project area have been recorded to have some medicinal use. For the purpose of this assessment only the most prominent medicinal floral species, of which several were encountered during the field assessment, as indicated by Van Wyk *et al.* (2005) and Van Wyk & Gericke (2003) (unless otherwise indicated) are included in the table below.

Table 4: Medicinal floral species identified during the field assessment across all habitat units within the project area

Species	Common name	Medicinal use and plant parts used
<i>Aloe greatheadii</i> subsp. <i>davyana</i>	Aloe	Leaf sap used for the treatment of burns and wounds. ⁹
<i>Boophone disticha</i>	Bushman poison bulb	Dry outer bulb scales are used to treat wounds and to alleviate pain.
<i>Catharanthus roseus</i>	Madagascar periwinkle	Roots and leaves are used as a remedy for diabetes and to treat rheumatism.
<i>Croton gratissimus</i>	Lavender croton	The bark is used to treat fever and numerous other ailments; leaf infusions are used for coughs.
<i>Dodonaea viscosa</i> var. <i>angustifolia</i>	Sand olive	Leaves and the tips of twigs are used for fever, colds, influenza, stomach trouble and measles.
<i>Dombeya rotundifolia</i>	Wild pear	Bark, wood and roots. Infusions are used to treat internal ulcers and various stomach problems.
<i>Elephantorrhiza elephantina</i>	Elandsbean	Underground rhizomes used for a wide range of ailments including stomach disorders and the treatment of skin diseases.
<i>Helichrysum</i> spp.	Everlastings	Leaves, twigs, and sometimes roots are used for many ailments including coughs, colds, fever, infections, headache, menstrual pain and wound dressing.
<i>Hilliardiella oligocephala</i>	Groenamara	Leaves and twigs are used in infusions to treat abdominal pain and colic. Other ailments treated include rheumatism, dysentery and diabetes. Roots are used to treat colitis.
<i>Lannea edulis</i>	Wild grape	The bark of the underground rootstock is used to treat stomach ailments and leaf infusions are applied to externally to treat sore eyes, boils and abscesses.
<i>Pellaea calomelanos</i>	Hard fern	Leaves are smoked for head chests, chest colds and asthma.
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	Marula	Decoctions if the bark, roots or leaves are taken orally for stomach problems and a general tonic. Lead infusions are drunk for diabetes.
<i>Terminalia sericea</i>	Silevr cluster-leaf	Roots, and sometimes stem bark, are used to treat stomach disorders.
<i>Xerophyta retinervis</i>	Monkey's tail	Dried roots are smoked for asthma relief, and smoke form the whole plant is used to stop nose bleeding. The stem bark is used for general body aches and as an anti-inflammatory.

⁹ <https://www.randomharvest.co.za/>

The medicinal floral species encountered occur throughout the project area, and within all habitat units identified. These species are also likely to be present in surrounding habitats within the Seringveld.

6.1.4 Alien and Invasive Floral Species

Alien and invasive floral species lead to degradation of the ecological integrity of an area, which in turn may lead to, amongst others, a decline in indigenous species diversity and potential local floral species' extinction, an ecological imbalance, and the decreased productivity of land (Bromilow, 2010). Alien and invasive floral species encountered during the field assessment within the boundaries of the project area are listed in Table 5 below. The various listed invasive species' categories as indicated by the NEMBA Alien and Invasive Species Lists (2016) are shown, as well as the categories as per CARA (Act No. 43 of 1983).

Table 5: Alien floral species identified during the field assessment across both habitat units within the project area

Species	Common name	NEMBA Category*	CARA Category
<i>Acanthospermum australe</i>	Sheep bur/ Spiny bur	N/A	N/A
<i>Ageratum conyzoides</i>	Goat weed	N/A	N/A
<i>Bidens bipinnata</i>	Spanish needles	N/A	N/A
<i>Catharanthus roseus</i>	Madagascar periwinkle	3	N/A
<i>Cereus jamacaru</i>	Queen of the night	1b	1
<i>Grevillea robusta</i>	Australian silky oak	1b	3
<i>Jacaranda mimosifolia</i>	Jacaranda	1b	1
<i>Lantana camara</i>	Lantana	1b	1
<i>Opuntia ficus-indica</i>	Sweet prickly pear	1b	1
<i>Richardia brasiliensis</i>	Mexicana clover	N/A	N/A
<i>Solanum mauritianum</i>	Bugweed	1b	1
<i>Tagetes minuta</i>	Tall khaki weed	N/A	N/A
<i>Zinnia peruviana</i>	Redstar zinnia	N/A	N/A

N/A – Not Applicable (not listed)

Category 1a – Invasive species that require compulsory control.

Category 1b – Invasive species that require control by means of an invasive species management programme.

Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.

Category 3 – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread.

X – proposed CARA category

When considering the table above, it is evident that a relatively low diversity of alien species are present within the project area. Six of the species listed in the table above are NEMBA listed invasive species that require mandatory control. From the field assessment it was found that none of these listed species occur in a high abundance, although *Catharanthus roseus* and *Lantana camara* were encountered relatively frequently and in more locations than the other alien species listed.

6.2 Results of the Faunal Assessment

The structure of the landscape and associated vegetation communities strongly influences faunal diversity through the provision of food resources, habitat corridors and refugia.

Three broadscale niches are associated with the project area namely terrestrial, arboreal and rupicolous habitats. The project area comprises of predominantly broad-leaved, deciduous woodland

characterised by rocky outcrops that punctuate the woodland, as well as a low ridge system in the north that provides foraging and refuge opportunities (variety of fissures) for faunal species (Figure 17). Ridges and associated rocky aspects form important faunal dispersal corridors and promote important ecological processes. The interconnected nature of these habitats also provides networks of micro-corridors within the project area. There is a high degree of connectivity to surrounding micro-habitats characterised by ecological features such as unique floral assemblages and landscape features i.e. rocky outcrops and more open woodland habitats. As such, these habitats provide elevated landscape permeability, niche heterogeneity and subsequent elevated species richness. Furthermore, as is the case for avian species, increased habitat components provide a wider range of resources available supporting higher abundance and diversity (Reynolds & Symes, 2013).

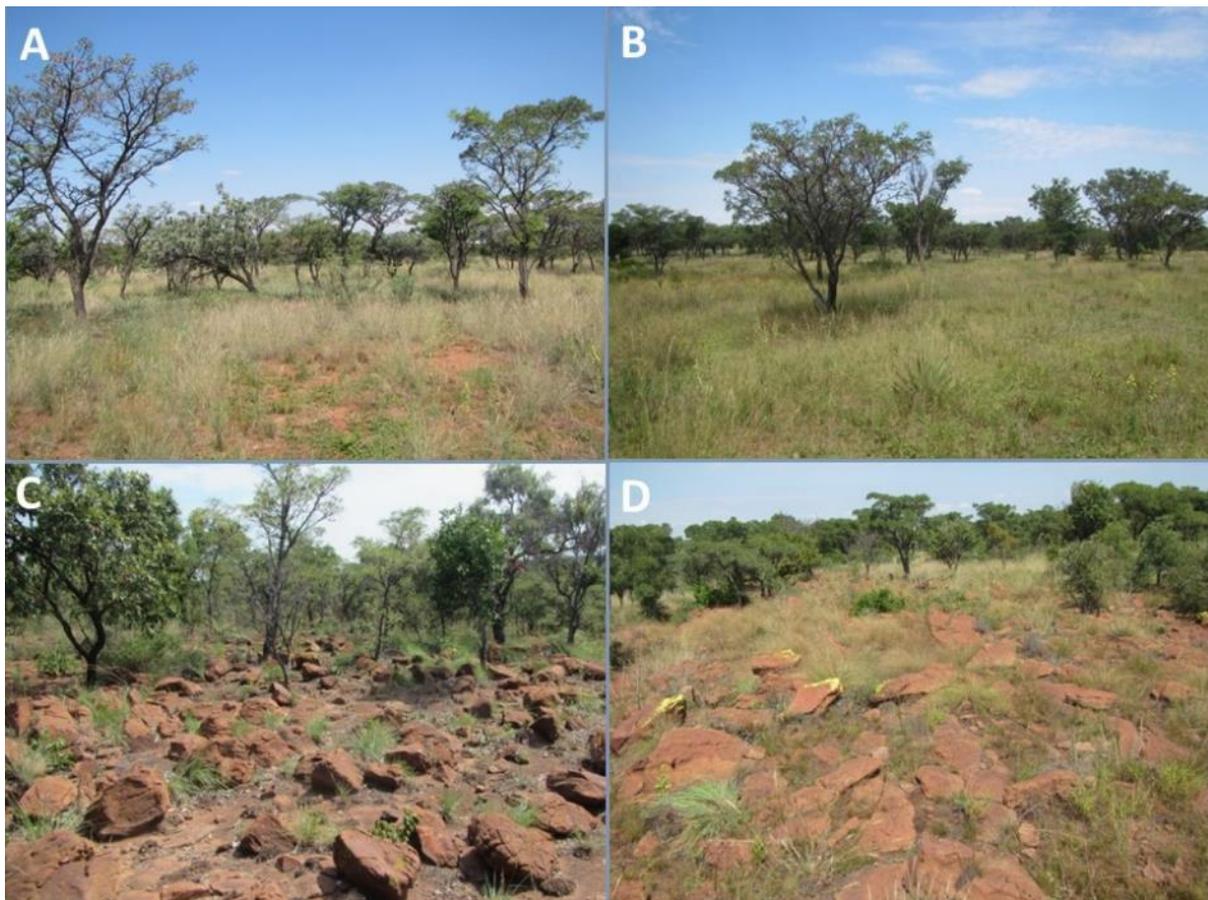


Figure 17: Representative photographs of available faunal habitats within the project area: A & B) Open sandy woodland habitats; C) rocky outcrops; and D) low ridges

The Gauteng Province is situated in both the grassland and savanna biomes and is associated with elevated biodiversity levels (Pfab et al., 2017). The Seringveld is located within the transition zone between the warmer, lower lying bushveld and the cooler highveld grassland. Such transition zones, also known as ecotones, are complex and dynamic, and typically contain high species diversity and increased levels of endemism (GA & SA, 2010).

According to distributional data the province is associated with approximately 125 mammals, 23 amphibians, 92 reptiles and 488 bird species (Pfab et al., 2017). As the project area lies within the western edge of the 2528DA QDS, data from the adjacent 2528CB QDS has been included to provide a more holistic understanding of faunal assemblages in this relatively poorly studied area. The full list

of faunal species (mammals, amphibians, reptiles and birds) reported within the 2528DA and 2528CB QDS is presented in Appendix B.

6.2.1 Mammals

According to MammalMap (2017) a total of 39 and 78 species have been recorded within the 2528DA and 2528CB QDSs, respectively. The relative proportions of prominent mammal families reported within the QDS are presented in Figure 18.

Habitat transformation and fragmentation coupled with increased human presence and associated impacts (persecution, hunting, trapping and intensification of land management) have had a negative impact on faunal species composition. This is particularly true for large ungulates and carnivores, with their presence in most cases largely restricted to conservation (informal and formal) areas.

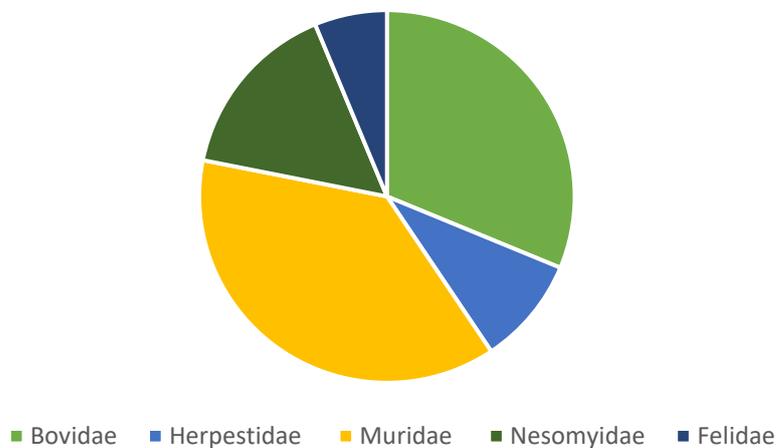


Figure 18: Relative proportions of prominent mammal families reported within the 2528DA

During the March 2020 field assessment, eight mammals were identified within the project area based on direct observations and indirect signs (Table 6). Furthermore, consultation with site personnel confirmed sightings of Black-backed Jackal (*Canis mesomelas*), Common Duiker (*Sylvicapra grimmia*) and Blesbok (*Damaliscus pygargus phillipsi*). Although the property is fenced and larger bovid movement will be impeded, signs of mammal movement/burrows under the fence was noted at several locations, further supporting the notion that the project area forms part of the larger habitat matrix for fauna. Livestock such as horses, donkeys and sheep were noted on the northern extent.

The rocky areas embedded within the *Burkea africana* woodland habitat act as refugia for smaller mammals and increase niche diversity within the project area. Small to medium sized mammals likely to be present within the project area include Namaqua Rock Mouse (*Micaelamys namaquensis*), Tete Veld Rat (*Aethomys ineptus*), Xeric Four-striped Mouse (*Rhabdomys pumilio*), Single-striped Grass Mouse (*Lemniscomys rosalia*), Bushveld Gerbil (*Gerbilliscus leucogaster*), Fat Mouse (*Steatomys pratensis*) and Yellow Mongoose (*Cynictis penicillata*). Further to the species reported, mammals known to occur within the Seringveld Conservancy, and by extension may also occur within the project area include Greater Kudu (*Tragelaphus strepsiceros*), Steenbok (*Raphicerus campestris*), Common Warthog (*Phacochoerus africanus*), Porcupine (*Hystrix africae australis*), Brown Hyena (*Parahyaena*

brunnea), Caracal (*Caracal caracal*), Chacma Baboon (*Papio ursinus*), Vervet Monkey (*Chlorocebus pygerythrus*) and Bushpig (*Potamochoerus larvatus*) (GA & SA, 2010).

Table 6: Mammals identified during the March 2020 field survey

Family	Scientific Name	Common Name	Conservation Status	Habitat
Bovidae	<i>Sylvicapra grimmia</i>	Common Duiker	LC	Woodland
Bovidae	<i>Aepyceros melampus melampus</i>	Impala	LC	Woodland
Bovidae	<i>Damaliscus pygargus phillipsi</i>	Blesbok	LC	Woodland
Herpestidae	<i>Herpestes sanguineus</i>	Slender Mongoose	LC	Woodland
Herpestidae	<i>Cynictis penicillata</i>	Yellow Mongoose	LC	Woodland
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	LC	Rocky ridge
Canidae	<i>Canis mesomelas</i>	Blacked-backed Jackal	LC	Woodland
Viverridae	<i>Genetta maculata</i>	Rusty Spotted Genet	LC	Rocky ridge

6.2.2 Herpetofauna

Herpetofauna are secretive, and robust lists require intensive field surveys over numerous seasons. Reptiles have adapted to a wide variety of habitats with their occurrence largely related to broad scale micro-habitats such as terrestrial, arboreal, fossorial, aquatic and rupicolous habits (Bates et al., 2014). During the March 2020 field assessment rocky outcrops/ ridges (rupicolous) and woodlands (terrestrial and arboreal) were the primary herpetofaunal habitats identified.

