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TERRESTRIAL BIODIVERSITY IMPACT ASSESSMENT FOR THE PROPOSED STORMWATER MANAGEMENT PROJECT FOR DE BEERS CONSOLIDATED MINES LIMITED – VENETIA MINE, THAT IS SITUATED NEAR ALLDAYS IN THE LIMPOPO PROVINCE

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SECTION A: EXECUTIVE SUMMARIES

Venetia Mine has a holistic water management programme that incorporates various deliverables, including a Storm Water Management Project, which is currently at a pre-feasibility stage. Although the mine is the holder of various licences and authorisations, licensing of the proposed SWMP facilities and related activities requires an Integrated Regulatory Process (IRP) including both an application for an Integrated Water Use Licence (IWUL) in terms of the National Water Act (NWA, Act 36 of 1998) as well as an application for an Environmental Authorisation (EA) in terms of Listing Notice 2 of the Environmental Impact assessment as promulgated under the National Environmental Management Act (NEMA, Act 107 of 1998).

To establish the faunal and botanical importance and inherent (ecological) sensitivity of the receiving environment, as well as determining the potential presence of conservation important plant and animal species within the respective sites, Pachnoda Consulting (terrestrial fauna and avifauna) and BEC (vegetation) was requested to conduct a concise ecological assessment of the proposed development sites and immediate surrounds. Towards this objective, a suitable site investigation was conducted on the 19th to 23rd April 2021 during which qualitative evaluations and observations were compiled. Climatic and environmental conditions were optimal to establish the nature of the site and no survey limitations were identified, although no austral winter surveys were conducted for this assessment.

1 BIOPHYSICAL ENVIRONMENT & REGIONAL SENSITIVITIES

The following local and regional biophysical aspects are relevant to the nature, diversity and status of the terrestrial biodiversity and ecological habitats that characterize the site and immediate surrounds:

⇒ Low regional and local transformation levels provide insight into the rural nature of the larger region.

⇒ Apart from the Venetia Mine that represents the most significant industrial development of the municipality and the larger region, much of the immediate surrounds comprise untransformed and natural woodland.

⇒ The low transformation levels of the natural vegetation is also a reflection of low population numbers from a local and regional perspective.

⇒ The geology of the general region is comparatively complex, but primarily comprise Gumbu Group marbles, silicates rock and gneisses of the Swazian Erathem.

⇒ Land types represented within the Venetia Mine boundary include Ae307, Ah 104, Db218, Fc621, and Fc622.

⇒ Musina Local Municipality lies in a summer rainfall region and has a warm climate, described by the Köppen Climate Classification subtype for the climate of the immediate region as "BSh" (Hot semi-arid (steppe) climate), which tend to be characterised by extremely variable temperature conditions

⇒ Temperatures range between an average minimum in July of 9°C to and an average maximum of 31°C between October and December, although January to March is also characterised by an average maximum of 30°C.

⇒ Rainfall in the region is unpredictable and spatially and temporally erratic, as well as highly seasonal with the largest extent of the precipitation received between the months of November and March. An annual average precipitation of approximately 365 mm is indicated.

⇒ The topography of the region is typified as 'Slightly Irregular Plains', with slopes ranging between 0 and 9 %, generally sloping in a northwestern direction. Numerous small topographic variations are noted from the presence of drainage lines and elevated crests.

⇒ The study area is drained mainly by surface run-off that concentrates in small non-perennial streams, draining in a northern direction, eventually into the Limpopo River.

⇒ The Kolope and Matotwane Rivers are situated on the western and eastern perimeter of the Venetia Mine perimeter, respectively. Smaller watercourses and non-perennial drainage lines from the site feed into these systems.

⇒ Surface drainage within the Venetia Mine property has been heavily modified as a result of infrastructure developments.

A review of available information sources indicates the following local and regional (terrestrial biodiversity and ecology) conservation categories ascribed to the wider study area:

⇒ The proposed development sites are situated, mostly, within the Venetia Mine perimeter, which is situated within the Venetia Limpopo Nature Reserve.

⇒ Venetia Mine is situated approximately 20 km south of the Mapungubwe National Park, which represents the nearest declared conservation area. The mine does however form part of the Venetia Limpopo Nature Reserve and, although not having a declared status, impacts that result in deterioration, or losses, of natural habitat within this conservation area, are considered significant.

⇒ The National List of Threatened Ecosystems (2011) information source indicates that the study sites are not situated in proximity to any of the threatened ecosystems from a regional perspective. The closest threatened ecosystem is represented by the Mapungubwe/ Greefswater Riverine Forest, which is situated approximately 22 km to the north (spatially included in the Mapungubwe National Park).

⇒ The Venetia Mine and proposed development footprints are situated within the Limpopo Ridge Bushveld (SVmp2) and Musina Mopane Bushveld (SVmp1) ecological types, as described by Vegmap (2018), both of which are ascribed a conservation status of Least Threatened.

⇒ The Limpopo Province C Plan indicates the nodal and transformed status of much of the natural habitat from the Venetia Mine, which is spatially situated within a natural (and conserved) area of natural and pristine habitat, comprising the following categories:

- No Natural Habitat Remaining;
- Other Natural Areas (natural habitat of indeterminate status);
- Ecological Support Areas (2);
- Ecological Support Areas (1); and
- Critical Support Areas (2).

The following aspects therefore informed the impact assessment on the floristic receiving environment:

<u>Positive:</u>

⇒ Presence of several protected tree species that are subject to pe2rmitting requirements (DFFE);

⇒ Spatial proximity to the Venetia Limpopo Nature Reserve;

⇒ Pristine and natural status of much of the remaining natural woodland habitat within the development footprints;

⇒ High correlation the regional ecological types;

⇒ Spatial proximity to sensitive riparian habitat types; and

⇒ Moderate to high floristic diversity.

<u>Negative:</u>

⇒ Poor floristic and fauna diversity recorded from certain sites, notably those that are situated in proximity to intensive and transformative mining-related activities;

⇒ Existing high impacts from surrounding mining-related activities;

⇒ Requirements for protection of adjacent natural habitat from effluents and run-off from mining areas (the purpose of the project);

⇒ Least concern conservation status of the regional ecological types; and

⇒ Highly deteriorated status of extensive parts of the proposed footprints from mining activities.

2 BOTANICAL ATTRIBUTES AND IMPACT STATEMENT

The regional floristic character is indicated as the Mopane Bioregion, which is spatially situated in the Savanna Biome. More specifically, the local region comprises two ecological types described by Mucina and Rutherford (2006) as the Musina Mopane Bushveld (SVmp1) and Limpopo Ridge Bushveld (SVmp2). The conservation status of both these units is indicated as 'Least Threatened' providing insight into the low local and regional transformation status. A review of regional floristic collection records (SANBI, NEWPOSA 2021) indicates the known presence of approximately 517 plant species from the wider study area, reflecting the high regional diversity context of the Savanna Biome and the local ecological types. However, a paucity of site-specific, accurate and comprehensive floristic data for the local region is indicated from regional collection records.

Results of the floristic assessment of the proposed development footprints indicated the following key considerations:

⇒ An Alpha Diversity of 105 species was collectively recorded from the study sites. This corresponds (numerically) to 20.3 % of the sampling records from the wider region, also reflecting a moderate floristic diversity.

⇒ A brief review of the growth forms recorded from the site assessments provides insight into the savannoid nature of the immediate region, with the tree and shrub components collectively dominating the physiognomy, which correlates with the physiognomy from the wider region.

⇒ A total of 31 plant families were recorded during this instantaneous survey bout, dominated by the Poaceae family, while Fabaceae and Malvaceae were moderately represented, also correlating with collection records from the wider region.

⇒ A total of 7 plant species of conservation concern (NFA, IUCN, LEMA) are known to occur within the wider region (NEWPOSA 2021).

⇒ Records from the site inspection indicated a total of 4 (four) plant species of conservation concern present within the proposed footprints, including:

- *Adansonia digitata* (Baobab, NFA 2014);
- *Boscia albitrunca* (Shepard's Tree, NFA 2014);
- *Combretum imberbe* (Leadwood, NFA 2014);
- *Philenoptera violacea* (Apple Leaf, NFA 2014); and
- *Sclerocarya birrea* (Marula, NFA 2014);

⇒ It is emphasised that valid permits need to be obtained from DFFE prior to the removal, damage, relocation, or any other activity that might affect these species. A suitable geolocation survey need to be executed to determine the diversity and number of protected trees within the development footprints for permitting purposes.

The floristic evaluation of the footprints indicated a suite of highly variable woodland types that are largely associated with slopes, rockiness, moisture regimes and also indicating deleterious effects of mining-related activities. The following broad-scale habitat types were observed across the various development footprints:

⇒ Artificial Impoundments (not mining retention dams) –exhibiting a moderate floristic sensitivity;

⇒ Deteriorated "Acacia" Woodland –exhibiting a moderate-low floristic sensitivity;

⇒ Deteriorated Mixed Woodland –exhibiting a moderate-low floristic sensitivity;

⇒ Water storage facilities (mining facilities) –exhibiting a low floristic sensitivity

⇒ Floodplain grassland –exhibiting a moderate-low floristic sensitivity;

⇒ Mixed woodland (Deteriorated) –exhibiting a moderate-low floristic sensitivity;

⇒ Natural and mixed woodland on quartzitic and calcareous soils –exhibiting a moderate-high floristic sensitivity;

⇒ Rehabilitated land –exhibiting a low floristic sensitivity;

⇒ Riparian Mopane Thickets and Riparian Thickets –exhibiting a moderate-high floristic sensitivity; and

⇒ Transformed and Deteriorated Land –exhibiting a low floristic sensitivity.

Botanical Impact Statement:

Considering the proposed activities, the spatial and geographic placement of the proposed facilities and the inherent floristic attributes, importance and sensitivity of the receiving environment, the following potential and likely impacts on the floristic environment are considered likely to ensue:

⇒ Impacts on/ losses of conservation important and protected plant species (individuals, stands, populations) as well as habitat that is associated with these plant of conservation consideration;

⇒ Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types; and

⇒ Depletion of local floristic diversity and loss of rare species or flora communities.

⇒ Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale;

⇒ Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat;

⇒ Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations; and

⇒ Exacerbated decline in the aesthetic appeal of the landscape.

⇒ Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts;

⇒ Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region, with specific reference to mining activities; and

⇒ Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).

Losses of remaining natural woodland habitat within the existing mine property is reasonably anticipated, but these areas are considered compromised to some extent and contains limited aspects of high floristic sensitivity, i.e. protected tree species. These losses are regarded reasonable and are unlikely to result in any impact of significance. Caution is however advised to implement a dedicated monitoring and eradication programme for declared invasive and encroacher plant species. Exacerbation of the current levels of infestation, notably in areas that are situated in proximity to the adjacent VLNR, should not be allowed. Similarly, disruption of existing ecological processes, specifically around informal and non-perennial drainage lines, should be managed with caution to prevent further disruption and impacts in adjacent natural habitat. The occasional presence of protected tree species within the proposed development areas is mentioned.

The location of a portion of the proposed PCD 3 and the southern access road towards PCD3, is considered aspects of concern and potentially significant impacts could result within the VLNR conservation area, although localised and comparatively small. While the loss of natural habitat, from a numerical perspective, is considered marginal, the implication of development within a nature reserve (although no legal status) and impacts on the nearby Kolope River is considered potentially significant; it is therefore strongly recommended that alternative options be selected that will not impact on natural habitat within the VLNR, i.e. Option 3A or Option 3D.

Concluding Professional Statement:

The general area provides for a physiognomically homogenous savannoid landscape and ecosystem that is characterised by locally variable broad-scale and micro-habitat types that has their origin from the continuum and interrelationship of slopes, geomorphological attributes, topographical heterogeneity and moisture regimes. Nodal areas of deterioration are largely restricted within a defined and demarcated area (i.e. Venetia Mine property), exhibiting typical and expected responses to developmental, transformative and disruptive activities.

The following key consideration are presented in support of the Professional Opinion:

⇒ Ecological attributes of the study site are regarded common and ubiquitous to the wider region;

⇒ No threatened plant species were recorded within the site during the site investigation, or are considered highly likely to occur within any of the development footprints;

⇒ A low number of protected (trees, NFA 2014) species were recorded within the site during the site investigation;

⇒ No habitat type within the site are regarded restricted on a local or wider scale. The site also does not exhibit any biophysical feature of rarity or elevated ecological importance or sensitivity;

⇒ The proposed development footprints comprise mostly woodland habitat that exhibit moderate levels of deterioration;

⇒ The loss of deteriorated habitat from the site is not expected to result in significant, or unacceptable, impacts on provincial biodiversity conservation efforts;

⇒ The loss of these portions of woodland habitat is also not anticipated to result in significant changes or disruptions to ecological processes on a local or regional scale;

⇒ Specific caution is however advised for PCD 3 site and the access road towards this site as it is situated within a conservation area and it strongly recommended that a spatial alternative be selected to avoid impacts within the VLNR; and

⇒ The application of the recommended mitigation approach is expected to ameliorate anticipated impacts to an acceptable low level.

It is therefore the considered opinion, based on results of this botanical investigation, that no specific objections are raised to the proposed development. This opinion is based on the explicit understanding that the recommended mitigation approach is timeously and comprehensively implemented and also adhered to during all stages of the development.

3 FAUNAL ATTRIBUTES AND IMPACT STATEMENT

The following key results were obtained from the faunal assessment:

⇒ The expected mammal richness on the study site and immediate surroundings was high, with approximately 79 species expected to be sympatric to the study area. However, much of the anticipated high mammal richness was attributed to the nearby Venetia-Limpopo Nature Reserve (VNLR).

⇒ The actual mammal richness on the proposed footprint sites was significantly lower than the expected richness, with 20 species confirmed. Prominent observed species consisted of "spill- over" game species from the adjacent Venetia-Limpopo Nature Reserve with conspicuous taxa being Plains Zebra (*Equus quagga*), Common Warthog (*Phacochoerus africanus*), African Civet (*Civettictis civetta*), Greater Kudu (*Tragelaphus strepsiceros*), Impala (*Aepyceros melampus*), Black-backed Jackal (*Canis mesomelas*) and two primate species, namely Chacma Baboon (*Papio ursinus*) and Vervet Monkey (*Cercopithecus pygerythrus*). Apart from these species, the African Elephant (*Loxodonta africana*) and the Lion (*Panthera leo*) were observed in the nearby Venetia-Limpopo Nature Reserve and could occasionally occur on the proposed footprint sites, most notably the proposed Southern Access Road, the "eastern area" and PCD 3.

⇒ The globally vulnerable Leopard (*Panthera pardalis*), the globally near threatened Brown Hyaena (*Parahyaena brunnea*) and the regionally near threatened Serval (*Leptailurus serval*) were the only three mammal species of concern observed on the proposed study areas. These three species were the only species of concern with a high frequency of occurrence on the study area, especially in the southern and western parts of the study area (corresponding to the proposed south road and PCD 3 footprint).

⇒ The amphibian richness on the study site was considered be low; 14 frog species were expected to occur, of which only the Foam-nest Frog (*Chiromantis xerampelina*) appeared to be prominent.

⇒ The reptile composition on the study site was poorly known with only 47 species currently known from the wider study area, of which six species were confirmed on the proposed footprint sites. The Nile Crocodile (*Crocodylus niloticus*) was present in the small artificial impoundment at the PCD 3 site and frequent reports of occasional observations from mine personnel is noted, most probably as a result of periodic migration patterns between areas of suitable habitat.

⇒ A review of available information indicates approximately 213 bird species were expected to occur on the wider study area (including adjacent habitat), of which 111 species were observed during the April site visit.

⇒ A total of seven (7) bird species of conservation importance has been recorded in the wider study area (sensu SABAP2 and personal observations) which included five (5) globally threatened species, one (1) globally near threatened species and one (1) regionally near threatened species. These species were primarily represented by large-bodied and iconic birds of prey species (c. White-backed Vulture *Gyps africanus*, Martial Eagle *Polemaetus bellicosus*, Bateleur *Terathopius ecaudatus*, Tawny Eagle *Aquila rapax*) that are regarded as occasional foraging visitors to the study area. In addition, none of these species were currently utilising the proposed footprint sites for breeding purposes, although these could breed or roost on the adjacent Venetia-Limpopo Nature Reserve (an active nest of the globally endangered Martial Eagle *P. bellicosus* was observed approximately 4 km west of the study area).

<u>Faunal and Avifaunal Impact Statement:</u>

It is predicted that the impacts on the faunal component of the study area were likely to be low significance at most of the proposed project sites (PCD1, PCD2, PCD4, OMWSD N&S, OMWSD3, FRD 1 RWD and the northern stormwater attenuation channel). However, impacts such as the displacement of fauna was predicted to occur at PCD3, OMWSD4, the southern access road and the "eastern area" due to the clearing of natural habitat, especially riparian woodland, of which the significance was estimated to be moderate-high. A review of the significance of impacts associated with the

preferred PCD3B site, the selection of either Option 3A, or Option 3D is advised, which is anticipated to result in the avoidance of significant impacts on natural habitat within the VLNR area.

Concluding Professional Statement:

This report concludes that the general faunal assemblages on the study area are diverse and also include charismatic and threatened carnivore and scavenger mammal taxa. However, even though these taxa were present on some of the proposed sites (e.g. PCD3 and the southern access roads) within the mine perimeter, most of these species are considered an "over-spill" from the VLNR due to their opportunistic behaviour. However, the occurrence of threatened and near threatened taxa are more prominent at sites with a high ecological connectivity to the VLNR (via drainage lines and riparian woodland), such as PCD3, the "eastern area", the southern access road and to a lesser extent also OMWSD4. Nevertheless, the remaining sites are located and surrounded by mine infrastructure and facilities, which collectively contributed over time to either degraded woodland habitat or habitat that are fragmented, thereby containing mainly unspecialised and generalist taxa.

It is predicted that the impacts on the faunal component of the study area were likely to be low significance at most of the proposed project sites (PCD1, PCD2, PCD4, OMWSD N&S, OMWSD3, FRD 1 RWD and the northern stormwater attenuation channel). However, impacts such as the displacement of fauna was predicted to occur at PCD3, OMWSD4, the southern access road and the "eastern area" due to the clearing of natural habitat, especially riparian woodland, of which the significance was estimated to be moderate-high. The implementation of the suggested mitigation approach is expected to result in the amelioration of the anticipated impacts to an acceptable level. Therefore, no specific objections to the project is raised, but with the understanding that the suggested mitigation protocol is timeous and adequately implemented.