6.2.2.1 Amphibians

The class Amphibia is represented in South Africa only by the Anura with a total of 117 species occurring in South Africa. Amphibians are globally the most threatened vertebrate group and approximately 29% of amphibians within South Africa are listed as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) (Tarrant & Armstrong, 2013). Suitable environmental conditions, particularly breeding sites, are critical for amphibians, as species are often restricted to specific habitats. In a biogeographical context, the project area falls within the interface between the grassland and moist savanna macro-habitat

Based on data extrapolated from the ADU (FrogMAP), 23 amphibians from nine families are confirmed to occur within the 2528DA and 2528CB QDSs. The majority of these species have wide distributions and comprises of Pyxicephalidae (eight members) and Bufonidae (six members).

Two amphibian species were recorded within the project area during the March 2020 site investigation namely Red Toad (*Schismaderma carens*) and Natal Sand Frog (*Tomopterna natalensis*). The low diversity of amphibians recorded is most likely due to the short nature of the site investigation (a single diurnal survey) as well as the lack of wetland/ watercourses and seasonal pans within the project area. Most amphibians are dependent on suitable aquatic habitat (perennial or ephemeral) for breeding, although there are exceptions where species utilise soil moisture and leaf litter. Given the lack of waterbodies, species likely utilising the project area will be comprised of Bufonidae members, which have the ability to forage over long distances i.e. Raucous Toad (*Sclerophrys capensis*), Power's Toad (*Sclerophrys poweri*), Olive Toad (*Sclerophrys garmani*) and Northern Pygmy Toad (*Poyntonophrynus fenoulheti*). After heavy rainfall, water accumulating within rocky outcrops

can further support transient movement of these species, with *P. fenoulheti* known to exploit these ephemeral habitats.

Impacts to amphibian communities arising from the proposed project are attributed to the altered vegetation structure and reduced matrix of suitable foraging habitat for amphibians. The project area is unlikely to be associated with an amphibian hotspot due to the lack of suitable niche habitat (calling, refuge and breeding sites).

6.2.2.2 Reptiles

Southern Africa has a high diversity of reptile species which are generally secretive and extremely sensitive to habitat destruction, fragmentation and modification; anthropogenic disturbance and degradation of habitats (Bates et al., 2014). Surveys indicate that approximately 92 reptile species occur within Gauteng (Pfab et al., 2017). Based on the findings of ReptileMAP (2019), 68 species, belonging to 17 families have been confirmed to occur within the 2528DA and 2528CB QDSs, dominated by members of the Lamprophiidae (16), Lacertidae (seven) and Scincidae (six) families. Most species favour rupicolous and arboreal habitats within savanna woodlands.

Four reptile species were recorded during the March 2020 survey (Table 7). Variable Skink (*Trachylepis varia*) was the most common species encountered. Spotted Sandveld Lizard (*Nucras intertexta*) and Cape Gecko (*Pachydactylus capensis*) were recorded in rocky habitats while Common Dwarf Gecko (*Lygodactylus capensis capensis*) was identified on at the base of a *Burkea africana* tree. More species will likely utilise the project area and the low observed species diversity (in comparison to known distributions) is attributed to the rapid nature of the assessment and is not a reflection of reptile diversity of the area (i.e. fossorial and species with an affinity for crevices are often overlooked). Species likely to utilise habitats within the project area include Puff Adder (*Bitis arietans arietans*), Mole Snake (*Pseudaspis cana*), Common Girdled Lizard (*Cordylus vittifer*), Yellow-Throated Plated Lizard (*Gerrhosaurus flavigularis*), Distant's Ground Agama (*Agama aculeate distanti*), Southern Tree Agama (*Acanthocercus atricollis*) and Snouted Cobra (*Naja annulifera*). Discussions with a property employee confirming the presence of *B. arietans* and *N. annulifera*.

Table 7: Reptile species recorded during the 2020 field survey

Scientific Name	Common Name	Conservation status	Habitat Preferences
<i>Trachylepis varia</i>	Variable Skink	LC	Rocky habitats in montane grasslands, savanna and coastal scrub.
<i>Pachydactylus capensis</i>	Cape Gecko	LC	Wide range of habitats with suitable refugia.
<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	LC	Savanna habitats. Adapts readily to urban situations.
<i>Nucras intertexta</i>	Spotted Sandveld Lizard	LC	Sandy substrates in arid savanna and open scrubland.

The main impact of the proposed project on reptilian abundance and diversity will be attributed to habitat loss and direct mortalities through earthworks/ blasting as well as the loss of available rocky habitats.

6.2.3 Avifauna

A total of 264, 288 and 281 avian species have previously been recorded within the 2530_2830, 2530_2835 and 2530_2825 pentads¹⁰ respectively based on the South African Bird Atlas Project 2¹¹. The project area is comprised of broad-leaved woodland and lies within the Seringveld Conservancy, a known birding location in Gauteng. Approximately 280 species have been recorded within the conservancy (Marais & Peacock, 2008). A full list of avifauna reported within the pentad can be accessed on http://sabap2.birdmap.africa/coverage/pentad/2530_2830.

A total of 46 species from twelve orders were recorded during the brief field assessment, with Passeriformes accounting for 50% of reported species (Table 8). Species recorded are largely associated with woodland/bushveld habitats and commonly noted species include Rattling Cisticola (*Cisticola chiniana*), Yellow-fronted Canary (*Crithagra mozambicus*), Blue Waxbill (*Uraeginthus angolensis*), Chinspot Batis (*Batis molitor*), Southern-black Tit (*Melaniparus niger*), Crested Barbet (*Trachyphonus vaillantii*), Grey Go-Away Bird (*Corythaixoides concolor*) and Cape Turtle Dove (*Streptopelia capicola*). Interestingly, several mixed-species foraging flocks (MSFFs) of birds comprising of Blue Waxbill, Southern Black Tit, Emerald Spotted Wood Dove (*Turtur chalcospilos*) and Chinspot Batis were noted. Cape Turtle Dove (*Streptopelia capicola*), Southern Grey-headed Sparrow (*Passer diffusus*), Crested Barbet (*Trachyphonus vaillantii*), White-bellied Sunbird (*Cinnyris talatala*) and Dark-capped Bulbul (*Pycnonotus tricolor*) were noted surrounding the existing homestead and adjacent Moloto Road.

The largely limited avian habitat diversity within the project area explains the lack of other guilds such as waders, riparian and grassland species which will utilise suitable habitats outside of the project area. No SCC were recorded within the project area during the field survey.

Table 8: Avian species identified during the March 2020 field assessment

Scientific Name	Common Name
Passeriformes	
<i>Apalis thoracica</i>	Bar-throated Apalis
<i>Pogoniulus chrysoconus</i>	Yellow-fronted Tinkerbird
<i>Turoides jardneii</i>	Arrow-marked Babbler
<i>Pycnonotus tricolor</i>	Dark-capped Bulbul
<i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting
<i>Crithagra mozambica</i>	Yellow-fronted Canary
<i>Sylvietta rufescens</i>	Long-billed Crombec
<i>Mirafraga africana</i>	Rufous-naped Lark
<i>Cisticola chiniana</i>	Rattling Cisticola
<i>Lonchura cucullata</i>	Bronze Mannikin
<i>Ploceus velatus</i>	Southern Masked Weaver
<i>Cisticola fulvicapilla</i>	Neddicky
<i>Vidua paradisaea</i>	Long-tailed Paradise Whydah
<i>Prinia subflava</i>	Tawny-flanked Prinia

¹⁰ A pentad is a 5 minute x 5 minute coordinate grid super-imposed over the continent for spatial reference.

¹¹ <http://sabap2.birdmap.africa>

<i>Dryoscopus cubla</i>	Black-backed Puffback
<i>Cossypha caffra</i>	Cape Robin-chat
<i>Cercotrichas leucophrys</i>	White-browed Scrub-robin
<i>Crithagra gularis</i>	Streaky-headed Seedeater
<i>Passer diffuses</i>	Southern Grey-headed Sparrow
<i>Lamprotornis nitens</i>	Cape Glossy Starling
<i>Cinnyris talatala</i>	White-bellied Sunbird
<i>Hirundo rustica</i>	Barn Swallow
<i>Tchagra senegalus</i>	Black-crowned Tchagra
<i>Uraeginthus angolensis</i>	Blue Waxbill
<i>Estrilda astrild</i>	Common Waxbill
<i>Vidua macroura</i>	Pin-tailed Whyda
<i>Batis molitor</i>	Chin-spot Batis
<i>Melaniparus niger</i>	Southern-black Tit
Piciformes	
<i>Trachyphonus vaillantii</i>	Crested Barbet
<i>Tricholaema leucomelas</i>	Acacia Pied Barbet
Coraciiformes	
<i>Merops pusillus</i>	Little Bee-eater
<i>Merops apiaster</i>	European Bee-eater
<i>Halcyon chelicuti</i>	Striped Kingfisher
Musophagidae	
<i>Corythaixoides concolor</i>	Grey-go-away-bird
Accipitriformes	
<i>Elanus caeruleus</i>	Black-winged Kite
Charadriiformes	
<i>Vanellus coronatus</i>	Crowned Lapwing
Columbiformes	
<i>Spilopelia senegalensis</i>	Laughing Dove
<i>Streptopelia capicola</i>	Cape Turtle Dove
<i>Turtur chalcospilos</i>	Emerald-spotted Wood-dove
Pelecaniformes	
<i>Scopus umbretta</i>	Hamerkop
<i>Bostrychia hagedash</i>	Hadedda Ibis
Galliformes	
<i>Numida meleagris</i>	Helmeted Guineafowl
<i>Pternistis swainsonii</i>	Swainson's Spurfowl
Coliiformes	
<i>Urocolius indicus</i>	Red-faced Mousebird
Piciformes	
<i>Campethera abingoni</i>	Golden-tailed Woodpecker
Bucerotiformes	
<i>Tockus nasutus</i>	African Grey Hornbill

6.3 Faunal Species of Conservation Concern

Twenty six (26) faunal SCC have been reported with distributions overlapping with the project area. Avifauna and mammals account for the majority of SCC assemblages (Figure 19). Faunal SCC likelihood of occurrence within the project area is discussed in detail below.

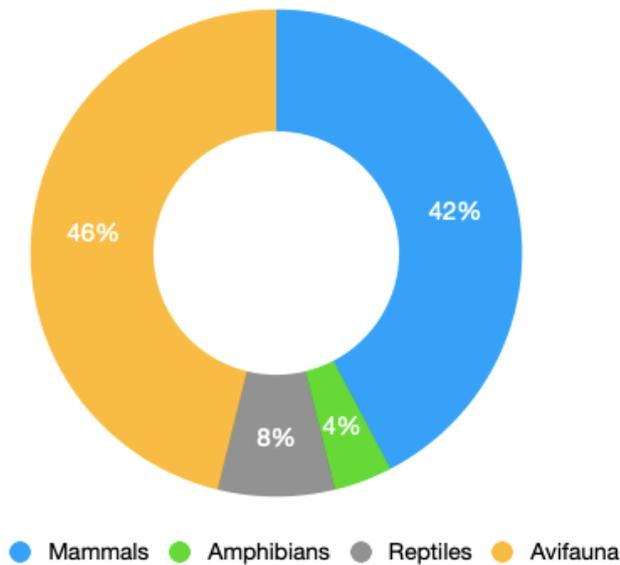


Figure 19: Relative proportions of faunal SCC

6.3.1 Mammals

Eleven mammalian SCC have been reported within the 2528CB and 2528CB QDSs, comprising of four orders namely Rodentia, Carnivora, Eulipotyphla and Artiodactyla. It is however important to consider that two conservation areas are located within the QDS's. The reporting of Sable Antelope (*Hippotragus niger niger*) and Leopard (*Panthera pardus*) are more likely associated with conservation areas than with habitats present within the project area (due in part to persecution). Although *P. pardus* has been reported outside of conservation zones and several historic sightings within the Seringveld (GA&SA, 2010), the density is likely to be low/rare. The likelihood of occurrence of reported mammals is summarised in Table 9. Habitat requirements of each species listed were obtained from the Endangered Wildlife Trust (EWT) Red Data List¹². Given the rapid nature of the survey, the Precautionary Principle was applied.

Moderate Likelihood of Occurrence within the project area

- Brown Hyaena (*Parahyaena brunnea*) is widespread utilising open woodland and scrub habitats, resting up in rocky bushveld areas. *P. brunnea* are known to occur outside of formally protected areas, with confirmed records in the vicinity of the project area. Given that *P. brunnea* is known from the Seringveld area, there is a moderate likelihood of occurrence

¹² www.ewt.org.za/resources/resources-mammal-red-list/

within the project area during transient movements however individuals are unlikely to reside specifically within the site.

- Southern African Hedgehog (*Atelerix frontalis*) occur primarily within savanna and grassland habitats as well as increasing observations in suburban areas (gardens). Key aspects to their occurrence are associated with sufficient ground cover, rocky outcrops and dense vegetation which provides both refugia as well as food resources. Given their nocturnal habits and propensity to nest under leaf litter, this results in *A. frontalis* being overlooked during short term field surveys. The project area is comprised of both dense vegetation as well as rocky aspects and are considered good habitat for *A. frontalis* and is sympatric with historic distributions.

Low Likelihood of Occurrence within the project area

- Swamp Musk Shrew (*Crocidura mariquensis*) are habitat specialists occurring only close to open water with intact riverine and semi-aquatic vegetation such as reedbeds and wetlands. They are found both in the wet substrates and drier grassland within this interface. Vlei Rat (*Otomys auratus*) and African Marsh Rat (*Dasymys incomtus*) show a similar affinity for densely vegetated wetland systems. Given the lack of wetland and other freshwater features within the project area and immediate surrounds, it is unlikely that these species will occur within the project area.
- White-tailed Rat (*Mystromys albicaudatus*) utilise highveld grasslands within Gauteng however the patchy distribution has hindered the ability for effective occupancy estimates. *M. albicaudatus* show a preference for calcrete soils within grassland habitats. Given these species-specific habitat requirements, *M. albicaudatus* it is unlikely to utilise the project area.
- Further research is required on the ecology of Maquassie Musk Shrew (*Crocidura maquassiensis*) with existing data indicating the importance of grasslands (rank) and associated wetlands. There is a low likelihood of occurrence within the project area.
- Black-footed Cat (*Felis nigripes*) is endemic to arid grasslands, dwarf shrub and savanna habitats where the preferentially select open, short grassland patches. Due to their secretive lifestyles coupled with specific habitat requirements and use of disused termite mounds/aardvark holes as den sites, there is a low likelihood of occurrence within the project area.
- Cape Clawless Otter (*Aonyx capensis*) and Spotted Necked Otter (*Hydrictis maculicollis*) have distributions which overlap with the project area. Both species are predominantly aquatic and found in close association with watercourses (rivers, dams and lakes). *A. capensis* show a preference for dense reed beds, boulders and overhanging vegetation within these aquatic systems, while *H. maculicollis* requires dense riparian vegetation to provide cover within unpolluted systems. Due to the lack of perennial watercourses within the project area, both species are unlikely to reside within the project area.
- Both Juliana's Golden Mole (*Neamblysomus julianae*) and Rough-haired Golden Mole (*Chrysoxalax villosus*) are listed as important mammal SCC within the GDARD Requirements for Biodiversity Assessments (2014). *N. julianae* is closely associated with sandy soils, with suitable cover on sandstone ridges and well irrigated suburban gardens while *C. villosus* utilises sandy soils in grasslands and adjacent wetland habitats. No recent reports of these species have been noted by ADU and there is a low likelihood of occurrence within the project area.
- Although listed as LC, Aardvark (*Orycteropus afer*) is listed as a TOPS by NEMBA (2015). It is known historically from the area (GA & SA 2010) however there have been no recent reports

within the 2528DA QDS. No signs (droppings, spoor, foraging signs or burrows) were observed during the field survey.