SECTION B: ADMINISTRATIVE DETAILS

4 PROJECT MINUTIAE

Table 1: Project Minutiae	
Client	Shangoni Management Services (Pty) Ltd (EAP), on behalf of De Beers Consolidated Mines Limited – Venetia Mine (the Client)
Report name	Terrestrial Biodiversity Impact Assessment for the proposed Stormwater Management Project for De Beers Consolidated Mines Limited – Venetia Mine, that is situated near Alldays in the Limpopo Province
BEC Reference Number	SGN – VEN – 2021/12
Report Version	2021.08.12.03
Report Status:	FINAL REPORT
Compiled by	Riaan A. J. Robbeson (Pr.Sci.Nat.), Bathusi Environmental Consulting cc
Compiled by	Lukas J. Niemand (Pr.Sci.Nat.), Pachnoda Consulting cc

5 REPORT REFERENCE & CITATION

When used as a reference, or included as an addendum, this report should be cited as:

Pachnoda Consulting cc (2021). Terrestrial Biodiversity Impact Assessment for the proposed Stormwater Management Developments for the De Beers Consolidated Mines Limited – Venetia Mine that is situated near Alldays in the Limpopo Province. Reference Number SGN – VEN – 2021/10. Version 2021.08.12.03.

6 SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act (South Africa, No. 27 of 2003) aims to 'provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith'. Quoting the South African Council for Natural Scientific Professions Act revised 2019), specialists must:

"5 Only undertake natural scientific work which their education, experience or background have rendered them competent to perform; and

8 Not knowingly misrepresent or permit misrepresentation of their own or their associates' academic or professional qualifications, neither exaggerate their own degree of responsibility for any work of a natural scientific nature."

Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*' (20(1) – pg 14).

Table 2: Biodiversity specialists for this project	
Botanical and Ecological Specialist:	Riaan Robbeson (Pr.Sci.Nat.)
Qualification:	M.Sc. (Botany), UP
Affiliation:	South African Council for Natural Scientific Professions (SACNASP)
Fields of Expertise:	Botanical Scientist & Ecological Scientist
Fields of Expertise:	Zoological Scientist (Cert.Nat.Sci.)
Registration Number:	400005/03
Affiliation:	Grassland Society of Southern Africa
Affiliation:	South African Association of Botanists
Affiliation:	South African Wildlife Management Association
Affiliation:	Zoological Society of Southern Africa
Faunal and Avifaunal Specialist:	Lukas Niemand (Pr.Sci.Nat.)
Qualification:	M.Sc. (Restoration Ecology), University of Pretoria
Professional Affiliation:	South African Council for Natural Scientific Professions
Fields of expertise:	Ecological Scientist & Zoological Scientist
Registration number:	400095/06
Affiliation:	Birdlife South Africa (1039913)
Affiliation:	Hartbeespoort Natural Heritage Society

7 DECLARATION OF INDEPENDENCE

We, the undersigned, acting in the capacity as specialist biodiversity consultants, and the legal representatives of the respective companies (Bathusi Environmental Consulting, Pachnoda Consulting), declare that:

- ⇒ while we are committed to the conservation of biodiversity, we also concomitantly acknowledge and recognize the need for economic development and the sustainable utilisation of natural resources;
- ⇒ we executed our duties as independent specialist consultants conducting the biodiversity impact assessments and preparing the products;
- ⇒ we performed all activities associated with the project in line with relevant legislation and comply with ethical requirements related to our profession;
- ⇒ findings, results, observations, conclusions, and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as the interpretation of information available to them at the time of compiling this report.
- ⇒ at the time of presenting this proposal, we did not have any interest, hidden or otherwise, in the proposed development or activity, as outlined in this document, other than expecting fair financial compensation for work performed in a professional capacity, as specified by the National Environmental Management Act (No 107 of 1998) (2014) Regulations GNR 983 and GNR 986, as amended in 2017;
- ⇒ as affiliated members, we consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions (SACNASP);
- ⇒ neither BEC, nor Pachnoda Consulting are subsidiaries, legally or financially, of Shangoni Management Services (Pty) Ltd (EAP) or De Beers Consolidated Mines Limited – Venetia Mine;
- ⇒ we shall not be affected in any manner by the outcome of the environmental process of which the reports and biodiversity assessments form part of, other than being part of the general public;
- ⇒ we do not necessarily object to or endorse the proposed development from a personal perspective, but aim to present facts and recommendations based on scientific data and relevant professional experience;
- ⇒ we do not have any influence over decisions made by the governing authorities; and
- ⇒ we undertake to disclose to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2005.

Riaan A. J. Robbeson (Pr.Sci.Nat.)
(Bathusi Environmental Consulting cc)

Lukas J. Niemand (Pr.Sci.Nat.)
(Pachnoda Consulting cc)

12th August 2021

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9 CONDITIONS, LIMITATIONS AND ASSUMPTIONS

⇒ Findings, results, observations, conclusions and recommendations presented in this report are based on the authors' best scientific and professional knowledge as well as the interpretation of information available to them at the time of compiling this report.

⇒ Due care and diligence was exercised by the authors in rendering services, preparing this document and executing responsibilities as specialist consultants.

⇒ It is assumed that third party information (obtained from government, academic/research institution, non-governmental organisations) is accurate and true.

⇒ Even though care is taken to ensure the accuracy of surveys, data analysis and other aspects of this report, it should be noted that ecological/ biodiversity studies, notably for EIA purposes, are limited in time, budget and scope. It is not the purpose of this report to present exhaustively detailed information. Decisions and discussions are therefore, and to some extent, based on reasonable and informed decisions and assumptions that are extracted from *bona fide* information sources and from deductive reasoning (Precautionary Principle).

⇒ In order to obtain a comprehensive understanding of the dynamics of terrestrial faunal assemblages and local floristic diversity patterns, with particular reference to endemic, rare, or threatened species in any area, biodiversity assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, such long-term studies are generally not part of the terms of reference for EIA assessments.

⇒ Results presented in this report are ultimately based on a snapshot investigation of the study area and not on detailed and long-term investigations of all environmental attributes and the varying degrees of biological diversity that may be present in the study area. Specifically, no discipline-specific, long-term and scientific survey methods were employed in the collation of data from the site. Although as much as possible data was obtained from opportunistic observations during the brief survey period, these surveys are customarily limited by budgetary and time constraints – results presented in this report need to be interpreted with these limitations in mind.

⇒ Background information that were used to inform and augment the assessment was limited to data and GIS coverage available for the project site on a relevant scale. A paucity of site-specific data is typical of these data sources and should be accepted as a norm.

⇒ Notably, rare and endemic species normally do not occur in great densities and, because of customary limitations in the search and identification of Red Listed species, the detailed investigation of these species was not possible. Results are ultimately based on estimations and specialist interpretation of imperfect data.

⇒ It is emphasised that information, as presented in this document, only have bearing on the sites as indicated on accompanying maps. This information cannot be applied to any other area, however similar in appearance or any other aspect, without proper investigation.

⇒ Additional or supplementary information may become known during a later stage of the process or development. The authors therefore reserve the right to modify aspects of the report, including findings and recommendations, should new information become available from ongoing research or additional work performed in the immediate region of this specific area, or any forthcoming information pertaining to this investigation after the submission of this report.

⇒ The respective companies and specialists therefore do not accept any liability for conclusions, suggestions, limitations and recommendations made in good faith, based on available information, or based on data that was obtained from surveys of a brief nature.

⇒ This report should always be considered in its entirety. Reading and representing portions of the report in isolation could lead to incorrect conclusions and assumptions. In case of any uncertainty, the authors should be contacted to clarify any viewpoints, recommendations and/ or results.

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10 ACRONYMS & ABBREVIATIONS

Table 3: Acronyms and abbreviations in the report	
ADU	Animal Demography Unit, Department of Biological Sciences, University of the Western Cape
BEC	Bathusi Environmental Consulting cc
CBD	Convention on Biological Diversity
CITES	Convention of International Trade in Endangered Species
CR	Critically Endangered
DD	Data Deficient
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EN	Endangered
End	Endemic Species
GIS	Geographic Information Systems
GPS	Global Positioning System (handheld device)
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
LC	Least Concern
mmasl	Mean Meters Above Sea Level, or m.
NEnd	Near Endemic Species
NT	Near Threatened
Pr.Sci.Nat	Professional Natural Scientist (registered at SACNASP)
SABAP	South African Bird Atlas Project
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SSC	Species of Special Concern
VLNR	Venetia Limpopo Nature Reserve
VU	Vulnerable

11 GLOSSARY OF TERMS

Table 4: Glossary of terms for the report	
Abundance	The quantity, number or amount of a species present in a particular area or sample
Ad hoc	Random, non-sequential, opportunistic observations
Altitude	Expressed as mean meters above sea level (mmasl), or meter (m)
Amphibian	Cold-blooded vertebrate animal of a class that comprises the frogs, toads, newts, salamanders and caecilians
Antelope	Swift running, deer-like ruminant with smooth hair and upward-pointing horns
Anthropogenic	Human induced
Austral	Southern hemisphere
Avifauna	Birds
Biodiversity	Diversity among and within plant and animal species in an environment
Carnivore	Flesh eating animal
Commute	Travel between destinations, normally on a daily basis
Composition	Constituents (animals or plants) of a sample, or area
Conspecific	Animals or plants belonging to the same species
Data Deficient	Species has been categorized (UICN) as offering insufficient information for a proper assessment of conservation status to be made
Density	Number of individuals in a given area
Disjunct	Disjoined or distinct from one another
Diversity	Number of species in a given area
Dominance	The predominance (abundance, numbers) of one or more species in a plant or animal community
Dwarf shrub	A plant that bears hibernating buds on persistent shoots near the ground, usually woody plants with perennating buds borne close to the ground, usually less than 25 centimetres above soil surface
Ecology	The branch of biology that deals with the relations of organisms to one another and to their physical surroundings
Endemic	Restricted to a certain geographic area

Granivore	Animals that eat seeds as the main part of their diet
Herbaceous	Vascular plants that have no persistent woody stems above ground
Herbivorous	Animals that eat plants
Herpetofauna	Amphibians and Reptiles
Hibernate	An animal or plant that spends the winter in a dormant state
Insectivorous	Animals that feed on insects as the main part of their diet
Invertebrate	An animal lacking a backbone, such as an arthropod, mollusc, annelid, coelenterate, etc
Lepidoptera	Butterflies
Mesic	An environment or habitat) containing a moderate amount of moisture
Mammal	A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young and (typically) the birth of live young
Nocturnal (animal)	Animals that are active during night periods
Omnivorous	Animals that feed on a variety of foot of both animal and plant origin
Passerine	Relating to or denoting birds of a large order distinguished by having feet that are adapted for perching, including all songbirds
Predator	Animals that naturally preys on other animals, species
Primate	Animals characterized by large brains relative to other mammals, as well as an increased reliance on stereoscopic vision at the expense of smell, the dominant sensory system in most mammals
Putative species	Species that are assumed to exist, or reputed to have existed
Rainfall	Expressed as millimetre (mm)
Red Data	A taxon included in the UICN list of threatened species
Reptile	Tetrapod animals in the class Reptilia, comprising today's turtles, crocodilians, snakes, amphisbaenians, lizards, etc
Rodent	Gnawing mammal of an order that includes rats, mice, squirrels, hamsters, porcupines and their relatives, distinguished by strong constantly growing incisors and no canine teeth. They constitute the largest order of mammals
Scavenger	An animal that feeds on carrion, dead plant material, or refuse materials
Subterranean	Existing, living under the earth's surface
Territorial	The sociographical area that an animal of a particular species consistently defends against conspecifics (or, occasionally, animals of other species). Animals that defend territories in this way are referred to as territorial. Territoriality is only shown by a minority of species.
Temperature	Expressed as Degrees Celsius (°C)
Threatened	Species (including animals, plants, fungi, etc.) which are vulnerable to endangerment in the near future. Species that are threatened are sometimes characterised by the population dynamics measure of critical dispensation, a mathematical measure of biomass related to population growth rate

12 SITE LOCATION

The proposed development will comprise the development of various stormwater management measures as part of the existing Venetia Diamond Mine infrastructure.

Country:	South Africa
Province:	Limpopo Province
District Municipality:	Vhembe District Municipality
Local Municipality:	Musina Local Municipality
Farm(s):	Portions 1, 2, 3, 4, 5 and the Remainder of Venetia 103-MS; Portion 1 and the Remainder of Krone 104-MS; the Remainder of Rugen 105-MS; Drumheugh 99-MS; Elesger 98-MS
Nearest town:	Alldays (32 km south-southwest)
Quarter Degree Grid:	2229AD
General GPS Locality:	S22.455333° and E29.319926° (Mine entrance)

The Venetia Diamond Mine is located in the northern part of Limpopo Province, situated approximately 22 km south of the Mapungubwe National Park, 32 km north-northeast of Alldays and approximately 72 km east of Musina. The Venetia Mine (mining rights area) comprise approximately 3,000 ha in totality and is situated within the 36,000 ha

Venetia Limpopo Nature Reserve (VLNR). An indication of the regional location is provided in Figure 1 and aerial imagery of the site and local surrounds is provided in Figure 2.

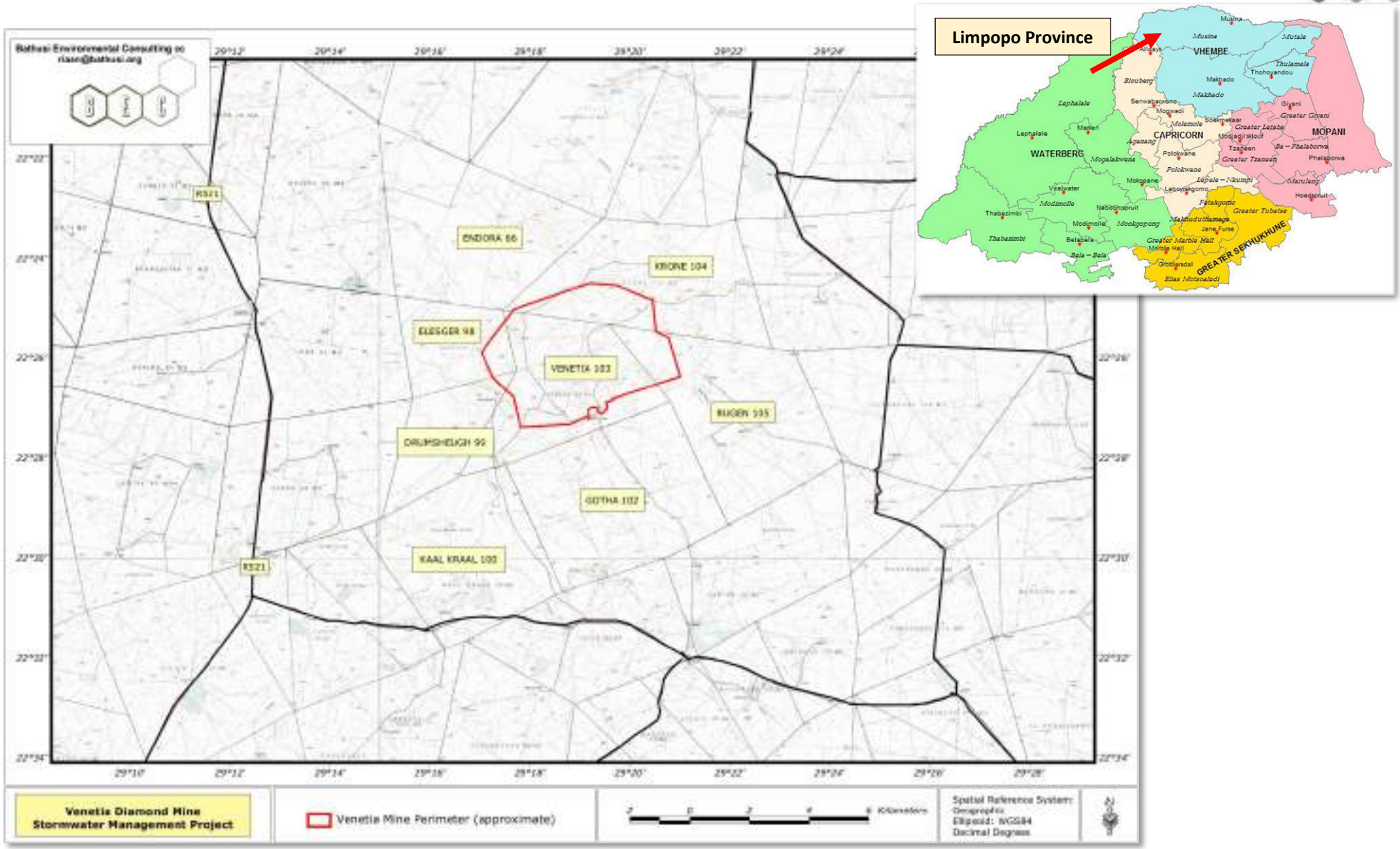


Figure 1: Regional location of the study area
note insert for municipalities within Limpopo Province and arrow for approximate site location

Figure 2: Aerial imagery of the site and immediate surrounds

13 PROJECT SYNOPSIS

Venetia Mine is an existing opencast diamond mine and commenced with operations in 1992. The extent of the Mining Right boundary is approximately 3,000 ha and includes three main kimberlite ore reserves, namely K1, K2 and K3 kimberlite pipes. In December 1997 DBCM acquired the rights to diamonds, (alluvial, general, kimberlite) on mineral lease area No. 2 on the Farm Venetia 103 MS. The Mining Right was converted in terms of Item 7 of Schedule II of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) ("MPRDA") in September 2008 and registered in 29 April 2009. Environmental approval was first granted in 1990 when operations commenced as an opencast operation and the Environmental Management Programme ("EMPr")) has since been amended in 2000, 2004, 2007 and 2012.

As the depth of the pit increases, cost associated with the extraction of waste rock increases and opencast mining becomes economically less viable and also environmentally unfeasible. Subsequent to technical considerations, the operation will therefore be converted from the existing opencast operation to an underground operation, extracting the remaining K1 and K2 reserves from a depth of approximately 450 m (Venetia Underground Project, "VUP") in accordance with the following approvals:

⇒ Environmental Management Programme for Proposed Underground Operations and EMP Consolidation for Existing Operations at De Beers Consolidated Mines, Venetia Mine, Limpopo Province, dated 2012 and prepared by Environmental Resources Management. DMRE reference number: LP30/5/1/2/3/2/1/58/EM;

⇒ Environmental Authorisation, dated 2012. DMRE reference number: LP30/5/1/2/3/2/1/58/EM;

⇒ Environmental Authorisation, dated 2012. Limpopo Department of Economic Development, Environment and Tourism ("LEDET"). Reference number: 12/1/9/2-V9;

⇒ Amended Environmental Authorisation, 2015. LEDET. Reference register number: 12/1/9/2-V9; and

⇒ Water Use Licence No 14/A63E/ABCGIJ/5111. File No: 27/2/2/A563/1/1. 7 August 2017. Department of Water and Sanitation.

As part of the conversion from opencast to an underground operation, Venetia Mine has identified the need to construct additional stormwater management infrastructure and containment facilities with the purpose of de-risking the above mentioned VUP from flooding and to prevent the release of mine-affected water. Venetia Mine therefore commenced with the Storm Water Management Project ("SWMP") conceptual studies in 2011, and subsequently included the required storm water infrastructure into the IWUL amendment application in 2014. Since 2014, various studies have been undertaken, including water balance updates to better inform the detailed designs, capacities and locations of the proposed facilities. The overarching purpose of the SWMP is to ensure legal compliance as per the requirements of GN R.704 as well as to ensure the safety of personnel working in the newly-developed underground mine (VUP). The application supports the principles of the hierarchy of water use, specifically focussing on water conservation and improved water security. The required storage for the SWMP is calculated at 2.27Mm^3, and would require the following proposed facilities:

⇒ Pollution Control Dam ("PCD") 1A;

⇒ PCD 2;

⇒ PCD 1 Compartment 4 (PCD 4);

⇒ Fine Residue Deposit ("FRD") 1 Return Water Dam (RWD") expansion;

⇒ On-mine Water Storage Dam ("OMWSD") North and South compartment expansion;

⇒ OMWSD Compartment 3;

⇒ OMWSD Compartment 4;

⇒ PCD 3;

⇒ K 03 Pit;

⇒ The discharge of mine water into the Kolope River;
⇒ Relocation of the mine boundary security fence (PCD 3 locality only);
⇒ Upgrading of southern access road to access the PCD 3 locality.
⇒ Re-routing of an 11 kV powerline;
⇒ Construction storm water management infrastructure including channels and trenches; and
⇒ Provision of pipelines and pumping systems.

To establish the botanical importance and inherent sensitivity of the receiving environment, as well as determining the potential presence of conservation important plants on the sites, BEC was requested to conduct a concise floristic assessment of the sites. Towards these objectives, a suitable site investigation was conducted on the 19th to 23rd April 2021. Climatic and environmental conditions were considered optimal to establish the nature of the site and no survey limitations were identified, although no surveys were executed during the austral winter period.

An illustration of the geographic layout of the respective development areas in relation to existing infrastructure is presented in **Figure 3**.

13.1 LAYOUT REDESIGN (LOCATION ALTERNATIVES)

The spatial locations of the proposed water containment facilities, as indicated on the accompanying figures, represent the 'preferred' options from the mine's perspective. These locations were selected based on available space either within already disturbed areas or based on the surface drainage for the containment of affected surface water runoff as well as taking cognisance of technical considerations. Apart from FRD 1 RWD, only one location was selected for each site. For the FRD 1 RWD, a second compartment alternative site was identified, but was subsequently discarded as the proposed alternative slopes relatively steeply from east to west, which would require a significant volume of earthworks (fill) to construct the dam embankment. Also, from a topographic perspective, it is not regarded as an ideal site for FRD 1 RWD and it was decided to expand the current FRD 1 RWD by raising the facility's wall by 3 m.

13.2 CAPACITY ALTERNATIVES

With the exception of PCD 2, PCD 4 and OMWSD Compartment 3 and 4, alternatives to the capacities of all the facilities were assessed. Capacity alternatives for PCD 2 and PCD 4 were not assessed, as such facilities were approved within the WUL (Licence No.: 14/A63E/ABCGIJ/5111) and the approved volumes considered as part of the SWMP capacity requirements. No alternatives were proposed for the OMWSD Compartment 3 and 4 due to the location of the proposed facilities. The capacity alternatives for the other facilities are illustrated in **Figure 4** and summarised below:

PCD 1:

PCD 1A – PCD 1A was identified as a polluted water dam site and designed in 2015, as part of the IWUL amendment project. It is located to the south of the existing SWCD and has a catchment area of 26 ha. This dam will receive runoff from the workshop areas located towards the east that currently flows into to the SWCD, following the construction of various planned dirty water canals. The 2015 design catered for a storage capacity of 60 000 m^3, as required to contain direct runoff to the dam.

PCD 1B (preferred) - Construction of a single dam to receive runoff from the workshop area towards the east as well as runoff from the VUP terrace area, requiring a storage capacity of at least 90 000 m^3. To increase the capacity of PCD1A, a greater portion of the area south of SWCD will be utilised. The wall height will be increased to approximately 8 m. This option has a storage capacity of 120 000 m^3.

PCD 2 (preferred)

PCD2 is located north-east of the CRD and was designed with two compartments separated by means of a dividing wall. PCD2 is constrained by the existing CRD's existing footprint to the south-west and by the future extension of the CRD dump to the west.

PCD 3:

PCD 3A is located on the western boundary of Venetia Mine, between the FRD and CRD. In order to maximise storage capacity without encroaching on the outer security fence line, the facility adopted a "dog-leg" shape. The design entails two compartments (north and south), each having different shapes due to the spatial constraints.

PCD 3B represents an alternative location to PCD3A, with the pollution control dam located predominantly outside of the current security fence line, extending into the 'Vanzylsrus' area. PCD3B has an estimated maximum storage capacity of 750 000 m^3 and requires approximately 154 500 m^3 of excavation to create a suitably shaped basin. The dam wall height is currently limited to 12 m that will classify it as a 'small dam'.

PCD 3C (preferred) is positioned at the same location as PCD3B, between the Kolope River and the current mine security fence west of the mine. The main embankment will have a curved-shape (radius of 350 m) to maximise the available space between the two koppies at Vanzylsrus. PCD3C will have an estimated storage capacity of 1 050 000 m^3 at a maximum embankment height of 13 m.

PCD 3D is positioned in between FRD1 and the CRD. This option was assessed as a potential fall-back option should it not be possible to construct PCD3B or PCD3C outside the mine fence. To optimise the potential storage capacity of the site, the dam was extended up to the outer mine fence. PCD3D will have an estimated storage capacity of 750 000 m^3. However, extensive earthworks will be required to build a U-shaped dam embankment with a crest length of approximately 1.35 km.

PCD 4 (preferred)

PCD4 is located to the west of the SWCD. This dam formed part of the 2015 design and was intended as an attenuation facility to contain runoff from the VUP terrace area. Water would be released to the SWCD as capacity at the latter facility became available. The dam was designed with a storage capacity of 30 000 m^3.

OMWSD Compartment 3 (preferred)

The OMWSD-3 is located north of the existing OMWSD North Compartment. By adopting the same crest height as for the existing OMWSD North Compartment an estimated storage capacity of 275 000 m^3 can be achieved. In addition, the proximity to the existing OMWSD allows for the utilisation of the existing pumping infrastructure at the dam, i.e. essentially operating as an extension to the OMWSD.

OMWSD Compartment 4 (preferred)

OMWSD Compartment 4 is located on the eastern side of the existing OMWSD South Compartment and falls outside the existing mine security fence. The area is topographically a low point, and due to the location of the existing OMWSD dams, forms a basin at which storm attenuation occurs during major flood events. The OMWSD Compartment 4 crest elevation will be limited to that of the existing OMSWD North Compartment and OMWSD South Compartment (698.25 m) in order to operate the dam as an extension of OMWSD South Compartment and / or OMWSD North Compartment. The footprint of OMWSD Compartment 4 is limited to the east in order to allow for clean water runoff to be diverted around the dam, into the existing clean water diversion system that bypasses south of OMWSD South Compartment. Furthermore, confirmation will need to be obtained that there are no restrictions with respect to the air strip that precludes the construction of a dam within a certain distance. OMSWD Compartment 4 will have an estimated storage capacity of 200 000 m^3. Earthworks will require 107 000 m^3 of excavation to establish a suitable dam

basin and remove silt transported to low-lying area in previous flood events. The embankment fill volume will be significantly less (in order of 15 000 m^3), which will predominantly constitute the eastern and southern embankments.

OMWSD North and South Compartments (preferred)

It is understood that the existing OMWSD North and South compartments will be re-lined in the next year or two. This provides the potential opportunity of increasing the capacity of the OMWSD by raising the embankments along the perimeter of the existing facility while it is decommissioned. The existing OMWSD North and South Compartment currently have a combined storage capacity of 460 000 m^3 (260 000 m^3 and 200 000 m^3 for northern and southern compartments respectively). An embankment raise of 2 m will result in a total combined storage capacity of 660 000 m^3 for the northern and southern compartments combined (from the current 460 000 m^3). This assumes the existing divider wall between the two compartments remains as it is. Removing the dividing wall completely could yield an additional ± 30 000 m^3 storage capacity, whilst raising the dividing wall by 2 m would reduce the capacity by a similar order of magnitude.

K03 pit (preferred)

The K03 pit is located to the east of FRD2 on the north-western perimeter of the open pit. The K03 pit is separated from the K02 pit by an unmined barrier wall that is approximately 250 m wide. The K3 pit has a total in-pit storage capacity of 3.5 million m^3, i.e. up to a highwall elevation of 640 m. The intention, however, is to limit the allowable storage capacity to a maximum level as defined by geological and geohydrological considerations.

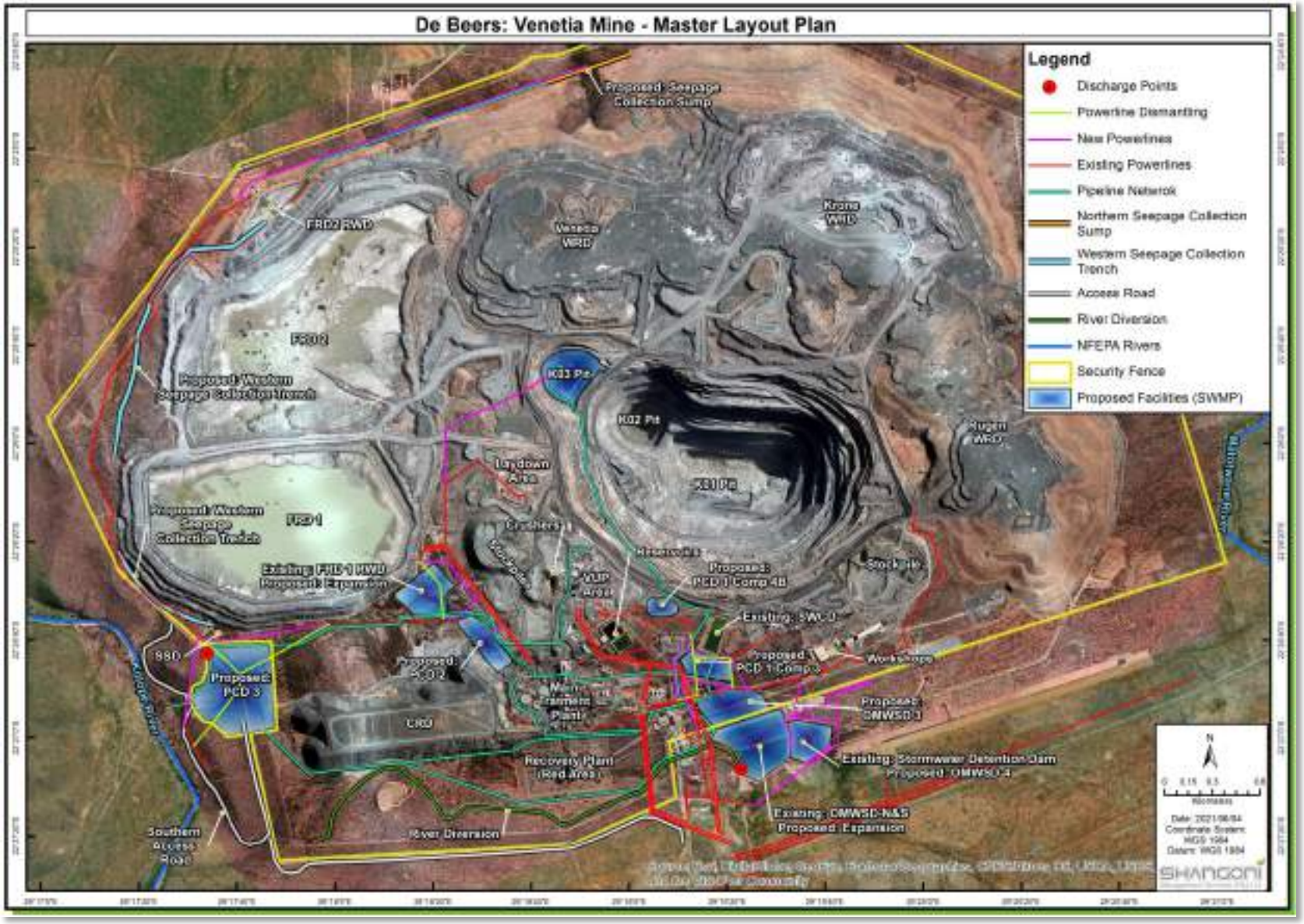


Figure 3: Project layout in relation to existing and relevant infrastructure

Figure 4: Identified alternatives in context of proposed facilities

SECTION C: BIOPHYSICAL ATTRIBUTES OF THE AREA

14 LAND COVER & LAND USE OF THE REGION

BGIS information (SANBI 2021) indicates the extent of the Musina Local Municipality as approximately 757,683 ha, of which 94.6 % remains untransformed, also confirmed by anecdotal evidence from site observations made during the site inspection period. The low levels of transformation provide insight into the decidedly rural nature of the larger region. Musina represents the major town of the municipality and functions as the major service centre for surrounding villages and commercial farms, which have extremely low economic bases. Urbanisation of people from surrounding villages to major towns represent a significant migration pattern. Several smaller rural villages and small towns occur in the eastern part of the municipality. Expansive tracts of untransformed and natural habitat (refer Figure 5) occur, and grassland, woodland and dense bush and thickets comprise a large extent of the region. Industrial developments (such as the Venetia Mine), commercial nodes and centres, and urban built-up areas comprise minor parts of the region and is scattered across the landscape. Land use of the municipality is strongly associated with natural land use practices that aims to conserve and utilise the natural status of the land. These include commercial wildlife and livestock farming operations, with minor commercial and subsistence agricultural practices.

Aerial imagery of the site and immediate surrounds (refer Figures 2 and 3) reflects the untransformed nature of much of the local region, apart from the Venetia Mine, which represents the most significant industrial development of the municipality and the larger region. The pristine and natural status of the vegetation also reflects local conservation efforts of the Venetia Limpopo Nature Reserve, the nearby Mapungubwe National Park to the north and conservation compatible land uses of private farms to the south of the VLNR, including wildlife farming and ecotourism-based land uses. Based on the dominant soil types of the region, it is assumed that the agricultural capability of the soils is generally low and that it is, at best, suitable for livestock grazing purposes. The low transformation rates of the natural vegetation is also a reflection of low population numbers in the local and larger region.

15 GEOLOGY AND SOILS

The geology of the general region is comparatively complex, but primarily comprises Gumbu Group marble, silicate rock and gneisses of the Swazian Erathem. The northern and westerns sections of Venetia Mine is underlain by gneiss, quartzite and pelite of the Malala Drift Group in the Beitbridge Complex, while intrusive rocks of the extreme northern part of the mine is overlain by quaternary sand and calcretes that manifests as sandstone and siltstone of the Clarens Formation (BAP, 2011) (refer Figure 6).

Land types are illustrated in Figure 7. A land type unit is classified as an area that displays a marked degree of uniformity with respect to terrain form, soil patterns and climate. The following land types are represented within the Venetia Mine boundary:

⇒ Ae307;
⇒ Ah 104;
⇒ Db218;
⇒ Fc621; and
⇒ Fc622.