Table 9: Summary of Red Listed mammal species and likelihood of occurrence within the project area

Scientific Name	Common Name	Conservation status	Likelihood of Occurrence	Habitat Preferences
Rodentia				
<i>Otomys auratus</i>	Vlei Rat	NT	Low	Mesic grasslands and densely vegetated wetlands.
<i>Dasymys incomtus</i>	African Marsh Rat	NT	Low	Wide variety of habitats, but rely on intact wetlands.
<i>Mystromys albicaudatus</i>	White-tailed Rat	VU	Low	Often associated with calcrete soils (black loam) within grasslands.
Carnivora				
<i>Felis nigripes</i>	Black-footed Cat	VU	Low	Open, short grass areas in dry, open savanna, grasslands and Karoo semi-desert with sparse shrub and tree cover. Uses abandoned termite mounds.
<i>Aonyx capensis</i>	Cape Clawless Otter	NT	Low	Permanent streams, rivers, marshes, dams and lakes.
<i>Hydrictis maculicollis</i>	Spotted-necked Otter	VU	Low	Unpolluted river systems.
<i>Panthera pardus</i>	Leopard	VU TNCO	Low	Wide habitat tolerance. Preference for well-wooded habitats.
<i>Parahyaena brunnea</i>	Brown Hyaena	NT TNCO	Moderate	Desert, semi-desert, open scrub and open woodland savanna.
Eulipotyphla				
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	NT	Low	Close to open water with intact riverine and semi-aquatic vegetation/ inundated grasslands.
<i>Crocidura maquassiensis</i>	Maquassie Musk Shrew	VU	Low	Limited ecology data present. Specimens collected in rocky or montane grassland.
<i>Atelerix frontalis</i>	Southern African Hedgehog	NT TNCO	Moderate-High	Dense vegetation with rocky aspects and suburban gardens.
Artiodactyla				
<i>Hippotragus niger niger</i>	Sable Antelope	VU TNCO	Low	Woodland/ grassland ecotones and are selective feeders.

6.3.2 Herpetofauna

Analysis of historic records and atlases indicate that project area falls within the distributional range of one amphibians SCC, Giant Bullfrog (*Pyxicephalus adspersus*). According to SAFAP, two confirmed reports of *P. adspersus* occurs within the 2528DA QDS and it has been noted within the Seringveld

Conservancy (GA &SA, 2010). *P. adspersus* is listed as Near Threatened (NT) and protected under Schedule 2 of the TNCO (No. 12 of 1983) as well as within NEMBA under Chapter 4.

P. adspersus inhabits a variety of vegetation types in the Grassland, Savanna, Nama Karoo and Thicket biomes. There are three habitat requirements necessary to maintain populations of *P. adspersus* namely:

- **Breeding habitat:** Ephemeral pans and rain-filled depressions.
- **Suitable aestivation habitat:** *P. adspersus* display fossorial characteristics during the dry season where they aestivate underground and emerge during the wet season in order to forage and breed. This often results in individuals being missed during rapid surveys. Burrows are preferentially made in sandy soils and are approximately 1m deep however, in some instances clay substrates are utilised (Du Preez & Carruthers, 2009).
- **Foraging habitats:** Comprise of open grassland habitats in close proximity to breeding sites.

These three habitat components are vital for persistence and must be in close proximity given that adults often remain within 1km of breeding habitats (Thomas et al., 2014). Estimates suggest that the range of *P. adspersus* has been reduce by between 25% and 48% in South Africa (Thomas et al., 2014). Given the unique habitat requirements for *P. adspersus*, there is a low likelihood of occurrence within the project area.

Seven (7) endemic reptile species have distributions which overlap with the project area.

Table 10: Endemic reptile species potentially occurring within the project area and surrounds

Scientific Name	Common Name	Habitat Preferences
Family: Agamidae		
<i>Agama aculeata distanti</i>	Distant's Ground Agama	Grassland and woody habitats, and partially in rocky areas.
Family: Gekkonidae		
<i>Lygodactylus nigropunctatus</i>	Black-spotted Dwarf Gecko	Rocky outcrops in savanna habitat.
<i>Pachydactylus affinis</i>	Transvaal Thick-tailed Gecko	Rocky outcrops and moribund termitaria.
Family: Lamprophiidae		
<i>Lamprophis aurora</i>	Aurora House Snake	Grassland, fynbos and moist savanna habitats.
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	Partially fossorial and known to inhabit old termitaria in grassland habitats.
Family: Colubridae		
<i>Philothamnus natalensis</i>	Western Natal Green Snake	Lowland forest, wooded grassland and forest edge often near water.
Family: Cordylidae		
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	Grassy slopes and plateau .

The Striped Harlequin Snake (*Homoroselaps dorsalis*) and Coppery Grass Lizard (*Chamaesaura aenea*) are regional endemics whose distribution overlaps with the project area. *H. dorsalis* occupies grassland habitats and the central bushveld bioregion while *C. aenea* is present in highveld grassland slopes and plateaus (Bates et al., 2014). The semi-fossorial nature of *H. dorsalis* as well as propensity to use moribund termitaria often result in this species being overlooked. Threats to both *H. dorsalis* and *C. aenea* are associated with loss/ degradation of grassland habitats as well as the fragmentation

of remaining grassland patches. Improper veld management (livestock overgrazing and frequent burning) within remaining grasslands depletes available optimal habitats as well as prey abundance.

Although listed as Least Concern (Bates et al., 2014), Southern African Python (*Python natalensis*) is listed as a TOPS by NEMBA (2015) and records within the surrounding landscape have been reported (GA &SA, 2010).

6.3.3 Avifauna

Several avian SCC have been recorded within the site's pentads as well as surrounding pentads is detailed in Table 11 (SABAP2 and Gauteng Biodiversity Management Red List species information). It must be noted that several of the species discussed below may, at some point, utilise the project area during foraging bouts, but will however not necessarily breed or reside primarily within these habitats. Further, given the ability of avifauna to often move wide distances, the Precautionary Principle was applied with regards to likelihood of occurrence.

Moderate Likelihood of Occurrence within the project area

- European Roller (*Coracias garrulus*) occur in savanna and woodland habitat and given the suitable habitat within the project area and SABAP2 reports of *C. garrulus* in the larger area there is a moderate likelihood of occurrence.
- Lanner Falcon (*Falco biarmicus*) have a wide distribution however show a preference for grassland, cleared woodlands and agricultural areas. Although the project area is predominantly woodland habitat *F. biarmicus* is likely to move through the project area during transient movements/foraging bouts, warranting the moderate likelihood during transient movements. However, the lack of open habitats suggests that this species is unlikely to reside within the project area. No suitable roost/nest habitat occur within the project area (rocky cliffs).
- Secretarybird (*Sagittarius serpentarius*) occur in open grassland, scrub and open savanna habitats. *A. serpentarius* are able to utilise marginal habitats and as such there is a moderate likelihood of occurrence within the project area.

Low likelihood of occurrence within the project area and low SABAP2 reporting rates

- Verreaux's Eagle (*Aquila verreauxii*) favour mountainous habitats with rocky cliffs. *Procapra capensis* are favoured within their diet (although will switch prey items if numbers are low) and the project area may potentially form part of *A. verreauxii* foraging range. However, no suitable nesting/breeding habitat occurs within the project area.
- Half collared Kingfisher (*Alcedo semitorquata*) and African Finfoot (*Podica senegalensis*) are restricted to the immediate vicinity of fast flowing perennial rivers with dense riparian vegetation, overhanging shrubbery and reeds. Black Stork (*Ciconia nigra*) also show a preference for pans and dams, also utilising farm dams and sewage works. Given the lack of suitable habitat there is a low likelihood of occurrence within the project area.
- Black-winged Pratincole (*Glareola nordmanni*) and Blue Crane (*Grus paradisea*) favour grasslands and will exploit agricultural fields. *B. nordmanni* tend to congregate around dams and lakes. White-bellied Korhaan (*Eupodotis senegalensis*) utilise grasslands and ecotones

with savanna habitats (open savanna). Given these habitat requirements, these more grassland specialists, are unlikely to reside within the project area.

- Abdim's Stork (*Ciconia abdimii*) show a preference for grassland extending into sparsely wooded savanna habitats near water resources. They have also been noted utilising cultivated fields.
- Lesser Kestrel (*Falco naumanni*) is a prioritized species by GDARD. According to data obtained from SABAP2, reporting rates for *F. naumanni* are low (highest reporting rate of 11%) within the 9 pentads surrounding the project area, with three of these having no reports. Typically, they roost in tall alien trees.
- Grass Owl (*Tyto capensis*) mainly utilise tall, rank grass/sedge beds associated with permanent and temporary wetland systems. Foraging bouts tend to also concentrate to grassland habitats close to roost sites, however use of suboptimal habitats such as sparse woodlands has been recorded

Table 11: Summary of avian SCC and the probability of these species occurring within the project area

Scientific Name	Common Name	Conservation Status (RSA)	Likelihood of Occurrence
<i>Falco biarmicus</i>	Lanner Falcon	VU	Moderate (Transient)
<i>Coracias garrulus</i>	European Roller	NT	Moderate
<i>Aquila verreauxii</i>	Verreaux's Eagle	VU	Low-moderate (Transient)
<i>Sagittarius serpentarius</i>	Secretarybird	VU	Moderate
<i>Ciconia abdimii</i>	Abdim's Stork	NT	Low
<i>Podica senegalensis</i>	African Finfoot	VU	Low
<i>Alcedo semitorquata</i>	Half-collared Kingfisher	NT	Low
<i>Ciconia nigra</i>	Black Stork	VU	Low
<i>Grus paradisea</i>	Blue Crane	NT, TOPS	Low
<i>Eupodotis senegalensis</i>	White-bellied Korhaan	VU	Low
<i>Glareola nordmanni</i>	Black-winged Pratincole	NT	Low
<i>Tyto capensis</i>	Grass Owl	VU	Low

7 TERRESTRIAL ECOLOGICAL SENSITIVITY ASSESSMENTS

The results of the sensitivity analysis of each habitat unit according to the method described in Section 4.1.4 identified are outlined in the table below.

Table 12: Results and development implications of the terrestrial ecological sensitivity analysis

Habitat Unit including approximate area	Terrestrial Ecological Sensitivity	Development Implications
<i>Burkea africana</i> woodland on rocky slopes (±17ha of 19.9ha project area)	Medium High	<p>Habitat</p> <p>Development within this area will lead to the direct, permanent loss of good ecological condition woodland and associated rocky habitat that have not been significantly impacted in the past, and is considered remnant vegetation.</p>
Mixed woodland on ridge (±2.8ha of 19.9ha project area)	Medium High	<p>The habitat unit currently serves as functional floral and faunal habitat and acts as an important micro-habitat for reptiles, birds and small mammals.</p> <p>SCC</p> <p>Confirmed floral SCC are <i>Boophone disticha</i> (LC; Declining), <i>Protea caffra</i> (protected under the TNCO) and <i>Gladiolus</i> sp. (protected under the TNCO). One <i>Sclerocarya birrea</i> subsp. <i>caffra</i> (Marula) is located 50m west of the project area and is unlikely to be impacted.</p> <p>Suitable habitat is available for <i>Hypoxis hemerocallidea</i> (LC; Declining) and <i>Searsia gracillima</i> var. <i>gracillima</i> (NT).</p> <p>Faunal SCC including <i>Atelerix frontalis</i>, <i>Parahyaena brunnea</i> and <i>Coracias garrulus</i> may utilise this habitat unit.</p> <p>Key mitigation measures</p> <p>Should development of this vegetation unit be unavoidable, the following key mitigation measures, should be implemented:</p> <ul style="list-style-type: none"> • <i>Boophone disticha</i> must be rescued and relocated to suitable, similar habitat in the vicinity of the project area under the supervision of a qualified botanist and in line with a rescue and relocation procedure approved by GDARD. • Construction activities must take place in a phased approach to allow faunal species to disperse from the area. • Alien and invasive floral species must be controlled throughout all development phases of the project in line with an alien vegetation management plan if required by GDARD. • Impacts on adjacent natural habitat must be strictly managed. • Adequate and preferably concurrent rehabilitation must be undertaken within available areas and once quarrying activities have been completed.
<i>Terminalia sericea</i> Open Woodland (±0.06ha of 19.9ha project area)	Medium	<p>Habitat</p> <p>Only a small portion of this habitat unit will be affected. This habitat unit is relatively intact and in a moderate ecological condition.</p> <p>SCC</p> <p>The portion of this habitat unit that will be affected is of limited extent, but does provide suitable habitat for floral SCC such as <i>Boophone disticha</i> and <i>Hypoxis hemerocallidea</i>. Faunal SCC such as <i>Atelerix frontalis</i>, <i>Parahyaena brunnea</i> and</p>

		<p><i>Sagittarius serpentarius</i> may utilise the larger extent of this habitat unit beyond the boundaries of the project area.</p> <p>Key mitigation measures Strict management of edge effects, such as erosion and alien vegetation management must take place to prevent impacts on adjacent natural habitat.</p>
Modified Woodland (±0.04ha of 19.9ha project area)	Low	<p>Habitat Only a small portion of this habitat unit will be affected. This habitat unit has been significantly impacted and is characterised by an existing homestead and outbuilding within the project area.</p> <p>SCC No SCC were recorded in this habitat unit.</p> <p>Key mitigation measures Strict management of edge effects, such as erosion and alien vegetation management must take place to prevent impacts on adjacent natural habitat.</p>

The terrestrial ecological site sensitivity map developed for the proposed project is included as Figures 20 and 21 below, with the project development overlain over the sensitivity map in Figure 21. The locations of all floral SCC recorded during the field assessment, that require permitting or approval for destruction or relocation, namely *Boophone disticha* and *Sclerocarya birrea* subsp. *caffra*, are indicated. Note that more locations of these floral SCC than those recorded during the single day field assessment may be present within the project area and that certain locations shown include groupings of individual *B. disticha* plants.