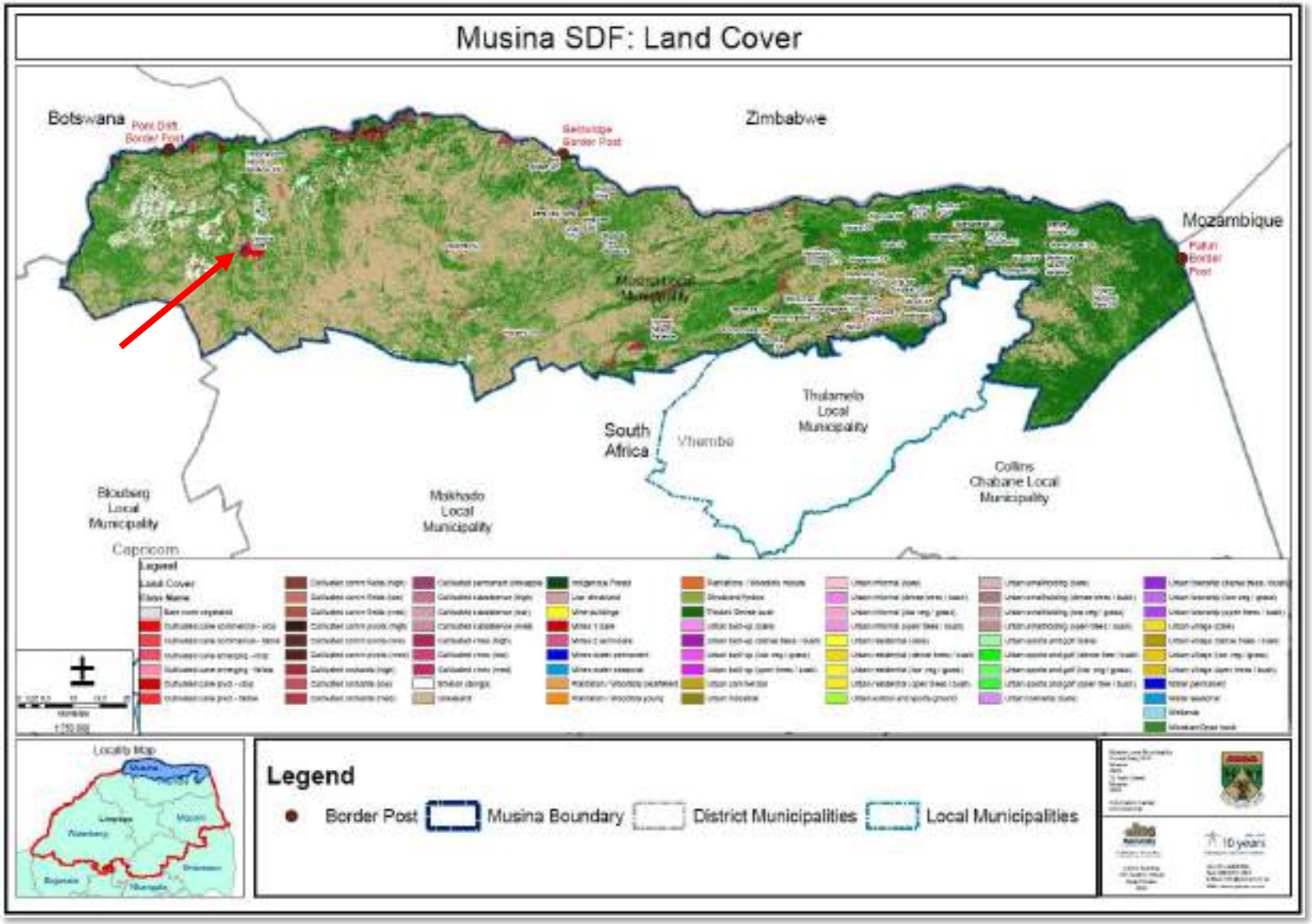


Figure 5: Broad land cover categories of the Musina Local Municipality (2019)
Source Limpopo Spatial Development Framework (2019), note red arrow for approximate site location

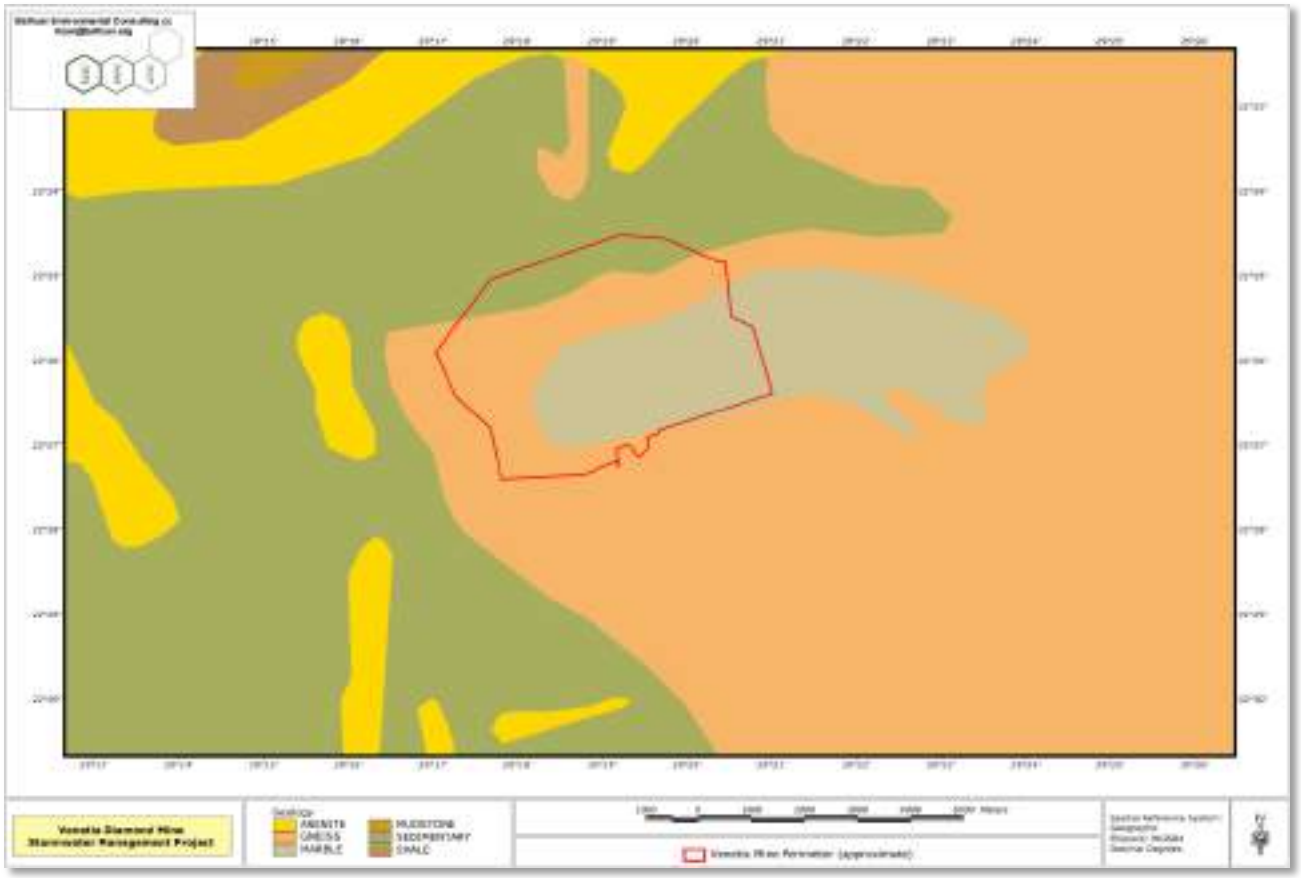


Figure 6: Geological patterns of the local region

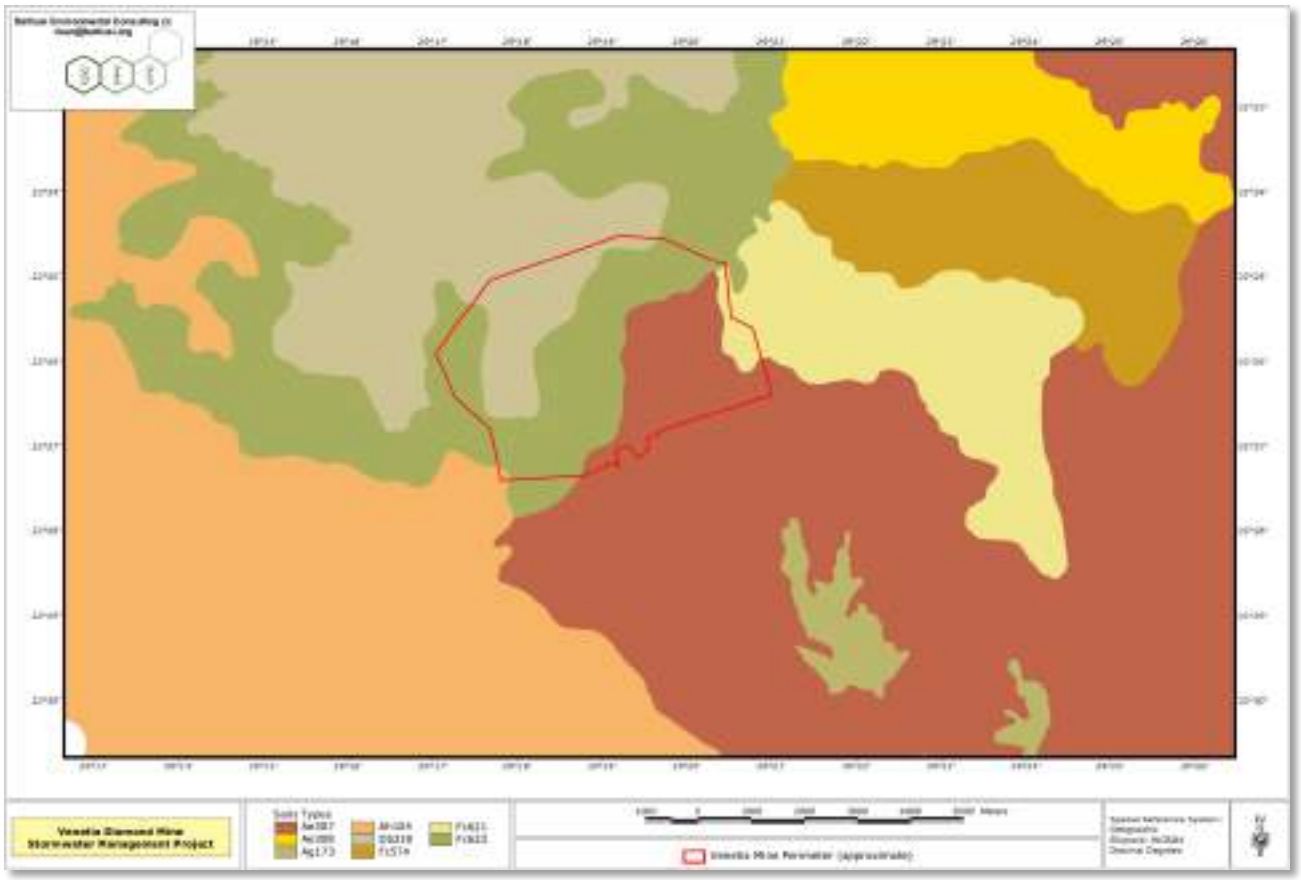


Figure 7: Soil type patterns of the local region

Map units A refer to yellow and red soils without water tables and belonging in one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin and Clovelly. The map units refer to land which does not qualify as a plinthic catena and in which one or more of the above soil forms occupy at least 40 % of the area. In Ae (red-yellow apedal, freely drained soils, red high base status, 450 - 700 mm deep, no dunes) and Ah (red and yellow, high base status), yellow soils occupy less than 10 % of the area while dystrophic and/or mesotrophic soils occupy a larger area than high base status red-yellow apedal soils. Resultant soils are generally poorly suited for arable agriculture and clay contents are generally lower than 15 %. Soil depths vary between 450 and 750 mm.

Units Da – Dc accommodates land where duplex soils are dominant, indicating a high erodibility, containing dominant prismacutanic and/ or pedocutanic diagnostic horizons and where the B horizons are generally not red. Upland soils that display duplex character include Estcourt, Sterkspruit, Swartland, Valsrivier and Kroonstad forms. Db refers to land where duplex soils with non-red B horizons comprise more than half of the area covered by duplex soils. Soils in these areas, despite comparatively deep (> 750 mm) are of intermediate suitability for arable agriculture where the climate permits.

The F group mainly includes Glenrosa and/ or Mispah forms (predominantly stony, rocky, but other forms may also occur) and is intended to accommodate pedologically young landscapes that are not predominantly roc and not predominantly alluvial or aeolian and in which the dominant soil forming processes have been rock weathering, the formation of orthic topsoil horizons and, commonly, clay illuviation, giving rise typically to lithocutanic horizons. The soil forms which epitomise these processes are Glenrosa and Mispah. However, exposed rock and soils belonging in almost any of the other soil forms may be found in these land types, provided these other soils do not qualify the land for inclusion in another map unit. Shallow and deep soils of the Oakleaf form (usually on upland sites) developed by rock weathering are accommodated here. Fc refers to land where lime occurs regularly (there do not need to be much of it, and it need not occur in every soil present) in upland and valley bottom soils. Soil depth is generally less than 450 mm clay percentage is less than 15 %. Resultantly soil potential is of intermediate suitability for arable agriculture where the climate permits.

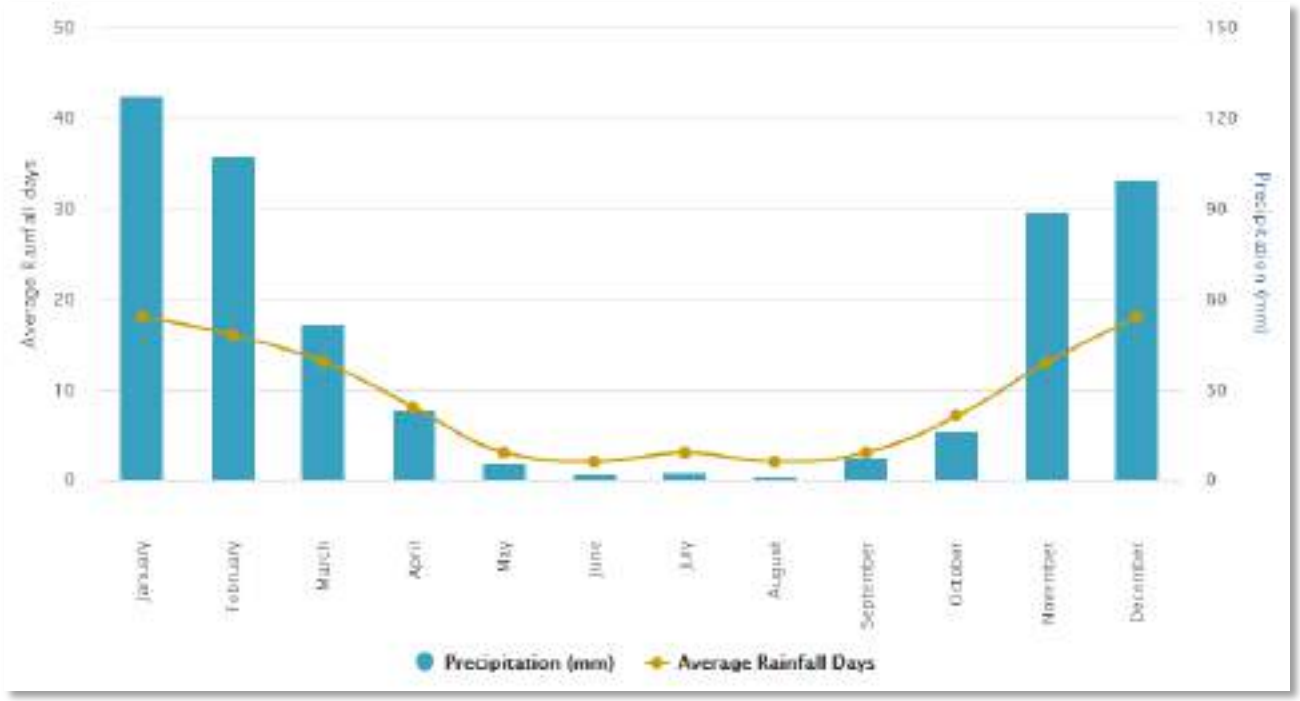
16 CLIMATE

Musina Local Municipality lies in a summer rainfall region and has a warm climate, described by the Köppen Climate Classification subtype for the climate of the immediate region as "BSh" (Hot semi-arid (steppe) climate), which tend to be characterised by extremely variable temperature conditions. These climates tend to have hot, sometimes extremely hot, summers and warm to cool winters, with some to minimal precipitation. Hot semi-arid climates are most commonly found around the fringes of subtropical deserts.

The study area lies in the summer rainfall region and has a warm climate, generally ranging between an average minimum in July of 12°C to and an average maximum of more than 30°C between September and March, November and December are indicated as the hottest period, with an average maximum of 32°C (refer Graph 1). Daily maximum temperatures above 30°C, and even 35°C is frequently recorded. The average maximum temperatures during the winter period (June – July) of 12°C provides further evidence of the extremely hot local environment. Highly infrequent and occasional frost conditions are noted; temperatures below 0°C are rarely recorded in the region.

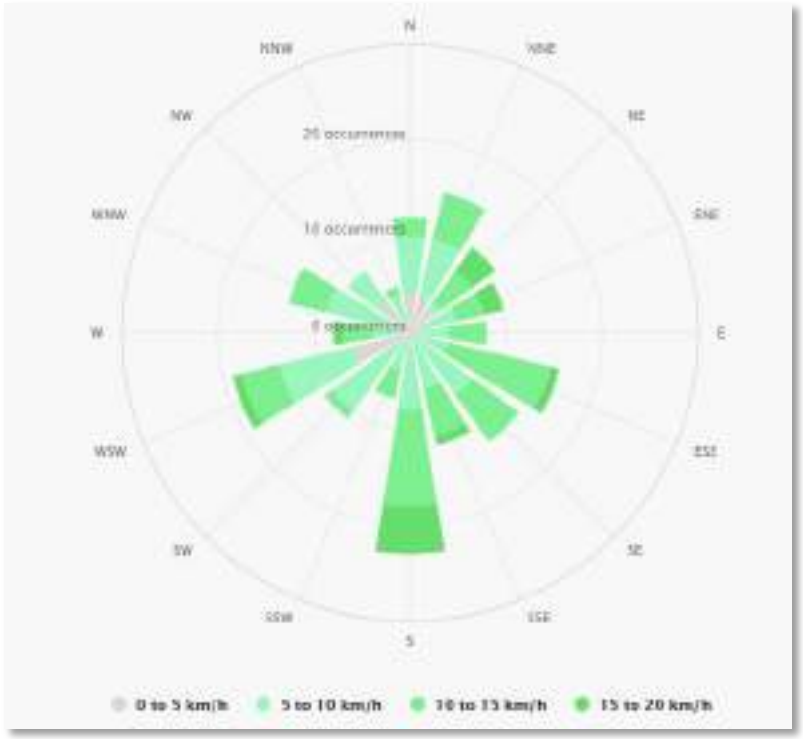
Graph 1: Average daily maximum and minimum temperatures and monthly precipitation
(www.worldweatheronline.com)

Rainfall in the region is unpredictable and spatially and temporally erratic, as well as highly seasonal with the largest extent of the precipitation received between the months of November and March. The period between May and September is exceedingly dry and only occasional and small rainfall events are recorded. The nature of precipitation is generally in the form of convective thundershowers (refer Graph 2). Because of the erratic and seasonal nature of rainfall of the region, average precipitation on a geographic scale is highly variable, but an annual average precipitation of approximately 533.8 mm is indicated.