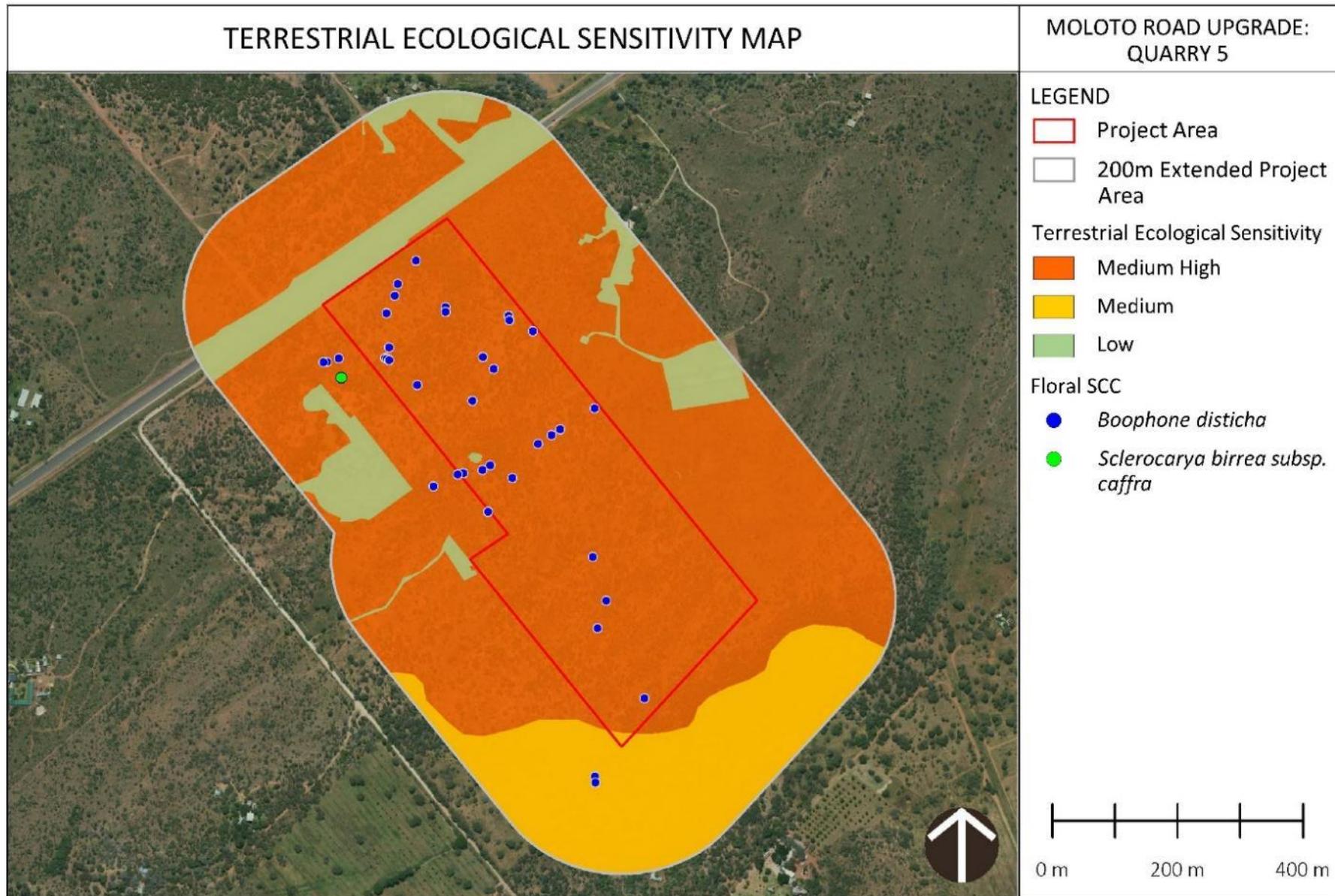


Figure 20: Terrestrial ecological sensitivity map for Quarry 5

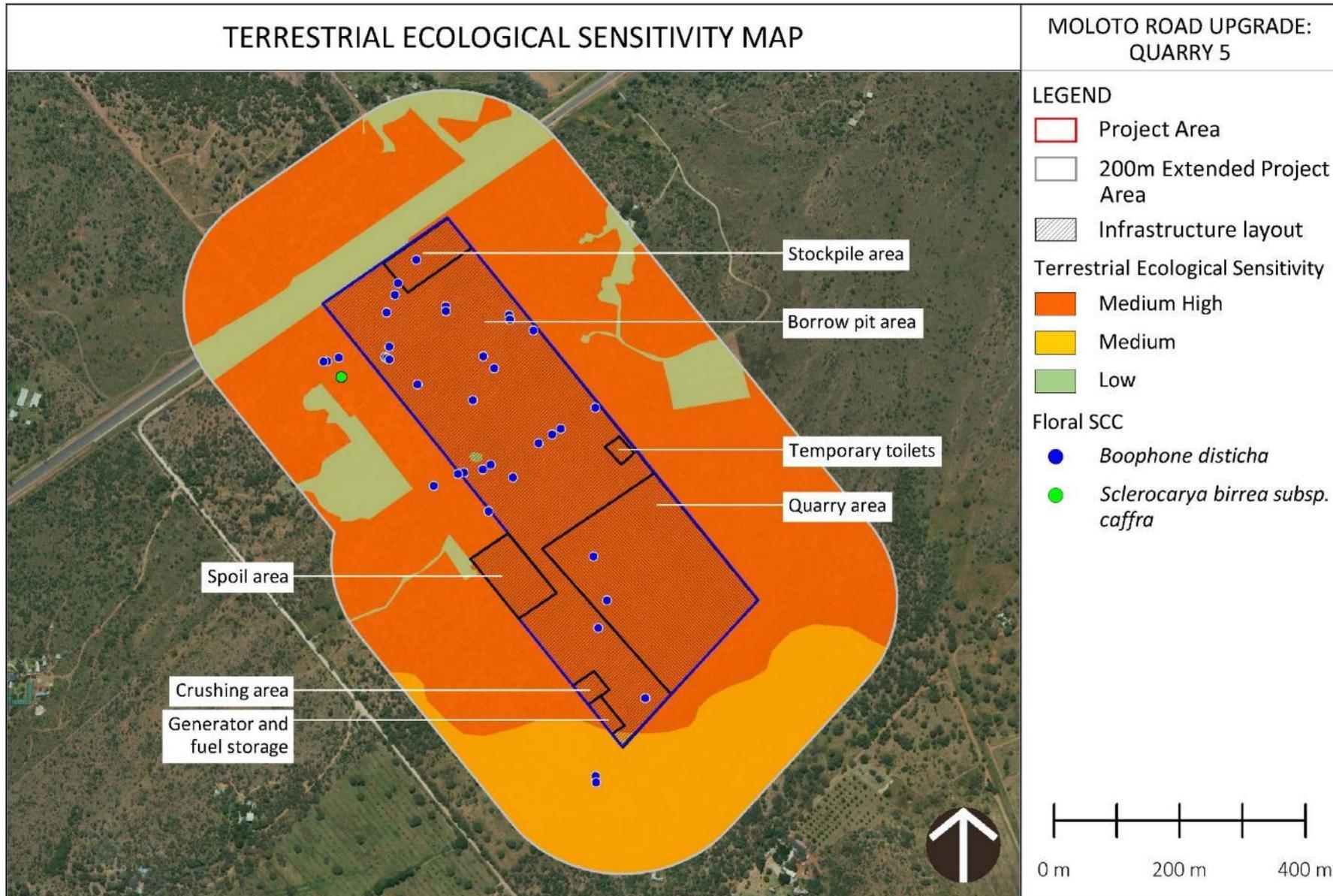


Figure 21: Terrestrial ecological sensitivity map for Quarry 5, indicating proposed infrastructure

8 IMPACT ASSESSMENT

Anthropogenic activities, including excavating, quarrying and developing infrastructure relating to the aforementioned, will negatively impact on the receiving natural environment. The section below serves to identify these potential impacts on the natural environment. Such impacts are likely to include the following:

- **Direct impacts:** Impacts directly associated with the project. These impacts can be temporary or remain as residual impacts, i.e. the clearing of natural vegetation within the development footprint.
- **Indirect impacts:** Impacts that are not a direct result of the project and often extend beyond the project boundary, i.e. encroachment of invasive alien vegetation outside of the project area.
- **Residual impacts:** Impacts that remain following the implementation of mitigation measures, and that may remain after the project has been completed.
- **Cumulative impacts:** Impacts occurring from the project/ development combined with impacts from past, existing and future projects that will affect the same natural resources e.g. a number of impacts occurring in the same ecosystem.

The results of the impact assessment from a terrestrial biodiversity perspective are outlined below, with significance ratings provided for the envisioned pre- and post-mitigation scenarios. In the context of the proposed development and operation of a quarry, the mitigation measures included in the section below are intended to prevent excessive degradation to the floral and faunal ecology within the project area and surrounds where possible, with specific reference of areas of increased ecological sensitivity.

8.1 Loss of Floral and Faunal Habitat

Loss of floral and faunal habitat will inevitably take place during the pre-construction/ pre-mining and construction phases of the project, and continue during the operational phase, mainly as result of direct clearing of vegetation and associated rocky habitat within the *Burkea africana* Woodland and Mixed Woodland habitat units prior to excavation of source material. Indirect loss of floral and faunal habitat is likely to occur as a result of edge effects such as alien vegetation proliferation and encroachment which may outcompete indigenous species in adjacent areas, potential erosion and a decline in faunal refugia and food resources.

Rehabilitation of the project area will be challenging due to the lack of a notable gradient (KBK, 2010). Furthermore, full rehabilitation of disturbed land within the Seringveld is not possible due to the likelihood that the characteristic geoxylic suffrutices or clonal underground trees will take many years (even centuries) to recolonise disturbed and impacted habitats (GA & SA, 2010), and due to it being extremely difficult to cultivate the slow-growing *Burkea africana*, the most prominent tree species of the region and within the project area, commercially, as a result of symbiotic relationships only available in its natural environment¹³.

Construction Phase

¹³ <http://pza.sanbi.org/burkea-africana>

- Initial clearing of vegetation during site establishment and preparing surface areas for excavation activities and stockpiling.
- Development of infrastructure and temporary infrastructure such as access roads, contractors' laydown areas and ancillary infrastructure such as generator and fuel storage areas, temporary toilets, spoil and crushing areas.
- Development of infrastructure and temporary infrastructure within areas of increased ecological sensitivity.
- Disturbance of soils leading to increased erosion, particularly on steep slopes and erosion-prone soils.
- Compaction of exposed soils due to vehicle movement.
- Littering and dumping of waste material outside of designated areas.

Operational Phase

- Ongoing excavation of source material from the quarry area and increasing development footprint areas leading to ongoing loss of vegetation and niche habitat.
- Erosion due to loss of geolytic suffrutices that play an important role in soil stabilisation in the region.
- Disturbance within the project area and surrounds due to increased human activity and operational vehicles.
- Movement of construction vehicles leading to soil compaction and excessive dust generation due to quarrying activities.
- Ongoing proliferation of alien and invasive floral species that may outcompete indigenous floral species and degrade faunal habitat.
- Altered community composition of areas within the project footprint as well as adjacent habitats due to altered ecosystem processes.
- Altered runoff patterns leading to erosion and sedimentation.
- Ineffective rehabilitation of exposed and impacted areas and failure to implement progressive backfilling, rehabilitation and revegetation according to an approved rehabilitation plan.

Table 13: Loss of Floral and Faunal Habitat - Impact Ratings

Issue	Project Phase	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Without mitigation measures							
Loss of Floral Habitat	Construction	Negative	2	5	8	5	75 Medium-High
	Operational	Negative	2	5	10	5	85 High
With mitigation measures							
Loss of Floral Habitat	Construction	Negative	2	4	8	4	56 Medium
	Operational	Negative	2	4	8	5	70 Medium - High
Mitigation and Management	<p>The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on the terrestrial ecology within the project area:</p> <ul style="list-style-type: none"> • The positioning of project infrastructure in relation to areas of increased ecological importance and sensitivity should be considered during the pre-construction and 						

	<p>planning phases of the project, to determine where and if habitat loss can be avoided within certain areas.</p> <ul style="list-style-type: none"> • No areas should be cleared of natural vegetation if not required for construction and operational purposes, and development footprint areas should be kept as small and compact as possible. The loss of indigenous vegetation should be limited where possible. • No natural areas on adjacent properties may be disturbed in any way and access roads towards the project area should follow existing roads and tracks and utilise existing access points to prevent clearing of additional areas. • Ecological connectivity within the project area and between the project area and adjacent properties should be considered and maintained where and if possible, to ensure faunal movement patterns are not completely restricted. • Where areas of increased ecological sensitivity can be avoided, these areas should be indicated on site and be off limits to construction vehicles and workers. • Vehicle access beyond the designated project footprint areas should be prohibited. • Construction camps, contractors' laydown areas and other temporary infrastructure are to be placed within areas that have already been modified where possible. • No littering or dumping of waste and construction material within natural areas beyond the project footprint areas may be allowed. • Edge effects from construction and operational activities, such as erosion and alien floral species proliferation and the spread of these within disturbed areas, should be managed throughout all the development phases through the implementation of erosion control measures where required and the implementation of an alien and invasive species control plan. • Dust suppression measures must be implemented. • Any fires made by construction workers, if unavoidable, should be restricted to designated areas, where accidental spread thereof can be avoided. • Prior to commencement of construction/ development, a rehabilitation plan for the extent of the project area and all areas impacted by the quarrying activities and associated infrastructure must be developed and approved by the relevant authorities for implementation. This rehabilitation plan should be based on the following principles: <ul style="list-style-type: none"> ○ Prior to commencement of site clearance, all available topsoil and upper soil layers containing the seed bank must be removed and stockpiled separately in such a way to prevent degradation, for use in rehabilitation (Van den Berg et al., 2011). ○ As far as possible, site restoration/ rehabilitation should take place concurrently/ progressively and as areas become available for rehabilitation. ○ When backfilling open voids, the surrounding topography needs to be considered and no surface depressions should remain post-closure. ○ The rehabilitation surface should be sloped and shaped in such a way to be free draining, to prevent erosion and to a degree which will support vegetation establishment. ○ Topsoil or suitable growing medium should be applied to the surface prior to revegetation to support vegetation growth, and the necessary soil amelioration should be undertaken. Soil analysis may be required to determine the necessary requirements. ○ Revegetation should, as a minimum, comprise direct seeding of an indigenous grass seed mixture comprising grass species recorded in the study area or species representative of the Central Sandy Bushveld vegetation type (refer to Section
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	<p>5.5 and Appendix A). The grass species mixture must comprise both pioneer and climax species, be applied at a density of at least 24kg/ ha and include at least eight grass species.</p> <ul style="list-style-type: none"> ○ It is strongly recommended that woody tree and shrub species such as <i>Senegalia (Acacia) caffra</i>, <i>Vachellia (Acacia) karroo</i>, <i>Peltophorum africana</i>, <i>Combretum molle</i>, <i>C. zeyheri</i>, <i>Diplorrhynchus condylocarpon</i>, <i>Croton gratissimus</i>, <i>Mundulea sericea</i>, <i>Gymnosporia buxifolia</i>, <i>Diospyros lycioides</i>, <i>Englerophytum magalimontanum</i> and <i>Burkea africana</i>, etc. be planted within the project area once topographical reinstatement has taken place and a growing medium has been applied. These species could be cultivated on site from seed collected from site within a shade house or temporary site nursery (if time frames will allow for this) or bought from local indigenous tree cultivators (Van den Berg et al., 2011). ○ The post-rehabilitation landscape should be capable of supporting a self-sustaining ecosystem. <ul style="list-style-type: none"> ● Any disturbed and compacted areas outside of the project footprint areas must be ripped, reprofiled and revegetated with indigenous plant species naturally growing within the area (refer to Section 5.5 and Appendix A).
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8.2 Loss of Floral Species Diversity

Loss of floral species diversity may take place during the construction and operational phases of the project as a result of the project activities outlined below.

Construction Phase

- Initial clearing of vegetation during site establishment and preparing surface areas for excavation activities and stockpiling.
- Movement of construction vehicles through areas with an increased floral diversity.
- Accidental fires due to increased human activity.
- Failure to implement alien and invasive floral species control throughout all development phases.

Operational Phase

- Ongoing excavation of source material from quarry and increasing development footprint areas leading to ongoing loss of habitat and a decrease in floral species diversity.
- Ongoing disturbance within the project area and surrounds due to increased human activity and movement of operational vehicles.
- Disturbance beyond the project footprint areas, leading to loss of habitat with increased floral diversity and species with limited representation in the region.
- Illegal harvesting of floral species with a limited representation within the project area or region.
- Accidental fires due to increased human activity.
- Dust generation from unpaved roads impacting on floral species diversity.
- Ongoing proliferation of alien and invasive floral species may outcompete certain floral species.
- Failure to undertake ongoing alien and invasive plants species management during the operational phase of the project.

Table 14: Loss of Floral Species Diversity - Impact Ratings

Issue	Project Phase	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Without mitigation measures							
Loss of Floral Species Diversity	Construction	Negative	2	5	8	4	60 Medium - High
	Operational	Negative	2	5	8	5	75 Medium - High
With mitigation measures							
Loss of Floral Species Diversity	Construction	Negative	2	4	6	4	48 Medium
	Operational	Negative	2	4	8	4	56 Medium
Mitigation and Management	<p>The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on the floral and faunal ecology within the project area:</p> <ul style="list-style-type: none"> Mitigation measures prescribed in Table 13 should be implemented. The establishment of a temporary site nursery for the purposes of cultivating tree and shrub species for use in revegetation should be considered, if time frames allow for this. 						

8.3 Loss of Floral SCC

Loss of floral SCC recorded within the project area during the field assessment may occur during both the construction and operational phases of the project as a result of the project activities outlined below.

Construction Phase

- Clearing of vegetation for construction and excavation purposes within areas of increased ecological sensitivity that are known to provide habitat for floral SCC.
- Construction of infrastructure and temporary infrastructure such as access roads and contractors' laydown areas through or within areas of increased ecological sensitivity known to provide habitat for floral SCC.
- Illegal harvesting of floral SCC and floral species with a limited representation within the project area and surrounds.
- Loss of floral species providing ecosystem goods and services (such as medicinal species) due to disturbance within and beyond the project footprint area.

Operational Phase

- Ongoing clearance of vegetation as excavation progresses and ongoing disturbance within the project area and surrounds due to increased human activity and movement of operational vehicles.
- Illegal harvesting of floral SCC and floral species with a limited representation within the project area.
- Movement of operational vehicles through areas of increased ecological sensitivity known to provide habitat for floral SCC beyond the project footprint area.

Table 15: Loss of Floral SCC - Impact Ratings

Issue	Project Phase	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Without mitigation measures							
Loss of Floral SCC	Construction	Negative	2	5	8	4	60 Medium-High
	Operational	Negative	2	5	8	5	75 Medium - High
With mitigation measures							
Loss of Floral SCC	Construction	Negative	2	4	6	3	36 Medium-Low
	Operational	Negative	2	4	6	3	36 Medium-Low
Mitigation and Management	<p>The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on the floral ecology within the project area:</p> <ul style="list-style-type: none"> • All construction and operational personnel must be educated in environmental awareness and be trained to identify floral SCC known to occur in the project area, as well as floral SCC with a high probability of occurring in the project area (refer to section 6.1.2). • The loss of floral SCC must be actively avoided and floral SCC and habitat for these species should ideally be conserved <i>in situ</i> (GDACE 2006). If this is not possible (due to the location of the resource to be extracted, the size or habit of the species), the following are applicable: <ul style="list-style-type: none"> ○ Floral SCC should be removed/ rescued from the project footprint and relocated to suitable, similar habitat in the vicinity of the project area under the supervision of a suitably qualified botanist, with prior approval from GDARD to do so. ○ According to personal communication with GDARD dated February 2020, only threatened (Red Listed) and Orange listed species indicated for the Gauteng Province (GDARD, 2017) require removal/ rescue. For Quarry 5, this includes only <i>Boophone disticha</i>, which is a bulbous species and therefore has an increased probability of being successfully relocated. GDARD indicated that relocation of floral species listed as protected in terms of the TNCO (No. 12 of 1983) but not of national or provincial conservation concern in Gauteng, is not required. ○ One protected tree species in terms of the National Forest Act (Act No. 84 of 1998), namely <i>Sclerocarya birrea</i> subsp. <i>caffra</i> was recorded approximately 50m outside of the project area boundaries, where it is recommended to remain conserved <i>in situ</i>. Although <i>S. birrea</i> subsp. <i>caffra</i> was not recorded within the project area boundaries, a possibility exists that this species may be present. Should <i>S. birrea</i> subsp. <i>caffra</i> be encountered within the project development footprint area during any of the proposed project's development phases, a permit for the removal or destruction of these species has to be obtained from the Department of Environment, Forestry and Fisheries (DEFF; previously Department of Agriculture, Forestry and Fisheries (DAFF)). ○ Should any other floral species listed as being of conservation concern in the Gauteng Province, but not recorded during the current field assessment, be encountered during any of the proposed project's development phases, these species must also be rescued and relocated, with prior approval from GDARD to do so. If the species is nationally threatened or listed a NEMBA TOPS species, a 						

	<p>permit also has to be obtained from DEFF (previously Department of Environmental Affairs (DEA)).</p> <ul style="list-style-type: none"> ○ Prior to site clearance, a description of the rescue and relocation process and procedures must be submitted to GDARD for approval. This description must also include a map of the current location of floral SCC to be relocated, a map indicating where the plants will be relocated to and details of how the long-term survival of the plants once relocated will be ensured. If approved by GDARD, the rescue and relocation procedure must be implemented. ● No harvesting of firewood or collection of floral species from natural areas surrounding the project footprint should be allowed by construction workers.
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8.4 Loss of Faunal Species Diversity and SCC

Loss of faunal species will likely take place during the construction and operational phases of the project as a result of the project activities outlined below.

Construction Phase

- Initial clearing/harvesting of vegetation during site establishment and preparing surface areas for excavation activities and stockpiling, particularly within intact faunal habitats.
- Movement of construction vehicles through sensitive faunal habitats.
- Accidental fires due to increased human activity.
- Excavations and construction activities resulting in the Inadvertent burial or mortalities (fossorial/ rupicolous species).
- Increased human presence resulting in negative faunal interactions with humans (poaching, trapping and potential collection of faunal SCC).

Operational Phase

- Ongoing excavation of source material from the quarry site and increasing development footprint areas leading to ongoing loss of habitat and faunal species diversity.
- Ongoing disturbance within the project area and surrounds due to increased human activity and movement of operational vehicles.
- Uncontrolled fires.
- Potential collection/poaching of fauna.
- Disturbance beyond the project footprint areas, leading to loss of habitat quality.

Table 16: Loss of Faunal Species Diversity and SCC - Impact Ratings

Issue	Project Phase	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Without mitigation measures							
Loss of Faunal Species	Construction	Negative	2	5	8	4	60 Medium - High
	Operational	Negative	2	5	8	5	75 Medium - High
With mitigation measures							
	Construction	Negative	2	4	6	4	48 Medium

Loss of Faunal Species	Operational	Negative	2	4	6	4	48 Medium
Mitigation and Management	<p>The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on the faunal ecology within the project area.</p> <ul style="list-style-type: none"> Mitigation measures prescribed in Table 13 should be implemented. The conservation of faunal habitat is directly linked to the reduction in faunal related impacts such as direct loss and disturbance. Site clearance of the approved footprint must utilise a phased approach to allow faunal species to disperse from the area. With regards to Quarry 5, site clearance should proceed from the centre of the site moving outwards, to allow fauna to move into adjacent habitats that will not be affected by the proposed project. All vehicles (construction or light motor vehicles) accessing the project must adhere to a 30km/hr speed limit and vigilant driving techniques. No wild animals may under any circumstance be handled or removed by construction workers. Hunting/ killing/ collection of fauna is prohibited. Any snares or traps found on or adjacent to the project area must be removed and disposed of. Should any faunal SCC be noted within the project area, quarrying activities must stop, and the relevant authorities must be notified. Input into the possible relocation of such species must be provided by a suitably qualified ecologist. Biodiversity education and awareness programmes must be implemented. This programme should form part of the staff induction in which topics such as vigilant driving techniques and the necessary procedures for working in close proximity to sensitive habitats. 						

8.5 Disturbance to Faunal Communities

Disturbance to faunal communities will occur during both the construction and operational phases of the project. Elevated levels of disturbance will likely result in local faunal species moving away from the area and a subsequent localised decline in biodiversity (as certain species are more sensitive to disturbances). This is of particular concern as the project area falls within a conservancy. Fauna occurring in adjacent habitats, outside of the direct impact zone, may also be negatively affected such as altering/ impeding movement corridors. This following project activities may lead to disturbance of faunal communities:

Construction Phase

- Initial clearing/harvesting of vegetation during site establishment and preparing surface areas for excavation activities and stockpiling, particularly within intact faunal habitats
- Construction of infrastructure and temporary infrastructure such as access roads and contractors' laydown areas through or within areas of increased ecological sensitivity.
- Increased human activity within the project area and associated construction activities.
- Use of heavy machinery and construction activities such as blasting resulting
- Potential use of artificial lighting.

Operational Phase

- Ongoing clearance of vegetation and ongoing disturbance within the project area and surrounds due to increased human activity and movement of operational vehicles, powered

machinery, noise-pollution, vibrations, excessive dust, and artificial lighting associated with operational activities.

- Movement of operational vehicles through areas of increased ecological sensitivity known to provide habitat for faunal SCC.
- Likely alteration of faunal communities to those with a higher tolerance of anthropogenically modified landscapes. This will likely result in the decline in the likelihood of SCC being present.

Table 17: Disturbance to Faunal Communities - Impact Ratings

Issue	Project Phase	Impact Rating Criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Without mitigation measures							
Disturbance to fauna	Construction	Negative	2	5	8	5	75 Medium - High
	Operational	Negative	2	5	10	5	85 High
With mitigation measures							
Disturbance to fauna	Construction	Negative	2	5	6	4	52 Medium
	Operational	Negative	2	5	8	4	60 Medium - High
Corrective Actions	<p>The following mitigation measures are proposed in order to limit or reduce the impact of the proposed project on the faunal ecology within the project area:</p> <ul style="list-style-type: none"> • Disturbance to sensitive habitats must be avoided and the project footprint must be clearly demarcated. • No wild animals may under any circumstance be handled or be interfered with by construction workers or any personnel. • Construction activities should be timed to coincide with the period when Red List bird species that could potentially occur on site are unlikely to be breeding. • In order to reduce noise pollution, proper maintenance of equipment is required, and the implementation of low noise techniques is recommended. • Any faunal species located on the site during the construction phase, which cannot relocate themselves (e.g. fossorial species), must be moved to a more suitable location. This should be undertaken by a suitable qualified ecologist/faunal specialist. • Light pollution must be kept to a minimum so as not to interfere with insect life cycles and the attraction of nocturnal vertebrates into the site. Any lighting require must be directed away from sensitive habitats. In the case of the quarry site, lighting should be directed in a north-western direction and the use of sodium vapour lights are recommended. • No dumping of waste may take place outside of the project area and any accidental spills of hazardous waste must be immediately cleaned through an appropriate and approved plan. 						

8.6 Cumulative Impacts

Cumulative impacts are those impacts from the project combined with the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity or natural resources (e.g. a number of mines in the same catchment or ecosystem type collectively affecting water quality or flow, or impacting the same endemic species)¹⁴.

The project area is located within a region where some degree of land transformation is noticeable from available aerial imagery, and the region is known to be impacted by sand mining in particular. Furthermore, the effects of poor land management and resulting direct loss of resources is likely to diminish local biodiversity, and available habitat, associated with the region over time. The proposed quarry project, when considered together with surrounding activities may contribute to the overall loss of unique floral and faunal communities associated with the region, reduce the functional extent of the Seringveld Conservancy, and lead to the direct loss of certain floral SCC and the cumulative loss of the remaining extent of the Central Sandy Bushveld vegetation type.

8.7 Residual Risks

Latent or residual impacts associated with the floral and faunal ecology of the receiving environment are likely to occur. Once vegetation is lost to site clearance, it is highly unlikely that vegetation communities and associated faunal micro-habitats will be restored, even if revegetation and rehabilitation measures are implemented once decommissioning takes place. Certain edge effects are also likely to remain over the long term. Such residual edge effects may include the proliferation and spread of alien and invasive plant species, including agricultural weeds, and erosion as a result of loss of basal cover. These all contribute to the progression towards sub-optimal habitat for fauna, particularly SCC.

¹⁴ Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria.

9 MONITORING

Terrestrial ecological monitoring should take place during both the construction/ development and operational phases of the proposed project in order to identify and address unforeseen negative impacts, and to ensure the efficacy of mitigation measures. These monitoring measures should be incorporated into the Environmental Management Programme (EMP) for the project, together with the mitigation measures proposed in this report. An independent Environmental Control Officer (ECO) should be appointed to undertake the necessary monitoring and include the findings in monthly reports submitted to the relevant authorities.

The following monitoring activities should be undertaken once off prior to commencement of construction:

- The ECO will be responsible for ensuring that floral SCC (*Boophone disticha*) are removed from the development footprint areas and relocated to suitable habitat in the vicinity of the project area, outside of the development footprint area, in line with a relocation procedure and process approved by GDARD.

The following monitoring activities should be undertaken during the construction and operational phases of the proposed project on a monthly basis:

- All development activities must be monitored to ensure that the footprint areas do not exceed approved areas.
- Natural areas surrounding the project area must be inspected to ensure that these remain in a natural state and that no clearing, dumping or excavations that may obstruct faunal movement takes place.
- Relocated floral SCC must be monitored for establishment success.
- Should the presence of any floral or faunal SCC not recorded during the current study be confirmed within the project area, rescue and relocation of these species must take place under the supervision of a suitable qualified botanist or faunal specialist and with the required permits in place if necessary, and the existing management strategy must be adapted to protect such species.

The following monitoring activities should be undertaken during the rehabilitation and post-rehabilitation phases of the proposed project according to the time frames indicated:

- It must be ensured that the approved rehabilitation plan, together with management measures indicated in the EMP, is implemented to a high standard.
- The project area and immediate surrounds must be monitored for invasive floral species monthly during the rehabilitation phase, and where encountered, these should be eradicated immediately. Once rehabilitation work has been completed, invasive species monitoring, and eradication must continue biannually (every six months) for a period of two years.
- The project area and immediate surrounds must be monitored for erosion monthly during the rehabilitation phase, and where encountered, immediate rectification must take place. Once such monitoring must continue biannually (every six months) for a period of two years.
- Where plant species have been rescued and relocated, the ECO should be responsible for monitoring the reestablishment success every six months (biannually) for a period of two years after relocation.

- Areas that have been revegetated as part of the rehabilitation process, must be monitored biannually for a period of two years once rehabilitation has been completed to ensure that adequate vegetation cover (as defined in the rehabilitation plan) has been achieved, and that no die off of re-introduced tree and shrub species take place. Where large bare areas are noted, reseeding must take place at the beginning of the following rainy season and where tree mortalities are noted, these plants must be replaced.
- It must be ensured that the post-mining landscape is self-sustaining.

10 ALTERNATIVES

One alternative relating to the project area boundary is available for the proposed project (Figure 22). The project area boundary as discussed in this report is the preferred alternative for the following reasons:

- The Alternative project area boundary is 21.6ha in extent, which is larger in extent than the preferred project area boundary and would lead to a larger area of natural habitat potentially being impacted.
- A protected tree species in terms of the National Forests Act (Act No. 84 of 1998), *Sclerocarya birrea* subsp. *caffra*, is located within the boundary of the Alternative project area, while this tree species is excluded for the preferred project area.