Graph 2: Average monthly rainfall
(www.worldweatheronline.com)

Predominant winds are highly erratic in both direction and strength (refer Graph 3) with windspeeds ranging between 5 and 20 km/h.



Graph 3: Average wind speed and direction
(www.meteoblue.com)

17 TOPOGRAPHY, RELIEF AND SLOPES

Spatially heterogeneous habitat types provide critically important services in the habitat preferences of numerous fauna and flora species. High biodiversity levels are therefore a typical feature of hills and ridges, which also represent important habitat types for sensitive species. The preservation and effective management of these landscape features on a local and regional scale will therefore provide impetus for successful conservation of sensitive habitat types and biodiversity.

The general region is typified as 'Slightly Irregular Plains', with slopes ranging between 0 and 9 %, generally sloping in a northwestern direction from approximately 709 m in the southeast (airstrip) to a low of 638 in the northwestern corner, implying a drop of 71 m across a distance of 6 km (1.1 %) (refer Figure 8). However, numerous small topographic variations are noted from the presence of drainage lines and elevated crests with a relief between 30 and 210 m, which translates to moderate micro-habitat variability across the larger region.

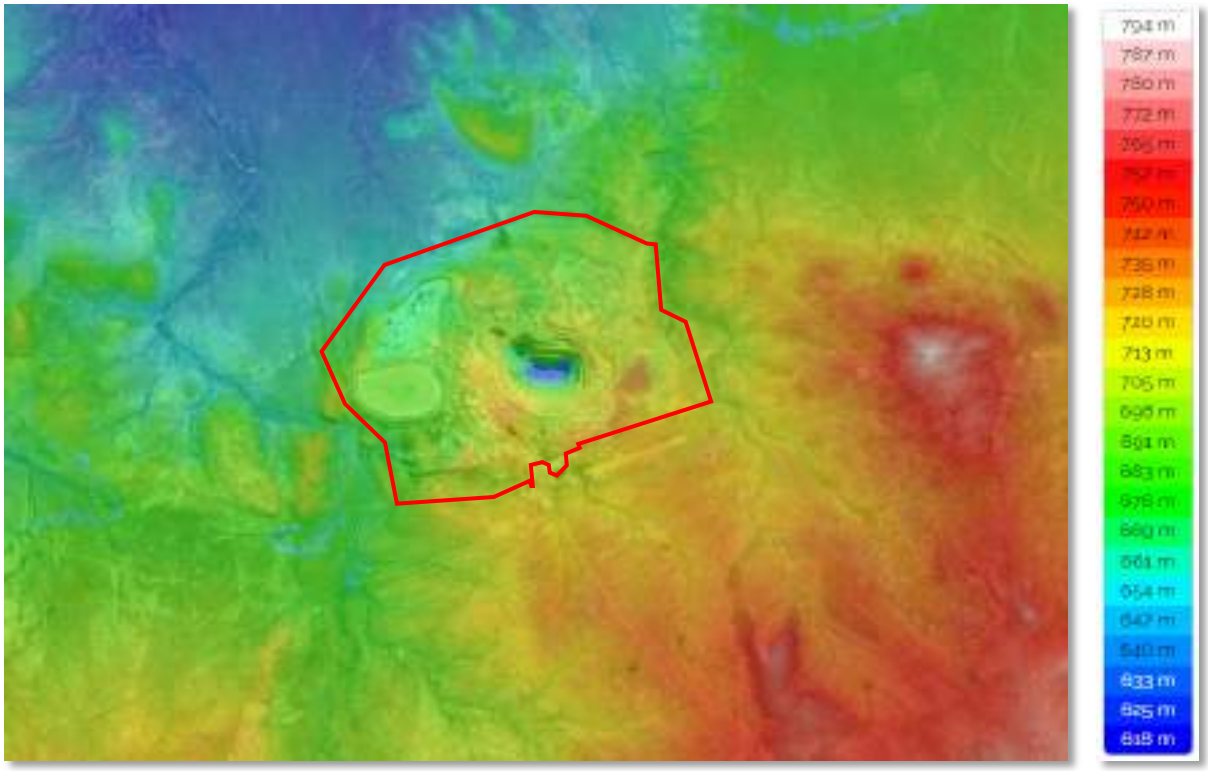


Figure 8: Topographical variations of the immediate region

18 WETLANDS AND SURFACE HYDROLOGY

Water, salt, and processes linked to concentration of both are the major controls of the creation, maintenance, and development of peculiar habitats. Habitats formed in and around flowing and stagnant freshwater bodies, experiences waterlogging (seasonal or permanent) and flooding (regular, irregular, or catastrophic), leading to the formation of special soil forms and unique habitat types. Invariably, both waterlogged and salt-laden habitats appear as 'special', deviating strongly from the typical surrounding zonal vegetation. They are considered to be of azonal character (Mucina & Rutherford, 2006). Water, in conjunction with geology, soil, topography and climate, is responsible for the creation of remarkably many types of habitats. Water chemistry, temperature, and temporary changes in both, together with the amount of water (depth of water column), timing of occurrence (regular tides or irregular floods) and speed of its movement (discharge, flow, and stagnation) are the major factors shaping the ecology of biotic communities occupying such habitats (VEGMAP, 2006).

Ecotones (areas or zones of transition between different habitat types) are occupied by species occurring in both the bordering habitats, and are generally rich in species due to the confluence of habitats. In addition to the daily visitors that utilise the water sources on a frequent basis, some flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas, exhibiting extremely low tolerance levels towards habitat variation. Ecotonal interface areas form narrow bands around areas of surface water, and they constitute extremely small portions when calculated on a purely mathematical basis. However, considering this high species richness, these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as an important distribution method for plant seeds.

The study area is situated in the Limpopo Primary Catchment area, which represents the northernmost water management area in South Africa and represents part of the South African portion of the Limpopo Basin which is also shared by Botswana, Zimbabwe and Mozambique. There are no RAMSAR site within the proximity to the study area, while wetlands occupy only 0.58 % of the Musina Local Municipality.

The study areas are drained mainly by surface run-off that concentrates in small non-perennial streams, eventually draining in a northern direction towards the Limpopo River. However, surface drainage within the Venetia Mine property has been heavily modified as a result of infrastructure developments , which includes stormwater management, artificial impoundments, clean- and dirty water facilities, pollution control facilities, paddocks, and evaporation dams. Specifically, the Kolope and Matotwane Rivers are situated on the western and eastern perimeter of the Venetia Mine perimeter, respectively (refer **Figure 9**). Smaller watercourses and non-perennial drainage lines feed into these systems.

Figure 9: Drainage lines and areas of surface water in the surrounds of the study sites

SECTION D: TERRESTRIAL ECOLOGICAL SENSITIVITY AND REGIONAL CONSERVATION EFFORTS

19 BACKGROUND

The preservation, and management, of natural habitat has become a priority on a local, regional, and national basis, hence the development of conservation tools, such as the Limpopo Province Conservation Plan and all developments need to be scrutinised to ascertain the biological diversity and inherent ecological sensitivity of the remaining habitat. The following categories were employed in establishing the ecological sensitivity of the range of habitat types within the study area:

Low No natural habitat remaining, poor species composition, low biodiversity; this category is represented by developed/ transformed areas, nodal and linear infrastructure, areas of agriculture or cultivation, areas where exotic species dominate exclusively, mining land (particularly surface mining), etc. The possibility of these areas reverting to a natural state is impossible, even with the application of detailed and expensive rehabilitation activities. Similarly, the likelihood of species of conservation importance occurring in these areas is regarded negligent.

Medium – low Areas where the natural habitat is degraded, with the important distinction that the vegetation has not been entirely decimated and a measure of the original vegetation remain, albeit dominated by secondary climax species. The likelihood of species of conservation importance occurring in these areas is regarded low. These areas also occur as highly fragmented and isolated patches, typical to cultivated fields, areas that have been subjected to clearing activities and areas subjected to severe grazing pressure. The species composition of these areas is typically low and is frequently dominated by a low number of species, or invasive plants.

Medium Indigenous natural habitat that comprehend habitat with a high diversity, but characterised by moderate to high levels of degradation, fragmentation and habitat isolation. Also includes areas where species of conservation importance could potentially occur, but habitat is regarded marginal;

Medium – high Indigenous natural vegetation that comprehend a combination of the following attributes:

- The presence of habitat that is suitable for the presence of these species;
- Areas that are characterised by a high/ moderate-high intrinsic floristic diversity;
- Areas characterised by moderate to low levels of habitat fragmentation and isolation;
- Regional vegetation types that are included in the lower conservation categories, particularly prime examples of these vegetation types;
- Low to moderate levels of habitat transformation;
- A moderate to high ability to respond to disturbance factors;

It may also include areas that are classified as protected habitat, but that are of a moderate status;

High Indigenous natural vegetation that comprehend for a combination of the following attributes:

- The presence of species of conservation importance, particularly threatened categories (Critically Endangered, Endangered, Vulnerable);
- Areas where 'threatened' species are known to occur, or habitat that is highly suitable for the presence of these species;
- Regional ecological types that are included in the 'threatened' categories (Critically Endangered, Endangered, Vulnerable), particularly prime examples of these vegetation types;
- Habitat types are protected by national or provincial legislation (Lake Areas Act, National Forest Act, draft Ecosystem List of NEM:BA, Mountain Catchment Areas Act, Ridges Development Guideline, Integrated Coastal Zone Management Act, etc.); and

- Areas that have an intrinsic high biodiversity (species richness, unique ecosystems), with particular reference to Centres of Endemism.

High sensitivity areas are generally also characterised by low transformation rates and habitat isolation levels and contribute significantly on a local and regional scale in the ecological functionality of nearby and dependent ecosystems, with particular reference to catchment areas, pollination and migration corridors, genetic resources, etc. A major reason for the high conservation status (sensitivity) of these areas is a poor ability to respond to disturbances (low plasticity and elasticity characteristics).

20 PROTECTED AREAS

Venetia Mine is situated approximately 20 km south of the Mapungubwe National Park, which represents the nearest declared conservation area. The proposed development sites are situated, mostly, within the Venetia Mine perimeter, which is situated within the Venetia Limpopo Nature Reserve. The reserve comprises approximately 33,000 ha, and is wholly owned and managed by the De Beers Diamond Mining Company, but does not have formal (national, declared) status. The reserve is home to abundant plant and animal life and is considered ecologically sensitive. Any impacts that results in deterioration, or losses, of natural habitat within the conservation area, is therefore considered significant.

21 THREATENED ECOSYSTEMS DATABASE

The National List of Threatened Ecosystems (2011) information source indicates that the study sites are not situated in proximity to any of the threatened ecosystems from a regional perspective. The closest threatened ecosystem is represented by the Mapungubwe/ Greefswater Riverine Forest, which is situated approximately 22 km to the north (spatially included in the Mapungubwe National Park).

22 VEGMAP CONSERVATION CATEGORIES

The Venetia Mine and proposed development footprints are situated within the Limpopo Ridge Bushveld (SVmp2) and Musina Mopane Bushveld (SVmp1) ecological types, as described by Vegmap (2018). Both these types were ascribed a conservation status of Least Threatened. No other vegetation type with an elevated conservation status is situated in the immediate surrounds of the study sites.

23 ANNOTATIONS ON LIMPOPO PROVINCE CRITICAL BIODIVERSITY AREAS AND ECOLOGICAL SUPPORT AREAS (DRAFT C-PLAN, 2018)

This bioregional plan was developed in 2018 and is based primarily on datasets and information available at the time, notably from the Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) that were identified and delineated for the Limpopo Conservation Plan V2 (LCPv2, 2013). It should be noted that, since is the first comprehensive bioregional plan, it does not replace any other bioregional plans, but serves as the primary biodiversity information source to a range of planning and land-use authorisation processes.

The purpose of a bioregional plan is to facilitate the safeguarding of biodiversity within identified biodiversity priority areas that fall outside of the Protected rea (PA) Network, as well as providing a map of biodiversity priorities with accompanying land use planning and decision-making guidelines to inform land-use planning, environmental assessment and authorisations, and natural resource management. One of the outputs of this bioregional plan is the updating of the LCPv2 in response to potential losses and threats that were identified during the alignment process undertaken during the development of the original plan, the CBAs and ESAs of the LCPv2 to ensure that biodiversity targets remained intact within the District. Specifically the following are noted:

⇒ Losses due to land uses that result in irreversible modification of natural habitat;
⇒ Threat due to altered land uses; and
⇒ Threats due to incompatible DSDF zonation.

The following categories were implemented for the Limpopo C Plan:

Protected Areas:

Declared and formally protected areas under the Protected Areas Act, such as National Parks, Nature Reserves, World Heritage Sites and Protected Environments that are secured by appropriate legal mechanisms. Recommendations for this category include maintaining of the current status or obtaining formal conservation protection.

Critical Biodiversity Areas (CBAs):

Sites that are required to meet biodiversity targets for ecosystems and species and need to be maintained in good ecological condition. The majority of the CBAs are CBA1, which can be considered irreplaceable in that there is little choice in terms of areas available to meet targets. If CBA1 areas are not maintained in a natural state, then targets cannot be achieved. Those areas falling within CBA2 are considered optimal. Although they represent areas where there are other spatial options for achieving targets, the selected sites are the ones that best achieve targets of the systematic biodiversity plan. Recommendations for this category include obtaining formal conservation protection where possible, and the implementation of appropriate zonation to avoid loss of intact habitat or intensification of land use.

Ecological Support Areas (ESAs):

Areas that are important for supporting the ecological functioning of CBAs and protected areas and for meeting biodiversity targets for ecological processes. This category has also been split into ESA1s and ESA2s on the basis of land cover. ESA1s are in a largely natural state, and are important for supporting CBAs, while ESA2s are no longer intact, but potentially retain significant importance from an ecological process perspective (e.g. agricultural land maintaining landscape connectivity). Recommendations for this category include implementation of appropriate zoning and land management guidelines to avoiding impacting of ecological processes, avoiding intensification of land use and avoiding fragmentation of the natural landscape, also avoiding conversion of agricultural land to more intensive land uses, which may have a negative impact on threatened species or ecological processes.

Other Natural areas (ONAs):

Areas that still contain natural habitat but that are not required to meet biodiversity targets. Recommendations for this category is subject to town and regional planning guidelines and policies.

No Natural Habitat Remaining (NNRs):

Areas without any remaining intact habitat remaining, entirely transformed. Recommendations for this category is subject to town and regional planning guidelines and policies.

Results and Discussion:

This information source designated the existing Venetia Mine footprint and proposed development footprint areas, as inclusive of the following categories (refer Figure 48):

⇒ No Natural Habitat Remaining;
⇒ Other Natural Areas (natural habitat of indeterminate status);
⇒ Ecological Support Areas (2);
⇒ Ecological Support Areas (1); and

⇒ Critical Support Areas (2).

The nodal and transformed status of much of the natural habitat from the Venetia Mine, spatially situated within a natural (and conserved) area of natural and pristine habitat is evident from **Figure 10**. The author is in general agreement with the accuracy of assigning conservation value to the respective categories, although minor discrepancies are noted from recent transformation and persistent habitat deterioration and the likely result of data with a coarse scale and outdated information on a local scale. For the purpose of this assessment, however, the assessment is considered sufficiently accurate to demonstrate the terrestrial importance assigned to remaining natural habitat from a regional perspective.

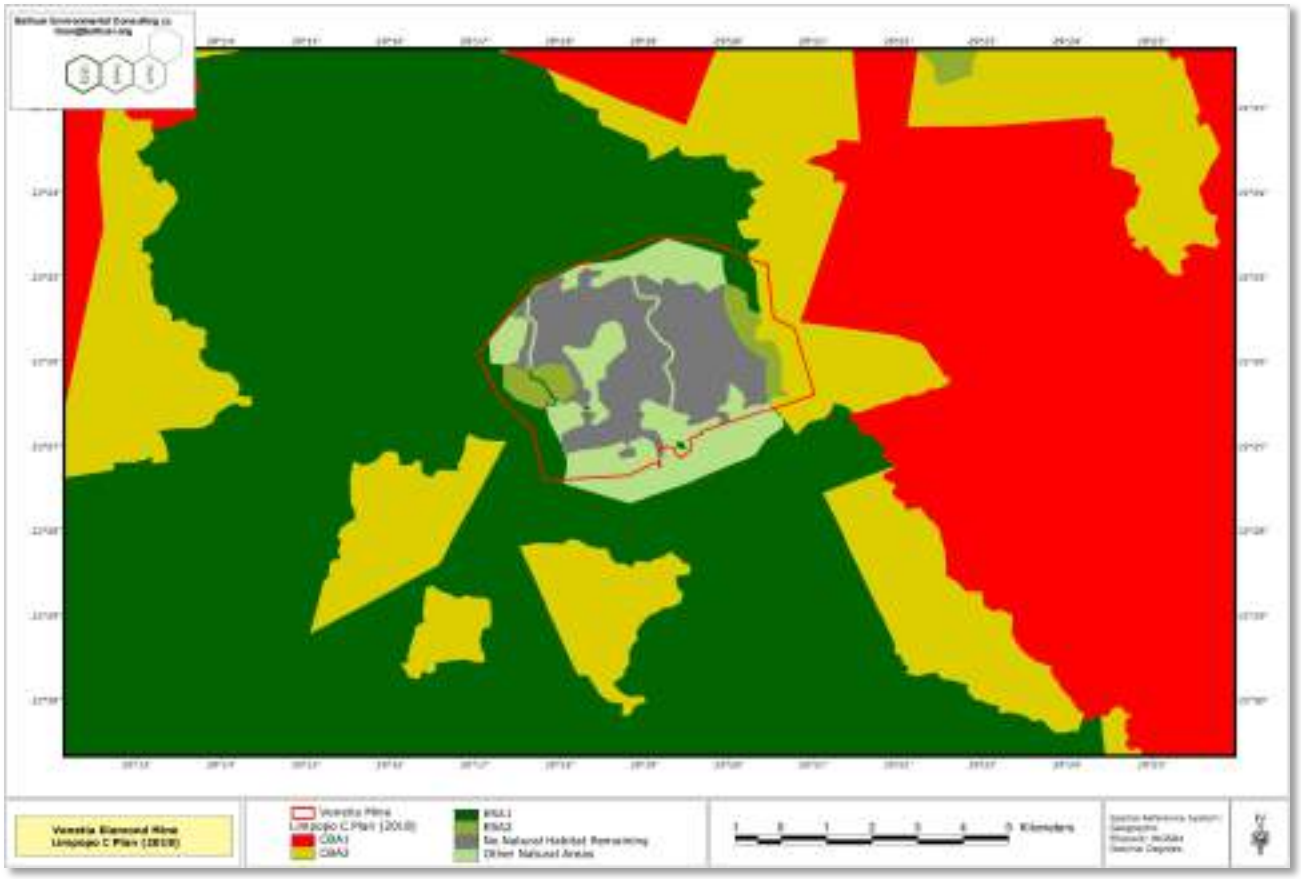


Figure 10: Limpopo Bioregional Conservation Plan (2018) for the immediate region
Please note that this information source is still in draft form and should not be disseminated indiscriminately

24 TERRESTRIAL BIODIVERSITY ATTRIBUTES CONTRIBUTING TO THE ECOLOGICAL SENSITIVITY

In addition to local and regional sensitivity patterns of this chapter, Section E indicated the moderate floristic sensitivity of most of the remaining natural woodlands within the proposed development footprints. However, natural woodlands situated on the perimeter, and within, the adjacent VLNR is considered to exhibit floristic sensitivity attributes of moderately high floristic sensitivity, informed by the following characteristics, and which will be considered during the impact assessment on the floristic receiving environment:

Positive:

⇒ Presence of several protected tree species that are subject to pe2rmitting requirements (DFFE);
⇒ Spatial proximity to the Venetia Limpopo Nature Reserve;
⇒ Pristine and natural status of much of the remaining natural woodland habitat within the development footprints;
⇒ High correlation the regional ecological types;
⇒ Spatial proximity to sensitive riparian habitat types; and
⇒ Moderate to high floristic diversity.