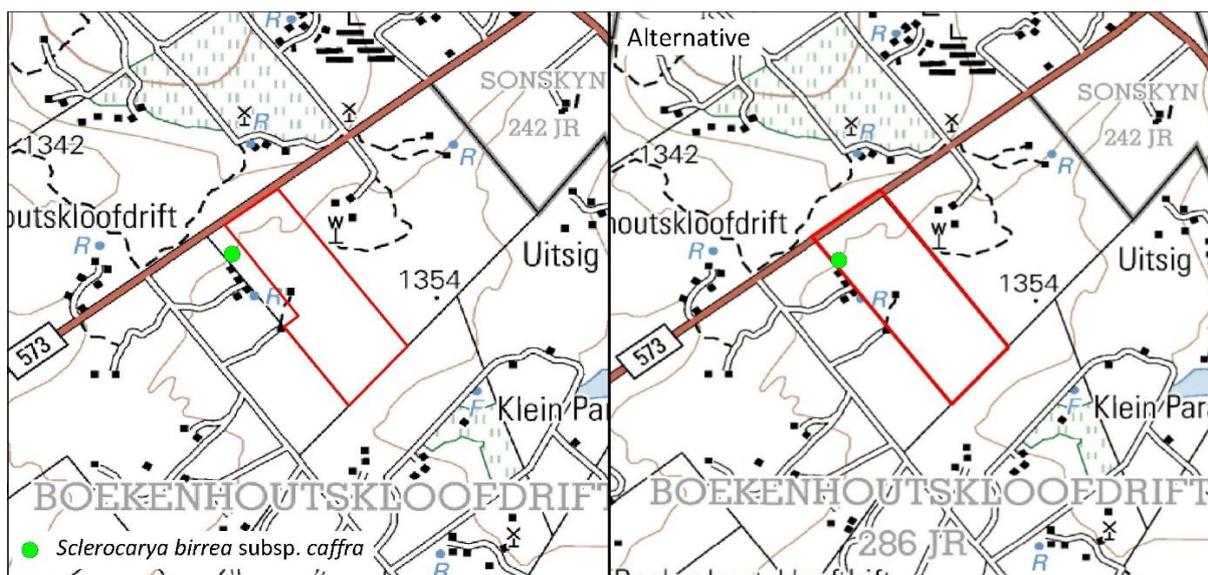


Figure 22: The preferred project area boundary, as discussed in this report (left), and the Alternative project area boundary (right)

The no-go alternative has also been considered, which would be the option of not undertaking the development of the proposed project. Should the no-go alternative be adopted, no further impacts on the floral and faunal communities within the project area, other than those impacts currently taking place, will occur.

11 CONCLUSION

As part of the terrestrial biodiversity assessment for the proposed project, both a desktop and a field assessment were undertaken. The findings of the desktop assessment indicated that the project area is not located within a listed threatened ecosystem, or within an area earmarked as being of high conservation importance in terms of the Gauteng C-Plan (2011) and the 2012 Mining and Biodiversity Guidelines. The project area is however located within a conservancy, indicated to comprise remnant vegetation in terms of the 2018 NBA, and located within the Central Sandy Bushveld vegetation type which has a Vulnerable (VU) conservation status according to Mucina & Rutherford (2006).

Based on the findings of the field assessment, it is evident that the habitat within the project area is largely intact, and that limited direct disturbances on the terrestrial ecology have taken place historically or are taking place currently. The project area predominantly comprises rocky niche habitat, and also provides habitat for several confirmed floral SCC (although no IUCN or SANBI Red Listed floral species were recorded), with an increased probability of several floral and faunal SCC to occur. A medium-high ecological sensitivity was therefore assigned to the majority of project area.

The development of the proposed quarry and associated infrastructure is likely to lead to the direct loss of existing terrestrial floral communities and faunal habitat within the extent of the project area, and it will not be possible to re-establish the terrestrial ecology to its current condition post-mining in the short to medium term, partly due to the presence of site-specific floral assemblages that have established over extended periods of time. The proposed quarry project will therefore have long term negative impacts on floral and faunal communities within the project area through complete transformation and habitat loss, with impacts possibly extending beyond the project area.

It is important that the need, desirability and importance of the proposed project, as well as the location of the resource, be taken into consideration and that the principles of integrated environmental management and sustainable development be applied in determining whether the project should proceed. Although potential impacts on the terrestrial ecology may be mitigated to some degree through careful project planning, implementing adequate and strict management measures throughout all development phases and the implementation of a high degree of rehabilitation in line with an approved rehabilitation plan, all defined impacts will remain of at least medium significance after implementation of mitigation measures.

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APPENDIX A – LIST OF FLORAL SPECIES RECORDED IN THE PROJECT AREA

Floral Species recorded within the two main habitat units within project area

* - Alien species

NFA – protected in terms of the National Forests Act (Act No. 84 of 1998)

TNCO – protected in terms of the Transvaal Nature Conservation Ordinance (No. 12 of 1983)

Declining – declining in terms of the SANBI Red List of South African plants

Species Alien: * Protected: bold	Protected/ Conservation Status	Vegetation Unit	
		<i>Burkea africana</i> bushveld on rocky slopes	Mixed (<i>Combretum</i>) Bushveld on low ridge
TREES AND SHRUBS			
<i>*Cereus jamacaru</i>	-		X
<i>*Grevillea robusta</i>	-	X	
<i>*Jacaranda mimosifolia</i>	-	X	X
<i>*Lantana camara</i>	-	X	X
<i>*Opuntia ficus-indica</i>	-		X
<i>*Solanum mauritianum</i>	-	X	
<i>Afrocanthium gilfillanii</i>	-	X	X
<i>Asparagus suaveolens</i>	-	X	X
<i>Burkea africana</i>	-	X	X
<i>Combretum apiculatum</i>	-		X
<i>Combretum molle</i>	-	X	X
<i>Combretum zeyheri</i>	-		X
<i>Croton gratissimus</i>	-	X	
<i>Cryptolepis oblongifolia</i>	-		X
<i>Diospyros lycioides</i>	-	X	
<i>Diplorrhynchus condylocarpon</i>	-	X	X
<i>Dodonaea viscosa</i> var. <i>angustifolia</i>	-	X	X
<i>Dombeya rotundifolia</i>	-		X
<i>Ehretia rigida</i>	-		X
<i>Elephantorrhiza elephantina</i>	-	X	
<i>Englerophytum magalismontanum</i>	-	X	X
<i>Faurea saligna</i>	-	X	
<i>Grewia occidentalis</i>	-	X	
<i>Grewia</i> sp.	-	X	
<i>Gymnosporia buxifolia</i>	-		X
<i>Lannea discolor</i>	-		X
<i>Lannea edulis</i>	-	X	
<i>Lopholaena coriifolia</i>	-	X	X
<i>Mundulea sericea</i>	-	X	X
<i>Ochna pulchra</i>	-	X	X
<i>Ozoroa paniculosa</i>	-		X
<i>Peltophorum africanum</i>	-		X
<i>Protea caffra</i>	TNCO	X	X
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	NFA	X	
<i>Searsia lancea</i>	-	X	
<i>Searsia leptodictya</i>	-	X	X
<i>Searsia magalismontana</i>	-	X	
<i>Searsia zeyheri</i>	-	X	
<i>Senegalia caffra</i>	-	X	X
<i>Strychnos pungens</i>	-	X	X
<i>Terminalia sericea</i>	-	X	
<i>Vangueria infausta</i>	-	X	X
<i>Vangueria parvifolia</i>	-	X	
FORBS			

Species Alien: * Protected: bold	Protected/ Conservation Status	Vegetation Unit	
		<i>Burkea africana</i> bushveld on rocky slopes	Mixed (<i>Combretum</i>) Bushveld on low ridge slopes
<i>*Acanthospermum australe</i>	-	X	
<i>*Ageratum conyzoides</i>	-		X
<i>*Bidens bipinnata</i>	-	X	X
<i>*Catharanthus roseus</i>	-	X	X
<i>*Lantana camara</i>	-	X	X
<i>*Richardia brasiliensis</i>	-	X	
<i>*Tagetes minuta</i>	-	X	X
<i>*Zinnia peruviana</i>	-	X	X
<i>Aloe greatheadii</i> var. <i>davyana</i>	-	X	X
<i>Anthospermum hispidulum</i>	-	X	
<i>Boophone disticha</i>	Declining	X	X
<i>Bulbine angustifolia</i>	-	X	
<i>Ceratotheca triloba</i>	-	X	
<i>Cleome maculata</i>	-	X	X
<i>Cleome monophylla</i>	-	X	
<i>Cleome rubella</i>	-	X	
<i>Commelina africana</i>	-	X	X
<i>Convolvulus sagittatus</i>	-	X	
<i>Crabbea acaulis</i>	-		X
<i>Cuumis zeyheri</i>	-	X	X
<i>Cyanotis speciosa</i>	-	X	
<i>Dichapetalum cymosum</i>	-	X	
<i>Fadogia homblei</i>	-	X	
<i>Felicia muricata</i>	-	X	
<i>Gladiolus</i> sp.	TNCO	X	
<i>Hebenstretia angolensis</i>	-	X	
<i>Helichrysum krausii</i>	-		X
<i>Helichrysum nudifolium</i> var. <i>nudifolium</i>	-	X	
<i>Hibiscus calyphyllus</i>	-		X
<i>Hibiscus micranthus</i>	-		X
<i>Hibiscus trionum</i>	-	X	
<i>Hilliardiella oligocephala</i>	-	X	
<i>Hypoxis acuminata</i>	-	X	
<i>Hypoxis rigidula</i>	-		X
<i>Indigofera comosa</i>	-	X	
<i>Indigofera daleoides</i>	-	X	
<i>Indigofera melanadenia</i>	-		X
<i>Ipomoea crassipes</i>	-	X	X
<i>Ipomoea magnusiana</i>	-	X	
<i>Kalanchoe paniculata</i>	-	X	
<i>Kalanchoe thyrsiflora</i>	-		X
<i>Kyphocarpa angustifolia</i>	-	X	X
<i>Lantana rugosa</i>	-		X
<i>Ledebouria</i> sp.	-		X
<i>Leonotis nepetifolia</i>	-		X
<i>Leonotis ocymifolia</i>	-	X	
<i>Limeum fenestratum</i> var. <i>fenestratum</i>	-	X	
<i>Monsonia burkeana</i>	-	X	
<i>Nidorella hottentotica</i>	-	X	
<i>Oldenlandia herbacea</i>	-	X	X
<i>Parinari capensis</i>	-	X	X
<i>Pavonia burchellii</i>	-		X

Species Alien: * Protected: bold	Protected/ Conservation Status	Vegetation Unit	
		<i>Burkea africana</i> bushveld on rocky slopes	Mixed (<i>Combretum</i>) Bushveld on low ridge
<i>Pearsonia sessilifolia</i>	-	X	
<i>Pellaea calomelanos</i>	-	X	X
<i>Pentanisia angustifolia</i>	-	X	
<i>Pentarrhinum insipidum</i>	-	X	X
<i>Phyllanthus parvulus</i>	-	X	X
<i>Pollichia campestris</i>	-		X
<i>Polycarpaea corymbosa</i>	-	X	
<i>Polydora poskeana</i>	-	X	X
<i>Portulaca kermesina</i>	-	X	X
<i>Pseudognaphalium luteo-album</i>	-	X	X
<i>Pupalia lappacea</i>	-	X	X
<i>Pygmaeothamnus zeyheri</i>	-	X	X
<i>Rhynchosia monophylla</i>	-	X	X
<i>Salacia rehmannii</i>	-	X	
<i>Searsia magalismsontana</i>	-	X	
<i>Senecio oxyriifolius</i>	-		X
<i>Senecio venosus</i>	-	X	X
<i>Sesamum triphyllum</i>	-	X	
<i>Sida cordifolia</i>	-	X	
<i>Solanum lichtensteinii</i>	-	X	X
<i>Solanum panduriforme</i>	-	X	
<i>Sphenostylis angustifolia</i>	-	X	
<i>Tephrosia elongata</i>	-	X	
<i>Viscum</i> sp.	-	X	
<i>Waltheria indica</i>	-	X	X
<i>Xenostegia tridentata</i> subsp. <i>angustifolia</i>	-	X	
<i>Xerophyta retinervis</i>	-	X	X
<i>Zornia linearis</i>	-	X	X
GRASSES			
<i>Andropogon schirensis</i>	-	X	
<i>Aristida congesta</i> subsp. <i>barbicollis</i>	-	X	X
<i>Aristida congesta</i> subsp. <i>congesta</i>	-	X	X
<i>Aristida diffusa</i>	-	X	
<i>Aristida transvaalensis</i>	-	X	X
<i>Cymbopogon caesius</i>	-	X	X
<i>Cymbopogon pospischilli</i>	-	X	X
<i>Digitaria eriantha</i>	-	X	X
<i>Diheteropogon amplexans</i>	-	X	X
<i>Elionurus muticus</i>	-	X	
<i>Eragrostis curvula</i>	-	X	X
<i>Eragrostis gummiflua</i>	-	X	
<i>Eragrostis nindensis</i>	-	X	
<i>Eragrostis racemosa</i>	-	X	
<i>Eustachys paspaloides</i>	-		X
<i>Hyparrhenia hirta</i>	-	X	X
<i>Loudetia simplex</i>	-	X	X
<i>Melinis nerviglumis</i>	-	X	
<i>Melinis repens</i>	-	X	X
<i>Panicum maximum</i>	-	X	X
<i>Perotis patens</i>	-	X	
<i>Pogonarthria squarrosa</i>	-	X	X
<i>Schizachyrium sanguineum</i>	-	X	X

Species Alien: * Protected: bold	Protected/ Conservation Status	Vegetation Unit	
		<i>Burkea africana</i> bushveld on rocky slopes	Mixed (<i>Combretum</i>) Bushveld on low ridge
<i>Setaria lindenbergiana</i>	-	X	
<i>Setaria sphacelata</i>	-	X	X
<i>Sporobolus pectinatus</i>	-	X	X
<i>Themeda triandra</i>	-	X	X
<i>Trachypogon spicatus</i>	-	X	
<i>Tristachya biseriata</i>	-	X	X
REEDS RUSHES AND SEDGES			
<i>Bulbostylis burchellii</i>	-	X	X
<i>Bulbostylis hispidula</i> subsp. <i>pyriformis</i>	-	X	X
<i>Cyperus denudatus</i>	-	X	
<i>Cyperus longus</i>	-	X	
<i>Cyperus margaritaceus</i>	-	X	X
<i>Cyperus obtusiflorus</i>	-	X	
<i>Cyperus rupestris</i>	-	X	X

APPENDIX B – FAUNAL ASSEMBLAGES

Mammalian species known from record within the 2528DA and 2528CB QDSs (MammalMAP, 2017). Mammal SCC are indicated in bold.