Negative:

⇒ Poor floristic and fauna diversity recorded from certain sites, notably those that are situated in proximity to intensive and transformative mining-related activities;
⇒ Existing high impacts from surrounding mining-related activities;
⇒ Requirements for protection of adjacent natural habitat from effluents and run-off from mining areas (the purpose of the project);
⇒ Least concern conservation status of the regional ecological types; and
⇒ Highly deteriorated status of extensive parts of the proposed footprints from mining activities.

SECTION E: BOTANICAL ATTRIBUTES OF THE AREA

25 TERMS OF REFERENCE FOR THE BOTANICAL ASSESSMENT

Based on the Scope of Works, this report is guided by:

⇒ Establishing the nature of the project and activities that are likely to affect the areas' botanical attributes and ecological receiving environment;

⇒ Assimilating and appraise existing records, data and reports that is available for the project area, with particular reference to results of the National Environmental Screening Tool;

⇒ Providing a local and regional context of the botanical nature and pertinent floristic attributes that characterise the area, taking cognizance of relevant biodiversity plans and bioregional planning documents for the region;

⇒ Conducting strategic site investigations to collate required botanical data, with reference to national guidelines and protocols for biodiversity studies;

⇒ Providing a clear description of the broad floristic attributes of the study areas and immediate surrounds. The following shall be identified and described where appropriate:

- Community and ecosystem level;
- Species level; and
- Other pattern issues;

⇒ Defining and mapping different broad-scale habitat types based on an evaluation of available aerial imagery and site investigations from the respective sites;

⇒ Compile species inventories that are present within each of the affected areas, based on strategic sampling and observation methods and an appraisal of available information sources;

⇒ Identifying key natural resources, with emphasis on environmental sensitivities, wetlands; ecology, red data communities, conservation important species and ecological types, that exist or may exist within the development areas;

⇒ Identifying ecologically valuable (threatened, protected and Red Data) species, communities and habitat types;

⇒ Providing a clear description of perceived floristic sensitivity aspects towards the proposed activity;

⇒ Providing a clear description of the ecological sensitivity of the environment as well as the local and regional conservation value of the various flora species and habitat types;

⇒ Compiling a sensitivity analysis of the receiving environment with the aim to highlight areas of particular (high) botanical and/ or ecological sensitivity;

⇒ Providing a prediction, assessment, and evaluation of potentially significant **direct and indirect impacts** in terms of botanical nature, ecological processes, species, and ecosystem services of concern (where relevant);

⇒ Providing a comprehensive assessment of the nature and extent of **cumulative impacts** on the botanical receiving environment; and

⇒ Providing a mitigation and management approach that will aid in minimising impacts on the environment.

This botanical assessment will be informed by (*inter alia*) the following information sources:

⇒ Satellite imagery;

⇒ IUCN and Regional Red List information;

⇒ NEWPOSA;

⇒ National Vegetation Map;

⇒ Available reports and biodiversity assessments; and

⇒ BGIS information source.

26 REGIONAL ECOLOGY AND FLORISTIC PATTERNS

26.1 BACKGROUND TO THE SAVANNA ECOLOGY

The Savanna Biome is the largest biome in southern Africa, covering about 46 % of its area. The term savanna is widely accepted as describing a vegetation type with a well-developed grassy layer and an upper layer of woody plants. Many environmental factors correlate with the distribution of different savanna vegetation types, including landform, climate, soil types, fire and a very specific fauna. South African savannas of nutrient-poor substrates are characteristically broad-leaved and without thorns, while those of nutrient-rich substrates are fine-leaved and thorny (Knobel, 1999).

The diversity of African savanna is exceptional, comprising more than 13,000 plant species, of which 8,000 are savanna endemics, more specifically, dry savannas have more than 3,000 species. This diversity equals that of the South African grasslands and is exceeded only by the Fynbos Biome (Knobel 1999). Similarly, in respect of animal diversity, savannas are without peer, including approximately 167 mammals (15 % endemism), 532 birds (15 % endemism), 161 reptiles (40 % endemism), 57 amphibians (18 % endemism) and an unknown number of invertebrates (Knobel, 1999). Flagship species include the Starburst Horned Baboon Spider (*Ceratogyrus bechuanicus*), ground Hornbill (*Bucorvus leadbeateri*), Cape Griffon (*Gyps coprotheres*), Wild dog (*Lycaon pictus*), Short-Eared Trident Bat (*Cloeotis percivali*) and the White Rhino (*Ceratotherium simum*) (EWT, 2002).

Conservation within and of the savanna biome is good in principle, mainly due to the presence of a number of wildlife reserves. Urbanisation is not a threat, perhaps because the hot, dry climate and diseases prominent in the savanna areas have hindered extensive urban development. Much of the savanna regions are used for game farming and the importance of tourism and big-game hunting in the conservation areas must not be underestimated. Savannas are the basis of the African wildlife and ecotourism industry and play a major role in the meat industry, but surprisingly little is known about the vegetation as most studies have been done in nature reserves and game farms.

The vegetation that characterises this area has developed many survival strategies, including the ability to produce tannins that are triggered when the leaves are browsed, the production of toxic sap, the development of thorns or their adaptation to sourveld areas that are not generally favoured by grazers. The interaction of vegetation, fire and animals play important roles in maintaining savanna ecosystems (Knobel, 1999). Over thousands of years, the savanna system and the antelope that inhabit them have developed side by side. Grasses, for example, have become well adapted to defoliation, as much a defensive response to constant pressure by grazers as to the regular veld fires that rage through the savanna in the dry seasons. The success of grasses has been a constantly renewed vast reservoir of food upon which large herds of grazers flourish. The woody component is also constantly exploited by many browsers, and with so many herbivores present, the carnivore component of the complex ecological system has also flourished (Knobel, 1999).

The savanna biome is populated by a greater diversity of bird species than any other biome in South Africa. The presence of both woody plants and a well-developed herbaceous layer provides diverse sources of food and shelter for specialist and generalist bird species, including seedeaters, insectivores and diurnal and nocturnal birds of prey abound. Much of the area is used for game farming and big game hunting, illustrating that utilisation and conservation of an area are not mutually exclusive. The savanna biome is the core of the wildlife, ecotourism and meat-production industries. Threats include rapidly expanding development of settlements for impoverished human populations and the associated need for firewood and building materials, diminishing water supply, agriculture and over-grazing (Knobel, 1999).

The study areas are situated in the Mopane Bioregion of the Savanna Biome, more specifically comprising ecological types described by Mucina and Rutherford (2006) as the Musina Mopane Bushveld (SVmp1) and Limpopo Ridge Bushveld (SVmp2) (refer **Figure 11**).

26.2 LIMPOPO RIDGE BUSHVELD (SVMP2)

This unit is situated on hills and ridges, such as Madiapala in the lower Mogalakwena River basin in the west through a cluster of hills in the Pontdrif area including Poortjieberg and Tsolwe, eastwards including Mapungubwe Mountain in the Mapungubwe National Park through to the hills and ridges in the vicinity of the Limpopo River further downstream. It also comprises hills and ridges that is situated far away from the river north of the Soutpansberg and generally east of the Sand River through to some rugged areas in the far northern Kruger National Park. Altitude ranges from about 300 m in the east to 700 m, with the top of a few hills, in the west at around 1,000 m.

The vegetation manifests as moderately open savanna with a poorly developed ground layer on extremely irregular plains with ridges and hills. Umbrella-shape canopied *Kirkia acuminata* is prominent on some of the ridge skylines with the often enormous *Adansonia digitata* on shallow calcareous gravels; the shrub *Catophractes alexandri* is locally dominant on these calcareous-silicate soils. These are particularly striking landscapes with rock walls and passages within areas of sandstone of the Clarens Formation (e.g. within the Mapungubwe National Park). Soils are generally shallow gravel and sandy (Glenrosa and Mispah soil forms) to calcareous clayey soil in the bottomland positions. The conservation status of this unit is Least threatened. With a target of 19 %, some 18 % is already statutorily conserved, mainly in the Kruger and Mapungubwe National Parks. An additional 2 % is also conserved in the Baobab Tree Reserve and only about 1 % is transformed, mainly for cultivation and mining.

Important taxa for this unit include:

Tall Trees:	*Adansonia digitata* (d), *Senegalia (Acacia[1]) nigrescens* and *Sclerocarya birrea* subsp. *caffra*.
Small Trees:	*Colophospermum mopane* (d), *Commiphora glandulosa* (d), *C. tenuipetiolata* (d), *Terminalia prunioides* (d), *Senegalia (Acacia) senegal* var. *leiorhachis*, *Vachellia (Acacia) tortilis* subsp. *heteracantha*, *Boscia albitrunca*, *Combretum apiculatum*, *C. imberbe*, *Commiphora mollis*, *Ficus abutilifolia*, *F. tettensis*, *Kirkia acuminata*, *Sterculia rogersii* and *Ximenia americana*.
Tall Shrubs:	*Catophractes alexandri*, *Commiphora pyracanthoides*, *Gardenia resiniflua*, *Grewia bicolor*, *G. villosa*, *Hibiscus calyphyllus* and *H. micranthus*.
Low Shrubs:	*Barleria affinis*, *Blepharis diversispina*, *Neuracanthus africanus*, *Plinthus rehmannii*, and *Ptycholobium contortum*.
Woody Climber:	*Cissus cornifolia*.
Graminoids:	*Aristida adscensionis*, *A. stipitata* subsp. *graciliflora*, *Digitaria eriantha* subsp. *eriantha*, *Enneapogon cenchroides*, *Panicum maximum*, *Schmidtia pappophoroides* and *Stipagrostis uniplumis*.
Succulent Herb:	*Tavaresia barklyi.*

Endemic taxa that are found in this unit include:

Low Shrub:	*Pavonia dentata*
Herb:	*Cleome oxyphylla* var. *robusta*.

[1] Note: Recently the *Acacia* genus has controversially been split into several genera, with Africa's indigenous *Acacia* now being categorises as either *Senegalia* or *Vachellia*. While the author do not accept the validity of the new nomenclature, the newest nomenclature are nonetheless provided.

26.3 MUSINA MOPANE BUSHVELD (SVMP1)

The Musina Mopane Bushveld is found on undulating plains from around Baines Drift and Alldays in the west, remaining north of the Soutpansberg and south of the Limpopo River (but also occurring to the north in Zimbabwe), through Musina and Tshipise to Malongavlakte, Masisi and Banyini Pan in the east. Altitude range between 300 m in the eastern Limpopo Valley, to approximately 800 m. The vegetation occupies undulating to very irregular plains and scattered hills. The western section comprises open woodland to moderately closed shrubveld that is dominated by *Colophospermum mopane* on clayey bottomlands and *Combretum apiculatum* woodland on hills. In the eastern section, on basalt, the vegetation conforms to moderately closed to open shrubveld that is dominated by *Colophospermum mopane* and *Terminalia prunioides*. On areas with deep sandy soils, moderately open savanna dominated by *Colophospermum mopane*, *T. sericea*, *Grewia flava* and *Combretum apiculatum*. The vegetation is generally well developed, specifically on the basalt, but it opens during the dry season. A poorly developed herbaceous layer is typical in areas with dense *Colophospermum mopane* shrubs, for example, north of Alldays bordering the Limpopo floodplain.

Soils are highly variable, from deep red and brown clays to moderately deep, dark, heavy clays or deep, freely drained sandy soils to shallower types including skeletal Glenrosa and Mispah soil forms. The conservation status is considered Least threatened and only 2 % statutorily conserved mainly in the Mapungubwe National Park as well as in Nwanedi and Honnet Nature Reserves. Additionally, about 1 % is statutorily conserved in the Baobab Tree Reserve. Roughly 3 % is already transformed, mainly by cultivation.

The unit is the most diverse mopaneveld type in South Africa and the Musina region has the highest species richness - also relative to the *Colophospermum mopane* – dominated areas in Namibia and the Save River Valley in Zimbabwe (F. Siebert et al. 2003). The relationship of this unit with the adjacent and often fragmented parts of SVmp 2 Limpopo Ridge Bushveld is spatially complex. Important taxa for this unit include:

Tall Trees:	*Senegalia* (*Acacia) nigrescens*, *Adansonia digitata* and *Sclerocarya birrea* subsp. *caffra*.
Small Trees:	*Colophospermum mopane* (d), *Combretum apiculatum* (d), *Senegalia (Acacia) senegal* var. *leiorhachis*, *Vachellia tortilis* subsp. *heteracantha*, *Boscia albitrunca*, *B. foetida* subsp. *rehmanniana*, *Commiphora glandulosa*, *C. tenuipetiolata*, *C. viminea*, *Sterculia rogersii*, *Terminalia prunioides*, *T. sericea* and *Ximenia americana*.
Tall Shrubs:	*Grewia flava* (d), *Sesamothamnus lugardii* (d), *Commiphora pyracanthoides*, *Gardenia volkensii*, *Grewia bicolor*, *Maerua parvifolia*, *Rhigozum zambesiacum* and *Tephrosia polystachya*.
Low Shrubs:	*Acalypha indica*, *Aptosimum lineare*, *Barleria senensis*, *Dicoma tomentosa*, *Felicia clavipilosa* subsp. *transvaalensis*, *Gossypium herbaceum* subsp. *africanum*, *Hermannia glanduligera*, *Neuracanthus africanus*, *Pechuel-Loeschea leubnitziae*, *Ptycholobium contortum* and *Seddera suffruticosa*.
Succulent Shrub:	*Hoodia currorii* subsp. *lugardii.*
Herbaceous Climber:	*Momordica balsamina*.
Graminoids:	*Schmidtia pappophoroides* (d), *Aristida adscensionis*, *A. congesta*, *Bothriochloa insculpta*, *Brachiaria deflexa*, *Cenchrus ciliaris*, *Digitaria eriantha* subsp. *eriantha*, *Enneapogon cenchroides*, *Eragrostis lehmanniana*, *E. pallens*, *Fingerhuthia africana*, *Heteropogon contortus*, *Sporobolus nitens*, *Stipagrostis hirtigluma* subsp. *patula*, *S. uniplumis*, *Tetrapogon tenellus* and *Urochloa mosambicensis*.
Herbs:	*Acrotome inflata*, *Becium filamentosum*, *Harpagophytum procumbens* subsp. *transvaalense*, *Heliotropium steudneri*, *Hermbstaedtia odorata* and *Oxygonum delagoense*.

Succulent Herbs: *Stapelia gettliffei, S. kwebensis.*

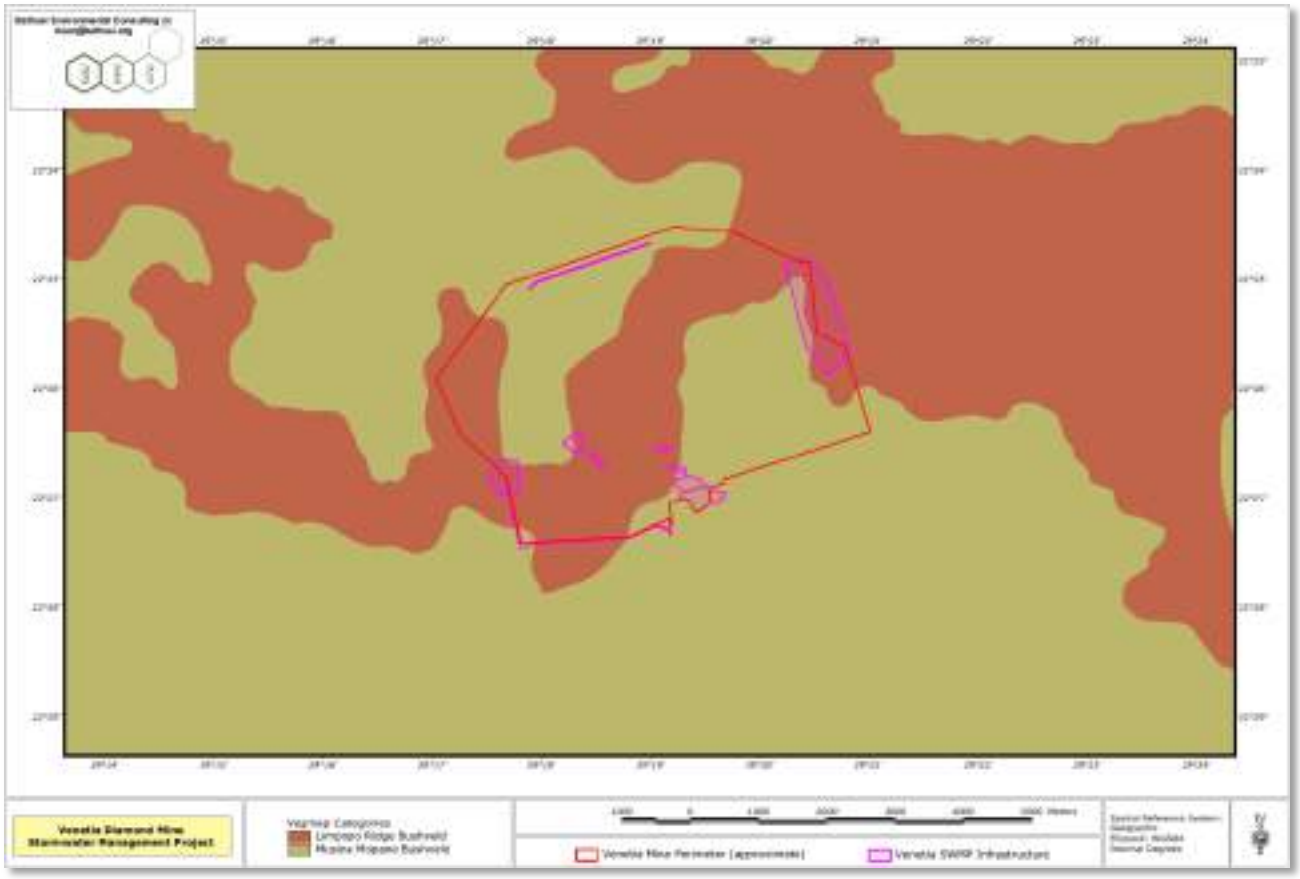


Figure 11: Regional Ecological Types (Vegmap)

27 FLORISTIC DIVERSITY

27.1 REGIONAL FLORISTIC DIVERSITY RECORDS (NEWPOSA, 2021)

Information obtained from the SANBI database (NEWPOSA 2021) indicates the known presence of approximately 517 plant species within the immediate region of the study area. Data records were selected within the immediate region from an area approximately between S22.3°, E29.1° and S22.6°, E29.5° (refer **Figure 12**), equating to approximately 1,370 km². The general region exhibits a high paucity of accurate and comprehensive floristic sampling records.

Despite the paucity of accurate and comprehensive floristic data for the region, the known diversity reflects the high regional diversity context of the Savanna Biome, as well as the regional ecological type of the local ecological types (refer **Sections 10.2 and 10.3**). It is therefore reasonable to expect that untransformed and pristine vegetation within the region is likely to exhibit a similarly moderate to high floristic diversity. To compile a comprehensive account of the floristic diversity, it is strongly recommended that surveys be executed during the height of the austral summer period and during a time when most plants are identifiable from reproductive material.

An appraisal of the growth forms of the region (refer **Graph 4**) indicates that herbs (209 species, 40.4 %) dominates the growth form patterns, although not always being physiognomically prominent. Grasses (72 species, 13.9 %), shrubs species (68 species, 13.2 %), and dwarf shrubs (42 species, 8.1 %) represent diverse growth forms, while trees, despite comprising only 35 species (6.8 %) of the floristic diversity, are typically dominant in the region, probably reflecting the fairly homogenous and monotonous nature of the vegetation. Climbers (29 species, 5.6 %) and succulents (26 species, 5.0 %) represent important, but poorly represented growth forms. The particularly low diversity of growth forms such

as geophytes, parasites, cyperoids, etc., is probably best explained by poor regional sampling records and efforts, rather than a true depauperate diversity.

The floristic diversity is represented by 90 plant families, dominated by Poaceae (grasses, 72 species, 13.9 %), Fabaceae (legumes, 66 species, 12.8 %), Malvaceae (34 species, 6.6 %) and Asteraceae (30 species, 5.8 %).

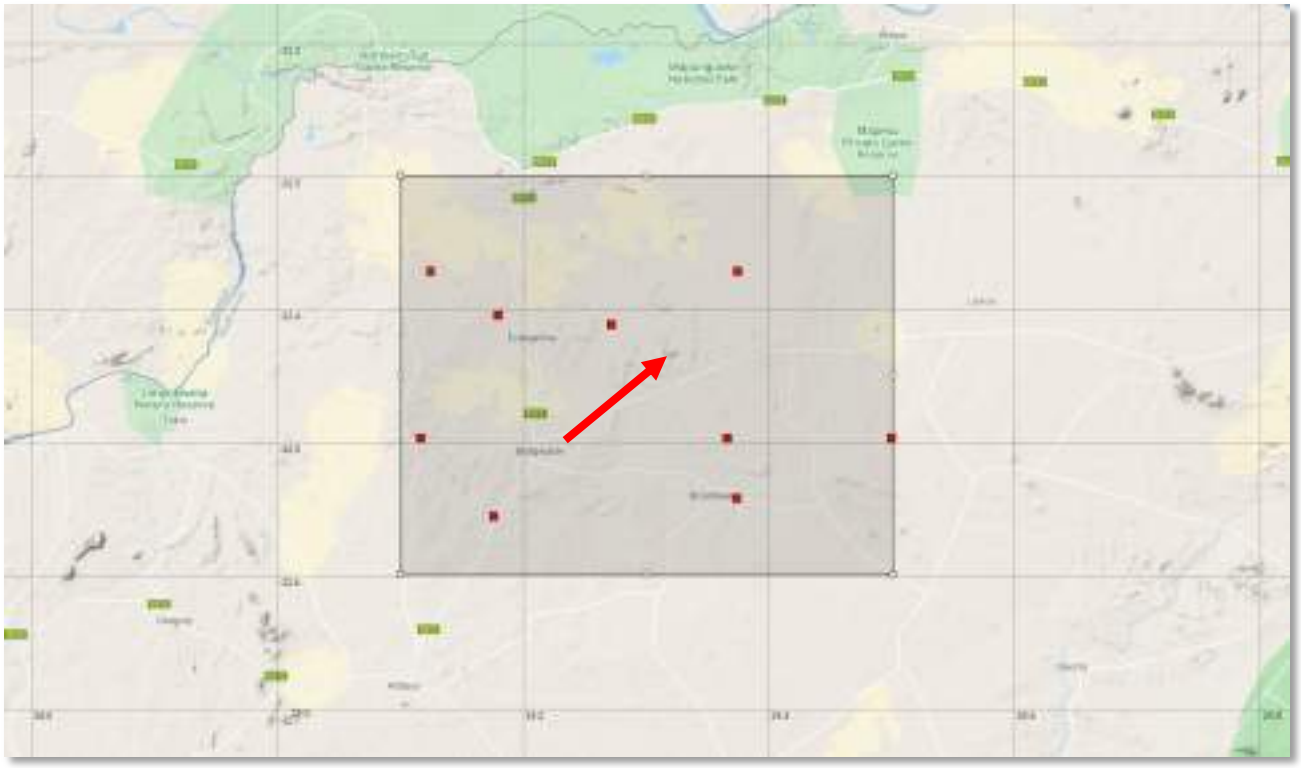
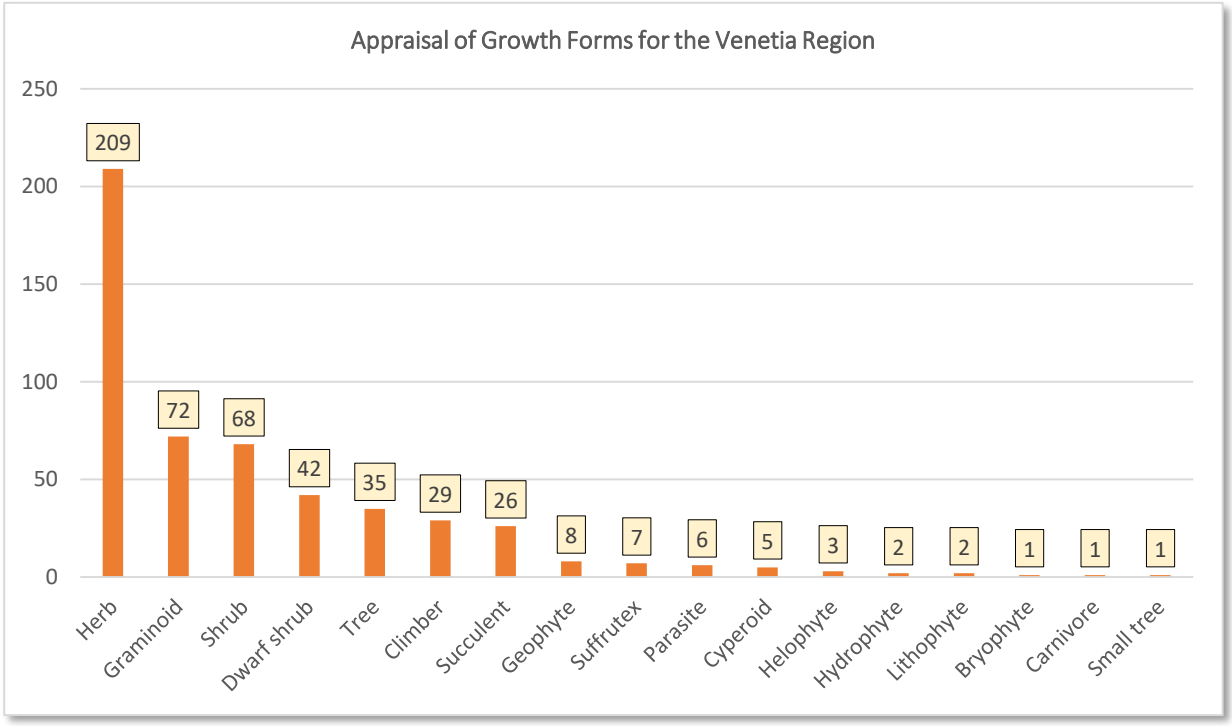


Figure 12: Floristic data records for the local region

Note red arrow for the approximate location of the study site, red squares for sampling localities



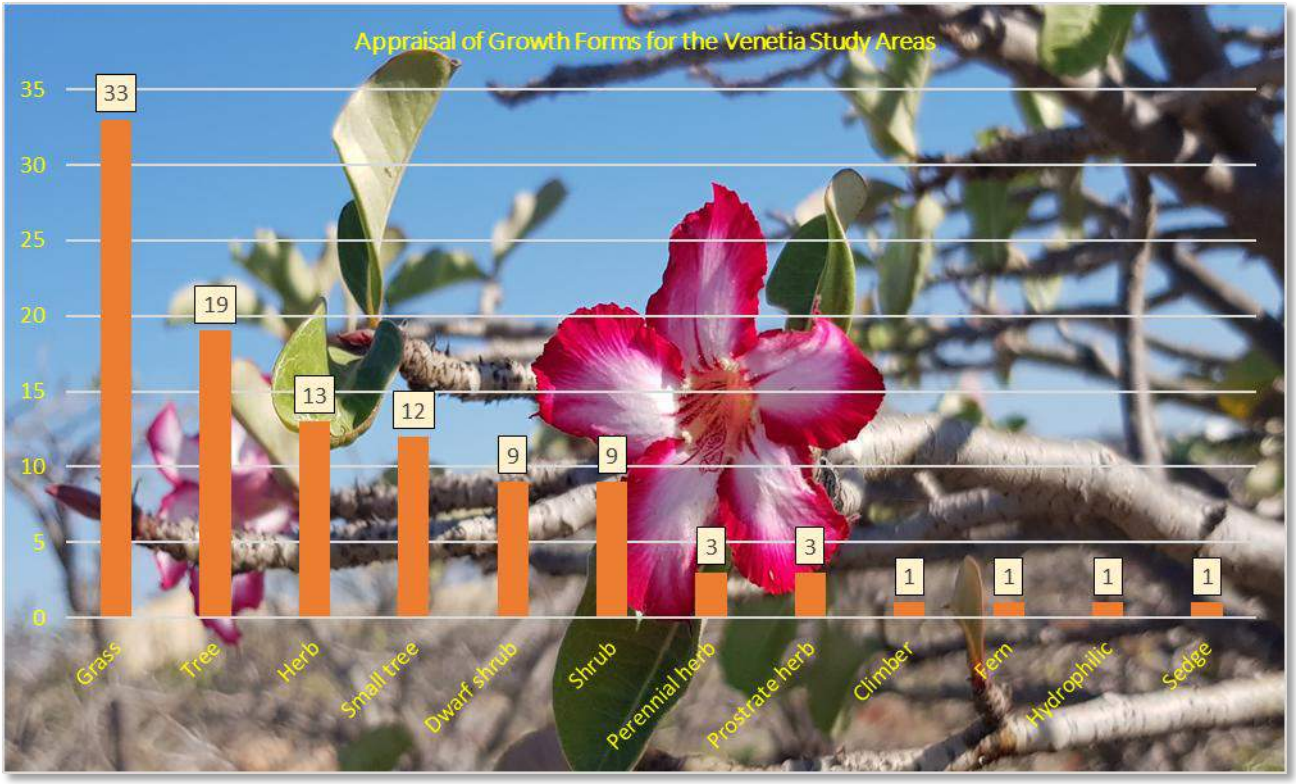
Graph 4: Plant growth form patterns for the region surrounding the Venetia Mine

27.2 FLORISTIC ALPHA DIVERSITY (SURVEY RESULTS, 2021)

A brief survey of the site revealed a floristic diversity of 105 plant species (refer **Appendix 1**), which corresponds (numerically) to 20.3 % of the sampling records from the wider study area, and reflecting a moderate floristic diversity, considering the comparative small survey areas. A total of 33 species of the species that have been recorded during this particular assessment, have not previously been recorded in the wider study area. However, these new distribution records might reflect under sampling or identification discrepancies, and further verification during seasonally appropriate (reproductive) times and more intensive assessments will result in higher accuracies from both the existing SANBI information source and results of the local studies. The moderate correlation to the regional diversity is also explained by the comparatively natural status of the remaining natural vegetation. A collage of images of selected plant species is presented in **Appendix 2.**

A brief review of the growth forms recorded from the site assessments also provides insight into the savannoid nature of the larger region, with the tree and shrub components collectively dominating the physiognomy, and the diversity to some extent. Notwithstanding, the herbaceous component of the vegetation is comparatively diverse, comprising an overwhelming percentage of grasses (33 species, 31.4%) and herbs 13 species (12.4 %). The homogenous nature of the vegetation is indicated by a low representation of growth forms such as geophytes, succulents, climbers, and species typically associated wetland and riparian vegetation types (refer **Graph 5**), also with reference to little variation in the species compositions and floristic diversity patterns that were recorded from various survey plots across the wider study area.

A total of 31 plant families were also recorded during this instantaneous survey bout, dominated by the Poaceae family (grasses, 34 species, 32.4 %), Fabaceae (15 species, 14.3 %) and Malvaceae (10 species, 9.5 %) were found to be moderately represented (refer **Table 5**).



Graph 5: Plant growth form patterns recorded on the site and immediate surrounds

Table 5: Appraisal of plant families recorded on the study sites		
Family	*Count*	*Percentage*
Anacardiaceae	1	1.0 %
Bignoniaceae	1	1.0 %
Boraginaceae	1	1.0 %
Caesalpiniaceae	1	1.0 %
Celastraceae	1	1.0 %
Convolvulaceae	1	1.0 %
Cucurbitaceae	1	1.0 %
Cyperaceae	1	1.0 %
Ehretiaceae	1	1.0 %
Euphorbiaceae	1	1.0 %
Kirkiaceae	1	1.0 %
Olacaceae	1	1.0 %
Pedaliaceae	1	1.0 %
Rhamnaceae	1	1.0 %
Rubiaceae	1	1.0 %
Selaginaceae	1	1.0 %
Tiliaceae	1	1.0 %
Zygophyllaceae	1	1.0 %
Acanthaceae	2	1.9 %
Amaranthaceae	2	1.9 %
Capparaceae	2	1.9 %
Scrophulariaceae	2	1.9 %
Sterculiaceae	2	1.9 %
Apocynaceae	3	2.9 %
Burseraceae	3	2.9 %
Solanaceae	3	2.9 %
Combretaceae	4	3.8 %
Asteraceae	5	4.8 %
Malvaceae	10	9.5 %
Fabaceae	15	14.3 %
Poaceae	34	32.4 %

28 PLANT SPECIES OF CONSERVATION CONCERN

28.1 BACKGROUND

The following information sources were consulted as background information for a brief evaluation of plant species of conservation concern:

1 SANBI Distribution data (NEWPOSA 2021), (IUCN Criteria, refer **Figure 13**);

2 National Forest Act of 1998 (protected tree species) (refer **Appendix 3**); and

3 Limpopo Environmental Management Act (Act No 7 of 2003, including Schedule 11 (Specially protected plants) and Schedule 12 (Protected plants) (Refer **Appendix 4**).

South Africa's Red List system is based on the IUCN Red List Categories and Criteria Version 3.1 (finalized in 2001) (http://www.iucnredlist.org), amended to include additional categories to indicate species that are of local conservation concern. The IUCN Red List system is designed to detect risk of extinction. Species that are at risk of extinction, also known as threatened or endangered species are those that are classified in the categories Critically Endangered (CR), Endangered (EN) and Vulnerable (VU). The South African Red List contains three additional categories (Critically Rare, Rare and Declining) to highlight plant species that are not in danger of extinction, but are of local conservation concern because they are rare, or there are threatening processes affecting their populations (refer **Figure 13**). These categories have been developed to highlight those taxa classified as Least Concern according to the IUCN system, should be considered in conservation prioritization processes. It is important to emphasize that the South African categories Critically Rare, Rare and Declining are intended for use in local conservation prioritization processes only. In submission

to the IUCN Red List of Threatened Species, these taxa have to be categorized according to the IUCN system and therefore their global status will be Least Concern.