(LC – Least Concern; NT – Near Threatened; VU – Vulnerable; TOPS – NEMBA Threatened or Protected Species (2015))

Scientific Name	Common Name	Conservation Status	Habitat
Family: Bathyergidae			
<i>Cryptomys pretoriae</i>	Highveld Mole-rat	LC	Subterranean; typically located in clays and sandy soils in scrubland habitats.
Family: Bovidae			
<i>Aepyceros melampus melampus</i>	Impala	LC	Ecotone species associated preferring light woodland with little undergrowth and grassland.
<i>Alcelaphus buselaphus caama</i>	Red Hartebeest	LC	Open savanna and woodlands.
<i>Antidorcas marsupialis</i>	Springbok	LC	Dry grasslands and shrublands and are mixed feeders.
<i>Damaliscus pygargus phillipsi</i>	Blesbok	LC	Primarily grassland habitats and are selective feeders.
<i>Hippotragus niger niger</i>	Sable Antelope	VU, TOPS	Woodland/ grassland ecotones and are selective feeders.
<i>Kobus ellipsiprymnus ellipsiprymnus</i>	Waterbuck	LC	Restricted to well-watered habitats in dense woody vegetation of savanna woodlands and forest-savanna mosaics.
<i>Sylvicapra grimmia</i>	Common Duiker	LC	Variety of habitats with sufficient cover. Persists in anthropogenically modified habitats.
<i>Taurotragus oryx</i>	Eland	LC	Succulent and Nama Karoo biomes, as well as grasslands, Acacia savannas and woodlands.
<i>Tragelaphus strepsiceros</i>	Greater Kudu	LC	Mixed scrub woodland, Acacia, and Mopane bush on lowlands and mountains.
<i>Connochaetes taurinus taurinus</i>	Blue Wildebeest	LC, TOPS	Savanna woodland and short grasslands. Availability of shade and drinking water are essential habitat requirements.
<i>Tragelaphus angasii</i>	Nyala	LC	Dry savanna woodland and along watercourses.
<i>Raphicerus campestris</i>	Steenbok	LC	Variety of grasslands, shrublands and savanna habitats.
Family: Equidae			
<i>Equus quagga</i>	Plains Zebra	LC	Grassland plains and open grasses woodlands. Access to water vital.
Family: Giraffidae			
<i>Giraffa camelopardalis giraffa</i>	Giraffe	LC	<i>Acacia</i> savanna/ woodland and open woodland.
Family: Canidae			
<i>Canis mesomelas</i>	Black-backed Jackal	LC	Wide habitat tolerance including savanna, shrubland and grasslands. Prefers drier habitats.

Scientific Name	Common Name	Conservation Status	Habitat
Family: Hyaenidae			
<i>Parahyaena brunnea</i>	Brown Hyaena	NT, TOPS	Desert, semi-desert, open scrub and open woodland savanna.
<i>Proteles cristata</i>	Aardwolf	LC	Wide habitat tolerance. Preference for open habitats, requires termites as food source.
Family: Felidae			
<i>Felis nigripes</i>	Black-footed Cat	VU, TOPS	Open, short grass areas in dry, open savanna, grasslands and Karoo semi-desert with sparse shrub and tree cover. Uses abandoned termite mounds
<i>Panthera pardus</i>	Leopard	VU, TOPS	Wide habitat tolerance. Preference for well-wooded habitats
<i>Caracal caracal</i>	Caracal	LC	Wide habitat tolerance. Open savanna, scrubland, moist woodland and evergreen forest
<i>Felis silvestris</i>	African Wild Cat	LC	Wide habitat tolerance.
Family: Herpestidae			
<i>Cynictis penicillata</i>	Yellow Mongoose	LC	Variety of habitats, savanna, shrubland, grassland and arid environments.
<i>Herpestes sanguineus</i>	Slender Mongoose	LC	Forest to open Savanna, as long as there is suitable cover. Can persist in urban areas.
<i>Mungos mungo</i>	Banded Mongoose	LC	Wide habitat tolerance, preference for woodland habitats.
<i>Atilax paludinosus</i>	Water Mongoose	LC	Well-watered areas along rivers, streams, marshes and swamps.
Family: Hystricidae			
<i>Hystrix africae australis</i>	Cape Porcupine	LC	Wide habitat tolerance occurring in cultivated/greenfield areas and within urban landscapes.
Family: Macroscelididae			
<i>Elephantulus myurus</i>	Eastern Rock Elephant Shrew	LC	Rocky outcrops or koppies with sufficient cracks and holes for shelter and nesting sites.
<i>Elephantulus edwardii</i>	Cape Elephant Shrew	LC	Rocky habitats, often with many large boulders and many crevices.
Family: Muridae			
<i>Aethomys ineptus</i>	Tete Veld Rat	LC	Savanna/ woodland habitats where there is abundant ground cover in the form of grass and rocks.
<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	LC	Wide range of habitats but requires rocky areas.
<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	LC	Variety of habitats, including bushveld and grasslands, may occur in transformed habitats.
<i>Gerbilliscus brantsii</i>	Highveld Gerbil	LC	Wooded grassland with sufficient cover.
<i>Lemniscomys rosalia</i>	Single-striped Grass Mouse	LC	Wide range of savanna habitats.

Scientific Name	Common Name	Conservation Status	Habitat
<i>Mastomys coucha</i>	Southern African Mastomys	LC	Wide habitat tolerance.
<i>Mastomys natalensis</i>	Natal Multimammate Mouse	LC	Cosmopolitan with a wide habitat tolerance.
<i>Otomys angoniensis</i>	Angoni Vlei Rat	LC	Well-watered savanna grassland, seasonally flooded grassland and wetlands.
<i>Otomys auratus</i>	Vlei Rat	NT	Mesic grasslands and wetlands within alpine, montane, sub-montane regions.
<i>Rhabdomys sp.</i>	Xeric Four-striped Mouse	LC	Widespread habitat. Only consistent requirement appears to be presence of grass.
<i>Thallomys paedulcus</i>	Tree Rat	LC	Arboreal using <i>Acacia</i> bushveld.
<i>Dasymys incomtus</i>	African Marsh Rat	NT	Forest and savanna, swampland and grasslands, but they rely on intact wetlands.
<i>Mus minutoides</i>	Pygmy Mouse	LC	Habitat generalist preferring grasslands also found in including savanna and fynbos.
<i>Rattus rattus</i>	House Rat	LC	Introduced. Often around human settlements.
<i>Saccostomus campestris</i>	Pouched Mouse	LC	Generalist that inhabits savanna woodland areas.
<i>Steatomys pratensis</i>	Fat Mouse	LC	Open grasslands and savannas.
Family: Gliridae			
<i>Graphiurus murinus</i>	Forest African Dormouse	LC	Woodland, savanna, grassland and rocky areas.
<i>Graphiurus platyops</i>	Rock Dormouse	LC	Rocky terrain such as granite outcrops, rock crevices and boulder piles.
Family: Soricidae			
<i>Crocidura mariquensis</i>	Swamp Musk Shrew	NT	Close to open water with intact riverine and semi-aquatic vegetation/inundated grasslands.
<i>Crocidura cyanea</i>	Reddish-gray Musk Shrew	LC	Rocks, dense scrub, grasslands and montane forest moist habitats, degraded areas and gardens.
<i>Crocidura hirta</i>	Lesser Red Musk Shrew	LC	Grassland, savanna, scrublands and gardens with moist habitats along streams and wetlands.
<i>Crocidura maquassiensis</i>	Maquassie Musk Shrew	VU	Limited ecological data available. Specimens collected in rocky or montane grassland.
<i>Crocidura silacea</i>	Lesser Grey-brown Musk Shrew	LC	Montane evergreen forest, savanna woodland, bushveld, grassland and coastal forest.
<i>Myosorex varius</i>	Forest Shrew	LC	Variety of habitats in both primary and degraded states.

Scientific Name	Common Name	Conservation Status	Habitat
<i>Suncus lixus</i>	Greater Dwarf Shrew	LC	Broad range of habitats.
Family: Suidae			
<i>Phacochoerus africanus</i>	Common Warthog	LC	Open habitats as well as lightly wooded savanna habitats.
Family: Vespertilionidae			
<i>Scotophilus dinganii</i>	Yellow-bellied House Bat	LC	Vvariety of Habitats but predominantly dry and moist woodland savanna.
<i>Neoromicia capensis</i>	Cape Serotine Bat	LC	Wide range of environmental conditions from arid semi-desert areas to montane grasslands.
Family: Emballonuridae			
<i>Taphozous mauritanus</i>	Mauritian Tomb Bat	LC	Variety of savanna woodlands, preferring open habitats and avoiding closed forest interior.
Family: Erinaceidae			
<i>Atelerix frontalis</i>	Southern African Hedgehog	NT	Scrub brush, grasslands and suburban gardens. Require ample cover and insect food resources.
Family: Galagidae			
<i>Galago moholi</i>	Southern Lesser Galago	LC	Arboreal. Bushveld and woodland habitats.
Family: Mustelidae			
<i>Ictonyx striatus</i>	Striped Polecat	LC	Open grassland, savanna woodland, thorn bush, rocky habitats and agricultural areas.
<i>Mellivora capensis</i>	Honey Badger	LC, CITES III, TOPS	Variety of habitat types but generally absent from the more open and central Grassland and Nama Karoo biomes.
Family: Nesomyidae			
<i>Dendromus mystacalis</i>	Chestnut African Climbing mouse	LC	Grassland and savanna mosaic habitats, where it prefers tall, rank grassland, riparian forests.
<i>Mystromys albicaudatus</i>	White-tailed Rat	VU	Often associated with calcrete soils within grasslands.
<i>Saccostomus campestris</i>	Pouched Mouse	LC	Generalist that inhabits savanna woodland areas.
<i>Steatomys pratensis</i>	Common African Fat Mouse	LC	Sandy substrates in range of habitats such as wooded grassland and moist savanna.
Family: Orycteropodidae			
<i>Orycteropus afer</i>	Aardvark	LC (TOPS, CITES II)	Broad range of habitats including open savanna, shrubland, grassland and thickets.

Scientific Name	Common Name	Conservation Status	Habitat
Family: Leporidae			
<i>Lepus saxatilis</i>	Scrub Hare	LC	Woodland, savanna and grassland with sufficient cover. Commonly seen in cultivated areas.
<i>Pronolagus randensis</i>	Jameson's Red Rock Rabbit	LC	Rocky areas, kranzes, hillsides and koppies.
Family: Procaviidae			
<i>Procavia capensis</i>	Rock Hyrax	LC	Wide range of habitats. Mainly Rocky outcrops, cliffs, or piles of boulders with bushes.

Amphibian species known from record within the 2528DA and 2528CB QDSs (FrogMAP). Amphibian SCC are indicated in bold.

(LC – Least Concern; NT – Near Threatened)

Scientific Name	Common Name	Conservation Status	Habitat
Family: Bufonidae			
<i>Sclerophrys capensis</i>	Raucous Toad	LC	Rivers and streams in grassland and fynbos. Frequently in gardens and farmland.
<i>Sclerophrys gutturalis</i>	Guttural Toad	LC	Open pools, dams, vleis and other semi-permanent or permanent water bodies.
<i>Sclerophrys poweri</i>	Power's Toad	LC	Thornveld and open savanna.
<i>Schismaderma carens</i>	Red Toad	LC	Savanna and woodland, readily adapting to human habitation.
<i>Sclerophrys garmani</i>	Olive Toad	LC	Vleis and pans in bushveld savanna where there is relatively high rainfall (more than 600mm).
<i>Poyntonophrynus fenoulheti</i>	Northern Pygmy Toad	LC	Variety of bushveld habitats, adjacent grassland and rocky outcrops.
Family: Ptychadenidae			
<i>Ptychadena oxyrhynchus</i>	Sharpnosed Grass Frog	LC	Moist open savanna and woodland habitat. Breeds in pools in rock outcrops, roadside pools, vleis and pans.
<i>Ptychadena anchietae</i>	Plain Grass Frog	LC	Savanna, open country in woodland, grassland and urban landscapes.
<i>Ptychadena porosissima</i>	Striped Grass Frog	LC	Close association to water, moist depressions and seepage areas and occasionally along streams.
Family: Phrynobatrachidae			
<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	LC	Margins of permanent and temporary water bodies including shallow marshes, rivers and ponds.
Family: Pyxicephalidae			
<i>Amietia delalandii</i>	Common River Frog	LC	Banks of slow-moving streams/ permanent bodies of water in a wide variety of wetland habitats.
<i>Cacosternum boettgeri</i>	Boettger's Caco	LC	Variety of habitats in Nama Karoo, succulent Karoo, grassland and thickets.
<i>Pyxicephalus adspersus</i>	Giant Bull Frog	NT	Open grassland habitats with ephemeral pans for breeding and clayey or sandy soil for aestivation.
<i>Tomopterna natalensis</i>	Natal Sand Frog	LC	Variety of habitats in savanna and grassland; breeds in shallow permanent furrows/ streams.
<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	LC	Various savanna and grassland habitats with standing water at the edges of dams and pans.
<i>Strongylopus fasciatus</i>	Striped Stream Frog	LC	Variety of habitat types and shows a strong association to water bodies.
<i>Strongylopus grayii</i>	Clicking Stream Frog	LC	Variety of savanna and grassland habitats.
Family: Hyperoliidae			
<i>Hyperolius marmoratus</i>	Painted Reed Frog	LC	Reeds and vegetation at the edge of waterbodies in savanna, grassland and forest habitats.
<i>Kassina senegalensis</i>	Bubbling Kassina	LC	Grassland around vleis and pans. Breeds in temporary and permanent water bodies.
<i>Semnodactylus wealii</i>	Rattling Frog	LC	Well vegetated areas surrounding pans and vleis in grasslands.

Scientific Name	Common Name	Conservation Status	Habitat
Family: Pipidae			
<i>Xenopus laevis</i>	Common Platanna	LC	Restricted to aquatic habitats but opportunistic and can be found in any form of wetland.
Family: Microhylidae			
<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	LC	Bushveld habitats and breeds in temporary pans and pools and flooded grassland.
Family: Brevicipitidae			
<i>Breviceps adpersus</i>	Bushveld Rain Frog	LC	Sandy to sandy-loam soils in semi-arid habitats in savanna and grassland habitats.
Family: Hemisotidae			
<i>Hemisus marmoratus</i>	Mottled Shovel-nosed Frog	LC	Bushveld habitats, breeding in pans, waterholes and artificial impoundments. <i>H. marmoratus</i> record within the 2528CB QDS is an outlying record may represent an accidental translocation.

Reptile species known from record within the 2528DA and 2528CB QDS (SARCA; Bates et al., 2014). Reptile SCC are indicated in bold.

(LC – Least Concern; NT – Near Threatened; TOPS – NEMBA Threatened or Protected Species (2015))

Scientific Name	Common Name	Conservation Status	Habitat
Family: Chameleonidae			
<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	LC	Variety of habitats usually found high up in bushes and trees.
Family: Agamidae			
<i>Acanthocercus atricollis</i>	Southern Tree Agama	LC	Typically associated with large trees, but sometimes found among rocks.
<i>Agama aculeata distanti</i>	Distant's Ground Agama	LC Endemic	Grassland and woody habitats, and partially in rocky areas.
<i>Agama atra</i>	Southern Rock Agama	LC Near-Endemic	Rocky habitats.
Family: Gekkonidae			
<i>Lygodactylus capensis capensis</i>	Common Dwarf Gecko	LC	Savanna habitats but adapts readily to urban environments.
<i>Lygodactylus nigropunctatus</i>	Black-spotted Dwarf Gecko	LC Endemic	Rocky outcrops in savanna habitat.
<i>Pachydactylus affinis</i>	Transvaal Thick-tailed Gecko	LC Endemic	Rocky outcrops and moribund termitaria.
<i>Pachydactylus capensis</i>	Cape Gecko	LC	Wide range of habitats with suitable refugia.
<i>Chondrodactylus turneri</i>	Turner's Gecko	LC	Rocky outcrops in savanna habitats.
<i>Hemidactylus mabouia</i>	Tropical House Gecko	LC	Variety of habitats, close association with anthropogenic landscapes.
Family: Lacertidae			
<i>Nucras holubi</i>	Holub's Sandveld Lizard	LC	Broken, rocky terrain in mesic savanna. Shelters in burrows in the ground or under rocks.
<i>Nucras intertexta</i>	Spotted Sandveld Lizard	LC	Sandy substrates in arid savanna and open scrubland.
<i>Ichnotropis capensis</i>	Ornate Rough-scaled Lizard	LC	Sandy areas with open vegetation.
<i>Meroles squamulosus</i>	Common Rough-scaled Lizard	LC	Sandy soils in both mesic and arid savanna.
<i>Nucras ornata</i>	Ornate Sandveld Lizard	LC	Grass tussocks and leaf litter on rocky hillsides.
<i>Pedioplanis lineocellata</i>	Spotted Sand Lizard	LC	Dry, open habitats.

Scientific Name	Common Name	Conservation Status	Habitat
<i>Pedioplanis lineoocellata pulchella</i>	Common Sand Lizard	LC Near- Endemic	Variety of habitats, generally associated with rocky areas.
Family: Gerrhosauridae			
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	LC	Variety of grassland, savanna and fynbos habitat. Shelters in bushes and under rocks.
Family: Lamprophiidae			
<i>Aparallactus capensis</i>	Black-headed Centipede-eater	LC	Variety of habitats. Partially fossorial, with an affinity for old termitaria.
<i>Atractaspis bibronii</i>	Bibron's Stiletto Snake	LC	Fossorial found in termitaria or on soil under logs or rocks, in a variety of habitat type.
<i>Atractaspis duerdeni</i>	Duerden's Stiletto Snake	LC	Fossorial snake that inhabits sandy soil. Poorly studied.
<i>Homoroselaps dorsalis</i>	Striped Harlequin Snake	NT Endemic	Partially fossorial and known to inhabit old termitaria in grassland habitats.
<i>Amblyodipsas polylepis polylepis</i>	Common Purple-glossed Snake	LC	Fossorial in a variety of habitats.
<i>Lycodonomorphus rufulus</i>	Brown Water Snake	LC	Aquatic habitats such as dams, streams and rivers.
<i>Pseudaspis cana</i>	Mole Snake	LC	Common in sand, scrub-covered areas and in grassland where it spends most of its time in disused animal burrows.
<i>Boaedon capensis</i>	Brown House Snake	LC	Wide range of terrestrial habitats and tolerant to considerable habitat transformation.
<i>Lamprophis aurora</i>	Aurora House Snake	LC Endemic	Grassland, fynbos and moist savanna habitats.
<i>Lycophidion capense capense</i>	Cape Wolf Snake	LC	Under rocks and logs or in old termitaria.
<i>Prosymna sundevallii</i>	Sundevall's Shovel-snout	LC Near-Endemic	Moist and dry savanna and karroid areas. Shelters in old termitaria and under rocks.
<i>Prosymna bivittata</i>	Two-striped Shovel-snout	LC	Moist and dry savanna. Shelters under logs and rocks.
<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	LC	Grassland and savanna habitats. Shelters in holes in the ground, under rocks and in old termitaria.
<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	LC	Savanna habitats sheltering under rocks and in old termitaria.
<i>Limaformosa capensis</i>	Common File Snake	LC	Savanna habitats sheltering under rocks and in old termitaria.
<i>Psammophis angolensis</i>	Dwarf Sand Snake	LC	Savanna habitats, sheltering under stones.

Scientific Name	Common Name	Conservation Status	Habitat
Family: Pelomedusidae			
<i>Pelomedusa subrufa</i>	Marsh Terrapin	LC	Fresh or stagnant waterbodies, seasonal pans and farm dams.
<i>Pelusios sinuatus</i>	Serrated Hinged Terrapin	LC	Fresh or stagnant waterbodies.
Family: Colubridae			
<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	LC	Damp areas in fynbos, lowland forest, moist savanna and grasslands.
<i>Philothamnus semivariiegatus</i>	Spotted Bush Snake	LC	Moist savanna, lowland forest and riverbanks as well as vegetated rocky areas.
<i>Philothamnus natalensis</i>	Western Natal Green Snake	LC Endemic	Lowland forest, wooded grassland and forest edge often near water.
<i>Dasypeltis scabra</i>	Rhombic Egg-eater	LC	Variety of habitats, sheltering in moribund termitaria, under rocks and crevices.
<i>Dispholidus typus typus</i>	Boomslang	LC	Arboreal in a variety of habitats.
<i>Thelotornis capensis capensis</i>	Southern Twig Snake	LC	Trees and shrubs in savanna habitats.
<i>Telescopus semiannulatus semiannulatus</i>	Eastern Tiger Snake	LC	Arid and moist savanna, sheltering under bark and in rock crevices.
Family: Cordylidae			
<i>Cordylus vittifer</i>	Common Girdled Lizard	LC Near Endemic	Occurs in rock outcrops in grassland and savanna habitat.
<i>Chamaesaura aenea</i>	Coppery Grass Lizard	NT Endemic	Grassy slopes and plateau.
Family: Scincidae			
<i>Trachylepis punctatissima</i>	Speckled Rock Skink	LC	Rocky outcrops and trees in savanna and grassland systems.
<i>Trachylepis varia</i>	Variable Skink	LC	Open rocky habitats in montane grasslands, savanna and coastal scrub.
<i>Panaspis wahlbergi</i>	Wahlberg's Snake-eyed Skink	LC	Variety of habitats ranging from rocky outcrops to open Highveld grasslands. Shelters in leaf litter.
<i>Acontias occidentalis</i>	Savanna Legless Skink	LC	Fossorial, found in soil under leaf litter.
<i>Mochlus sundevallii</i>	Sundevall's Writhing Skink	LC	Fossorial. Found in arid, sandy habitats, usually under logs, rocks or leaf litter.
<i>Trachylepis capensis</i>	Cape Skink	LC	Wide variety of habitats.
Family: Leptotyphlopidae			

Scientific Name	Common Name	Conservation Status	Habitat
<i>Leptotyphlops incognitus</i>	Incognito Thread Snake	LC	Mesic environments, under rocks and rotting logs.
<i>Leptotyphlops scutifrons scutifrons</i>	Peters' Thread Snake	LC	Subterranean in habits and found in a wide variety of soil types.
<i>Leptotyphlops distanti</i>	Distant's Thread Snake	LC Near Endemic	Mesic habitats, found under logs and stones and among the roots of grasses.
Family: Varanidae			
<i>Varanus niloticus</i>	Water Monitor	LC	Close to water sources including rivers, pans and major lakes
<i>Varanus albigularis albigularis</i>	Rock Monitor	LC	Savannas and arid areas. Affinity for rocky areas
Family: Testudinidae			
<i>Kinixys spekii</i>	Speke's Hinged Tortoise	LC	Occurs in subtropical savanna, mixed bushveld and thornveld habitats.
<i>Stigmochelys pardalis</i>	Leopard Tortoise	LC	Wide variety of habitats with most habitats containing sweet, palatable grasses
<i>Kinixys lobatsiana</i>	Lobatse Hinged Tortoise	LC Near Endemic	Savanna, bushveld and thornveld habitats. Prefers rocky habitats and ridges
Family: Elapidae			
<i>Naja mossambica</i>	Mozambique Spitting Cobra	LC	Lowland forests and moist savanna. Shelters in holes in the ground, rock crevices and under rocks
<i>Naja annulifera</i>	Snouted Cobra	LC	Savana habitats, shelters in holes in the ground, old termite mounds and rocky outcrops
<i>Dendroaspis polylepis</i>	Black Mamba	LC	Variety of habitats especially rocky hillsides and outcrops. Shelters in rock crevices and under logs
<i>Hemachatus haemachatus</i>	Rinkhals	LC Near Endemic	Open grasslands, rocky outcrops and wetland margins
Family: Viperidae			
<i>Causus rhombeatus</i>	Rhombic Night Adder	LC	Mesic habitats usually near water
<i>Bitis arietans arietans</i>	Puff Adder	LC	Wide habitat preference but absent from alpine habitats, dense forests and true deserts
Family: Pythonidae			
<i>Python natalensis</i>	Southern African Python	LC, TOPS	Variety of habitats but usually in riverine or rocky areas, and often in association with large animal burrows.
Family: Typhlopidae			

Scientific Name	Common Name	Conservation Status	Habitat
<i>Afrotrophlops bibronii</i>	Bibron's Blind Snake	LC Near Endemic	Burrows in loose soil and found in old termitaria, in soils under rocks and rotting logs.
<i>Rhinotyphlops lalandei</i>	Delalande's Beaked Blind Snake	LC	Fossorial found under rocks and rotting logs and in moribund termitaria.

APPENDIX C – CURRICULUM VITAE OF SPECIALISTS

CURRICULUM VITAE – MICHELLE PRETORIUS

Personal Details

Identity Number: 8210050124087

Telephone Number: 0824427637

Marital Status: Married

Drivers Licence Code: 08

Languages: English, Afrikaans

Academic qualifications

MSc (Environmental Ecology) – University of Pretoria	in progress
BSc (Hons) Plant Science Cum Laude – University of Pretoria	2008
BSc (Landscape Architecture) – University of Pretoria	2006
BSc (Botany) – University of Pretoria	2003

Professional Membership

Professional Natural Scientist (Ecological and Botanical Science) - South African Council for Natural Scientific Professions (SACNASP) Registration number: 400003/15.

Professional Landscape Architectural Technologist - South African Council for the Landscape Architectural Profession (SACLAP) Registration number: 20253

Member of the Botanical Society of South Africa (BotSoc) since 2011

Member of the Grassland Society of southern Africa (GSSA) since 2018

Member of the Land Rehabilitation Society of southern Africa (LaRSSA) since 2018

Snapshot of Project Experience - Flora

- Floral Assessment as Part of the Environmental Authorisation Process for the Proposed Bryanston Ext. 3B Housing Project Located in the City of Johannesburg Metropolitan Municipality, Gauteng Province (2020).
- Floral Assessment as Part of the Environmental Assessment Process for the Proposed Bryanston Ext. 3C Housing Project Located in the City of Johannesburg Metropolitan Municipality, Gauteng Province (2020).
- Terrestrial Biodiversity Assessment as Part of the Environmental Assessment Process for the Extension of the South African Nuclear Energy Corporation (NECSA) Pipe Storage Facility, North West Province (2020).
- Floral Assessment as Part of the Environmental Authorisation Process for the Proposed Rietfontein Housing Project Located in the City of Johannesburg, Gauteng Province (2020).
- Vegetation assessment for the proposed subdivision and development of residential units on Portion 551 (a portion of Portion 43) of the Farm Witpoort 406JR, Gauteng province (2019).
- Floral ecological assessment as part of the Environmental Impact Assessment Process for the proposed Driefontein Mining Project near Middelburg, Mpumalanga Province (2019).

- Floral ecological assessment for the proposed Lower Maguga Hydropower Project, Kingdom of Eswatini (2019).
- Floral biodiversity assessment for the proposed R573 road upgrade: Baviaanspoort Road to Stormvoël Road, City of Tshwane, Gauteng Province (2019).
- Floral species diversity assessment report for Vele Colliery, located in the Vhembe District, Mucina Local Municipality, Limpopo Province (2019).
- Floral Species of Conservation Concern Assessment for the Proposed Development of Distance Measuring Equipment for the O.R. Tambo International Airport Terminal Manoeuvring Area, Gauteng Province – FAOR3 (Magaliesberg) (2018).
- Floral Species of Conservation Concern assessment for the proposed development of distance measuring equipment for the O.R. Tambo International Airport Terminal Manoeuvring Area, Gauteng Province – FOAR 3: Magaliesberg and FASJ 4: Donkerhoek (2018).
- Vegetation assessment for the proposed Wildealskloof mixed-use development, Mangaung Local Municipality, Bloemfontein, Free State Province (2018).
- Proposed Mixed-Use Development on Part of Portion 29 of the Farm Hatherley No. 331 – JR, City of Tshwane, Gauteng Province Vegetation Assessment (2018).
- Eco-Conditional Requirements (Eco-0) Assessment for Green Star South Africa Rating Purposes, of an Office Building at the VSAD Reatile Bulk Petroleum Products Storage and Distribution Facility, Heidelberg, Gauteng Province (2018).
- Floral Species of Conservation Concern rescue and relocation plan for the proposed outfall sewer line from German Development to Eastdene, Middelburg, Mpumalanga (2018).
- Vegetation assessment for the proposed construction of the Thusanang Powerline and Substations in Westonaria, Gauteng Province (2017).
- Wetland rehabilitation and management plan for the proposed Hyde Park Country Estate, near KwaDukuzu (Stanger), KwaZulu-Natal Province (2017).

CURRICULUM VITAE – CRAIG WIDDOWS

Personal Details

Identity Number: 8810235028085

Telephone Number: 0837818725

Marital Status: Married

Drivers Licence Code: 08

Languages: English

Academic qualifications

PhD (Ecology) – University of KwaZulu-Natal	2016
MSc (Ecology) – University of KwaZulu-Natal	2014
BSc (Biological Sciences) Cum Laude – University of KwaZulu-Natal	2012
BSc (Biological Sciences) – University of KwaZulu-Natal	2011

Professional Membership

Professional Natural Scientist (Ecology and Zoology) - South African Council for Natural Scientific Professions (SACNASP) Registration number: 117852.

Member of the South African Wetland Society (Membership No. KE9AJ0J4)

Member of the Herpetological Association of Africa (Membership No. AF 025)

Member of the Zoological Society of Southern Africa (Membership No. 199)

Member of the Field Guides Association of Southern Africa (Membership No. 22691)

Snapshot of Project Experience - Fauna

- Nkomati Nickle Mine, Mpumalanga. Terrestrial and Aquatic Biodiversity Baseline Assessment. (2020).
- Biodiversity assessment as part of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Section 24G retroactive environmental authorisation process for the unlawful construction of a dam on the Farm South Downs No. 17934. Biodiversity Assessment (2019).
- Pongola Substation Battery Energy Storage System, Zululand District Municipality, KwaZulu-Natal. Biodiversity Assessment (2019).
- Proposed Bhokwe Community Sanitation Project, Abaqulusi Local Municipality, KwaZulu-Natal: Biodiversity Assessment (2019).
- Proposed Zwelibomvu Pipeline Project, eThekweni Metropolitan Municipality: Preliminary Ecological Assessment (2019).
- Subdivision and Rezoning of Erf 15990, Ladysmith Township, KwaZulu-Natal. Ecological and Wetland Assessment (2019).
- Proposed upgrade and construction activities outside of the National Route 2 Wild Coast Toll Highway road reserve. Eastern Cape: Faunal Assessment (2019).
- Faunal ecological assessment for the proposed Lower Maguga Hydropower Project, Kingdom of Eswatini (2019).
- Proposed construction of a dam and irrigation pipeline on the farm compensation, within the Matatiele Local Municipality, Eastern Cape: Ecological Assessment (2018).
- Rezoning for Portion 204 (of 184) of the Farm Mt. Albert No. 2074 in Pennington, Umdoni Municipality: Ecological Sensitivity Assessment (2018).
- Mulberry Park, eThekweni Metropolitan Municipality: Ecological Sensitivity Assessment (2018).
- Proposed Khoto Residential Development, eThekweni Metropolitan Municipality, KwaZulu-Natal: Ecological Sensitivity Assessment (2017).
- Elandspruit Colliery Mining Pan Amendment Plan, Middleburg: Ecological Assessment (2017).
- Ayesha Avenue internal access road and residential parking lot development, eThekweni Metropolitan Municipality, KwaZulu-Natal: Faunal Assessment (2015).
- PeaceValley III Road Upgrade Project, uMsunduzi Local municipality: Faunal and Vegetation Assessment (2015).
- Proposed development of the Eskom Agulhas 400/132Kv 2x500 MVA Transmission Substation and loop-in loop-out lines, Swellendam Local Municipality, Western Cape Province: Avifaunal Assessment (2015).