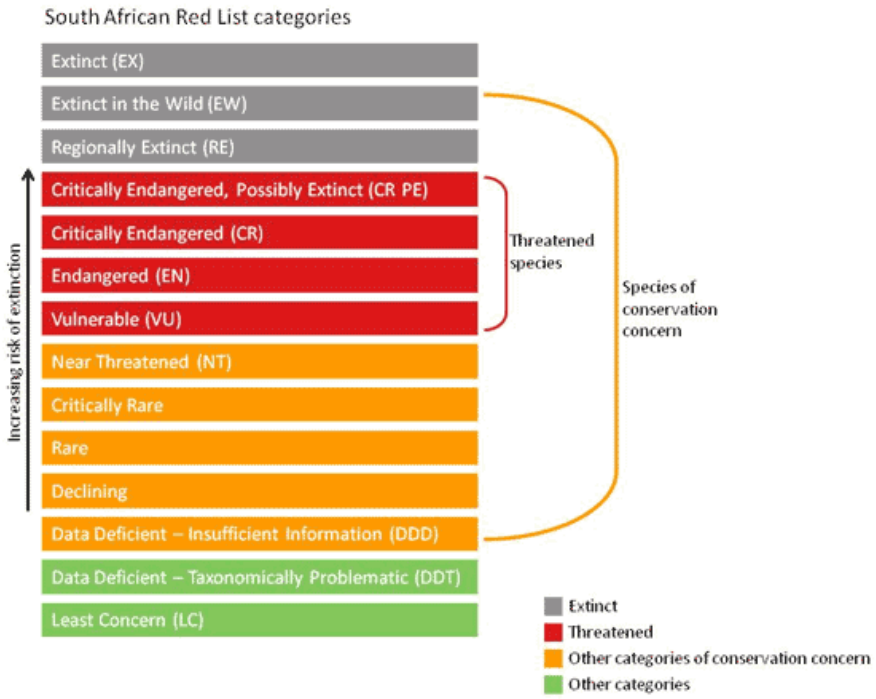


Figure 13: South African Red List Categories (courtesy of SANBI)

Guidelines for the assessment of Red List species include (but are not necessarily limited to):

⇒ A botanical specialist with local botanical and ecological knowledge and experience should undertake the survey;

⇒ A suitable survey should be undertaken; in the summer-rainfall areas of the country, botanical surveys should take place October to April while in the winter-rainfall areas they should take place between August and October;

⇒ Prior to visiting the site, the specialist consultant should download a list of species that could potentially occur at the site from POSA;

⇒ It is important that specimens are collected as part of the botanical survey, especially for taxonomic groups likely to be of conservation concern;

⇒ Plants should be identified to species level wherever possible, not genus level;

⇒ Species that may be dormant should also be reported;

⇒ Once specimens are collected, they should be identified at a herbarium. Potential species of conservation concern sampled should be identified by a taxonomist specializing in the plant group in question; and

⇒ Specialist botanists should also include in their reports a list of species of conservation concern that may occur at a site but may be dormant as a result of unfavourable environmental conditions, for example species that were not seen because the vegetation at a site has not been burnt for many years.

28.2 PLANT SPECIES OF CONSERVATION CONCERN – REGIONAL SAMPLING RECORDS (NEWPOSA, 2021)

Table 6 provides a list of SCC plants that have been recorded from the wider region surrounding the study site (refer Figure 12 for an indication of the geographical extent). Results of the site inspections indicated the confirmed presence of 4 of these species within the respective footprints (refer Table 7).

Table 6: Plant species of conservation concern recorded in the region (NEWPOSA, 2021)

Taxon	*IUCN category*	*Probability of Occurrence*
Adansonia digitata L.	LC (IUCN), Protected tree (NFA, 1998), LEMA (Schedule 12)	Confirmed
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	LC (IUCN), Protected tree (NFA, 1998)	Confirmed
Catha edulis (Vahl) Forssk. ex Endl.	LC (IUCN), Protected tree (NFA, 1998)	Low
Combretum imberbe Wawra	LC (IUCN), Protected tree (NFA, 1998)	Confirmed
Podocarpus latifolius (Thunb.) R.Br. ex Mirb.	LC (IUCN), LEMA (Schedule 12)	Low
Sclerocarya birrea (A.Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro	LC (IUCN), Protected tree (NFA, 1998), NEMA (Schedule 12)	Confirmed
Vachellia erioloba (E.Mey.) P.J.H.Hurter	LC (IUCN), Protected tree (NFA, 1998)	Moderate

28.3 PLANT SPECIES OF CONSERVATION CONCERN – SURVEY RESULTS (2021)

Four plant species of conservation concern were recorded from the site during the brief survey period (April 2021) (refer Table 7). Survey conditions were considered to be optimal, and the site inspection was conducted during a seasonal period that coincided with the flowering period of most plant taxa that could reasonably be expected to occur in the region. Furthermore, the presence/ absence of vegetative material was also used as to establish the presence/ absence of plant taxa of conservation concern. It is emphasised that valid permits need to be obtained from DFFE prior to the removal, damage, relocation, or any other activity that might affect these species.

Table 7: Plant species of conservation concern recorded from the site during the March 2021 survey period

Species Name	*Conservation Status*	*Habitat*	*Abundance/ Comment*
Adansonia digitata L.	Malvaceae	Natural woodland, rehabilitated areas (transplanted)	Low abundance
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Capparaceae	Natural woodland	Moderate abundance
Combretum imberbe Wawra	Combretaceae	Natural woodland	Low abundance
Philenoptera violacea (Klotzsch) Schrire	Fabaceae	Natural woodland	Moderate abundance
Sclerocarya birrea (A.Rich.) Hochst. ssp. *caffra* (Sond.) Kokwaro	Anacardiaceae	Natural woodland	Moderate abundance

28.4 ANNOTATIONS ON SCC FROM THE ENVIRONMENTAL SCREENING REPORT

Results obtained from the Environmental Screening Report (2021/05/24) indicated no plant species of specific consideration is known to occur within the study area, as per **Figure 14**.

Figure 14: Plant species theme sensitivity from the National Environmental Screening Report (2021/05/24)

28.5 DECLARED INVASIVE SPECIES & COMMON WEEDS

Table 8 denotes a list of common weeds species as well as declared alien and invasive species that were recorded on the study site during the site investigation.

Table 8: List of common weeds and declared alien and invasive plant species within the study area

Species Name	*Status/ Uses*	*Common Name*	*Abundance/ Threat*
Alternanthera pungens Humb.	Common weed, pioneer species	Khaki Weed (e), Dubbeltjie (a)	Extensive, low threat
Calotropis procera (Aiton) R.Br.	Currently not listed as invasive. Regarded as an encroacher species	Giant Milkweed (e), Apple of Sodom (e)	Moderate-extensive, moderate threat
Datura inoxia Mill.	Noxious weed. Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Downy thorn apple (e)	Moderate-extensive, significant threat
Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016). Not listed for CARA	Smelter's bush, Smelterbossie (a)	Extensive, moderate threat
Sesbania bispinosa	Exotic species, currently unlisted. Originally from India, China and Iran. Edible parts	Prickly Sesban	Low occurrence, low threat
Solanum panduriforme E.Mey.	Common weed, poisonous parts	Poison Apple (e), Gifappel (a)	Low occurrence, low threat

28.6 PLANTS WITH TRADITIONAL MEDICINAL USES

Table 9 lists plants with popular traditional and medicinal uses that were recorded on the site and immediate surrounds.

Table 9: List of popular traditional and medicinal plant species recorded within the site and immediate surrounds

Species Name	*Status/ Uses*	*Common Name*
Adansonia digitata L.	Traditional uses, edible parts, traditional medicinal uses	Baobab (a), Cream-of-tartar-tree (e), Kremetartboom (a), Muvhuyu (v)
Boscia albitrunca (Burch.) Gilg & Gilg-Ben.	Important fodder, traditional uses, traditional medicinal uses	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)
Boscia foetida Schinz subsp. *rehmanniana* (Pestal.) Toelken	Medicinal uses, browsing value	Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
Calotropis procera (Aiton) R.Br.	Medicinal uses, indicator of overgrazed land, deterioration. Currently not listed as invasive. Regarded as an encroacher species	Giant Milkweed (e), Apple of Sodom (e)
Ceratotheca triloba (Bernh.) Hook.f.	Medicinal properties	Wild Foxglove (e), Vingerhoedblom (a)
Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Traditional medicinal uses, traditional uses, pods browsed by game, host plant for moth larvae *Gonimbrasia belina* (Mopane worm). Regarded as an encroacher species	Mopane (e), Mopane (a), Mopane (tw)
Combretum apiculatum Sond. subsp. *apiculatum*	Traditional medicinal uses, seeds possibly poisonous but consumed by Brown-headed Parrots, , leaves eaten by game, firewood	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
Combretum imberbe Wawra	Popular firewood, medicinal uses	Leadwood (e), Hardekool (a), Motswiri (tw), Mudzwiri (v)
Combretum zeyheri Sond.	Edible parts, timber, weaving, medicinal uses	Large-fruited bushwillow (e), Raasblaar (a)
Commiphora viminea Burtt Davy	Traditional uses, browsed by game and cattle	Zebra-bark Corkwood (e), Zebrabas-kanniedood (a), Mutonyombidi (v)
Corchorus asplenifolius Burch.	Traditional and medicinal uses, edible parts	Gusha (e), Geel varingblaartjie (a), Ubangalala (z)
Croton gratissimus Burch. var. gratissimus	Medicinal uses, larval food for *Charaxes candiope candiope*	Lavender fever-berry (e), Laventelkoorsbessie (a)
Cucumis zeyheri Sond.	Edible parts	Wild Cucumber (e), Wildekomkommer (a)
Dalbergia melanoxylon Guill. & Perr.	Traditional uses. Roots are used medicinally	Zebrawood (e), Sebrahout (a)
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Encroacher species, traditional medicinal uses, firewood, pods browsed extensively by game and stock	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
Dicoma capensis	Medicinal uses	Koorsbossie (a)
Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia*	Wood is used for traditional purposes, bark, roots and root is used medicinally	Wild Pear (e), Drolpeer (a)
Ehretia rigida (Thunb.) Druce	Roots are used medicinally	Puzzle Bush (e), Deurmekaarbos (a)
Gardenia volkensii K.Schum. subsp. *volkensii* var. *volkensii*	Fruit and root are used medicinally, traditional uses	Bushveld gardenia (e), Bosveldkatjiepiering (a)
Gomphocarpus fruticosus (L.) Aiton f.	Medicinal uses, common weed	Milkweed (e), Melkbos (a)
Grewia bicolor Juss. var. bicolor	Medicinal uses, edible parts, highly variable	White-leaved Raisin (e), Witrosyntjie (a)
Grewia flava DC.	Edible parts, weaving, traditional uses, declared indicator of encroachment	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Grewia flavescens Juss.	Edible parts, beer brewing	Bushman Raisin (e), Kruisbessie (a)
Grewia monticola Sond.	Edible parts, traditional uses, important browsing	Silver raisin (e), Vaal rosyntjiebos (a)
Kirkia acuminata Oliv.	Emergency water source	White Kirkia (e), Witsering (a), Modumêla (tw)
Litogyne gariepina (DC.) Anderb.	Unpleasant smell, traditional uses	Dwarf Sage (e), Blougifbossie (a)
Pergularia daemia	Medicinal uses	Bobbejaankambro (a), Kgaba
Philenoptera violacea (Klotzsch) Schrire	Medicinal uses. Host plant for *Charaxes bohemanii* and *Coeliades forestan*	Apple leaf (e), Appelblaar (a)
Sclerocarya birrea (A.Rich.) Hochst. ssp. *caffra* (Sond.) Kokwaro	Edible parts, traditional uses	Marula (e), Maroela (a)

Table 9: List of popular traditional and medicinal plant species recorded within the site and immediate surrounds		
Species Name	*Status/ Uses*	*Common Name*
Selaginella dregei (C.Presl) Hieron.	Medicinal uses	Resurrection Plant (e)
Senegalia caffra (Thunb.) P.J.H.Hurter & Mabb.	Dyes & tans	Common hook-thorn (e), Gewone haakdoring (a)
Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.	Declared indicator of encroachment, medicinal uses, poison source	Black Thorn (e), Swarthaak (a)
Senegalia nigrescens (Oliv.) P.J.H.Hurter	Tannin rich bark, important browse for game, Host plant for larvae of *Charaxes phaeus*. Often regarded as an encroacher species	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
Solanum panduriforme E.Mey.	Traditional medicinal uses, poisonous	Poison Apple (e), Gifappel (a)
Sterculia rogersii N.E.Br.	Traditional uses, edible seeds	Star-chestnut (e), Sterkastaiing (a), Mukakate (v)
Stipagrostis uniplumis	Edible parts, thatching, weaving	Silky Bushman Grass (e)
Terminalia prunioides M.A.Lawson	Traditional uses	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
Tribulus terrestris L.	Medicinal uses	Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.	Medicinal uses (bark). Often regarded as an encroacher species	Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)
Vachellia xanthophloea (Benth.) P.J.H.Hurter	Ornamental	Fever tree (e), Koorsboom (a)
Ximenia caffra Sond. var. *caffra*	Edible parts	Large Sourplum (e), Grootsuurpruim (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Edible parts, traditional medicinal uses, traditional uses	Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

28.7 ENCROACHER SPECIES (LOCALLY INDIGENOUS TAXA)

Bush encroachment is a term used for stands of plants where individual plants are closer to each other than three times the mean crown diameter. Plants in this group are not necessarily alien or exotic species, but rather plants that tend to become abnormally abundant when the area is degraded by e.g. overgrazing or injudicious fires. Therefore, the plants, occurring at densified abundance is therefore a symptom of poor land management practices. While CARA does not outlaw the species, it instead prescribes management practices aimed at preventing bush encroachment, and at combating to where it already occurs. Table 10 denotes plants that were recorded within the study sites and which are categorised as encroacher species, or species that exhibit attributes of dominance with changes in land use and status. While none of these species were found to present a significant problem in terms of large-scale bush encroachment, the abundance, and changes in abundance, should be monitored, specifically in areas where significant land use changes occur and in proximity to areas where infestation might present problems, such as on the perimeter of the LNVR. Localised encroachment of *Colophospermum mopane* (Mopane) were recorded and observed across the site, but is considered a natural occurrence and not necessarily a result of poor management practices.

Table 10: List of encroacher species (CARA)			
Species Name	*Status/ Uses*	*Common Name*	*Abundance/ Threat*
Calotropis procera (Aiton) R.Br.	Not evaluated. Regarded as an exotic encroacher species	Giant Milkweed (e), Apple of Sodom (e)	Extensive, low threat
Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern. CARA Listed Encroacher species	Mopane (e), Mopane (a), Mopane (tw)	Extensive, low threat
Combretum apiculatum Sond. subsp. apiculatum	Least Concern. CARA Listed Encroacher species	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)	Low occurrence, low threat
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern. CARA Listed Encroacher species	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)	Moderate-low occurrence, low threat
Grewia bicolor Juss. var. *bicolor*	Least Concern. CARA Listed Encroacher species	White-leaved Raisin (e), Witrosyntjie (a)	Low occurrence, low threat

Table 10: List of encroacher species (CARA)			
Species Name	*Status/ Uses*	*Common Name*	*Abundance/ Threat*
Grewia flava DC.	Least Concern. CARA Listed Encroacher species	Velvet Raisin (e), Fluweelrosyntjiebos (a)	Low occurrence, low threat
Grewia flavescens Juss.	Least Concern. CARA Listed Encroacher species	Bushman Raisin (e), Kruisbessie (a)	Low occurrence, low threat
Grewia monticola Sond.	Least Concern. CARA Listed Encroacher species	Silver raisin (e), Vaal rosyntjiebos (a)	Low occurrence, low threat
Senegalia caffra (Thunb.) P.J.H.Hurter & Mabb.	Least Concern. CARA Listed Encroacher species	Common hook-thorn (e), Gewone haakdoring (a)	Low occurrence, low threat
Senegalia erubescens (Welw. ex Oliv.) Kyal. & Boatwr.	Least Concern. CARA Listed Encroacher species	Blue Thorn (e), Blouhaak (a), Moloto (tw)	Moderate-low occurrence, low threat
Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.	CARA Listed Encroacher species	Black Thorn (e), Swarthaak (a)	Moderate-low occurrence, low threat
Senegalia nigrescens (Oliv.) P.J.H.Hurter	Least Concern. CARA Listed Encroacher species	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)	Moderate-low occurrence, low threat
Sesbania bispinosa	Currently unlisted, considered an exotic encroacher species	Prickly Sesban	Low occurrence, low threat
Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern. CARA Listed Encroacher species	Horned thorn (e), Horingdoring (a), Masaoka (tw)	Moderate-low occurrence, low threat
Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.	CARA Listed Encroacher species	Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)	Moderate-low occurrence, low threat

29 FLORISTIC ATTRIBUTES OF THE DEVELOPMENT FOOTPRINT SITES

Historically, development of vegetation is a result of complex interacting driving forces that include climatic-, geological (soil), topographical- and moisture gradients that characterise a region. With the continuous growth in the extent and intensity of anthropogenic activities and associated land uses in an area, vegetation within development footprints and immediate surrounds are often severely affected. This gradient of impacts ranges between immediate and complete decimation and land clearance of all vegetation for development purposes, to peripheral and long-term changes that are often difficult to quantify and detect from an instantaneous observation, but ultimately manifests as vegetation types that exhibit floristic and vegetatal attributes that are different to the local, regional types.

The suite of development footprints for the proposed activity provides evidence of a range of anthropogenic impacts that resulted from disruptive and transformative mining and associated activities over an extensive time period. Irremediable changes in vegetatal structure, species abundance, presence, absence, and composition resulted from land clearance activities in some parts, often recent, while other areas comprise natural and pristine woodland habitat.

For the purpose of this report, the respective development areas are discussed individually.

29.1 PCD 1

PCD 1 is situated within the existing Venetia mine property and comprises an area of approximately 2.1 ha. Habitat within the site exhibit some evidence of surface disturbances and deterioration from surrounding mining activities, however portions of natural woodland remain within the footprint (refer **Figure 15**). The area and immediate surrounds are characterised by terrestrial, mixed woodland on the upland, outer parts of the site and lowland mesic environment in the central part, which forms part of the drainage line from the nearby (southern) non-perennial system. The characteristic vegetation habitat types within the footprint reflects topographical placement (i.e. terrestrial slopes and lowland floodplains), which are also characterised by varying soils; quartzitic and stony soils are generally encountered on the terrestrial upland areas while the lowland drainage line and floodplains are typically characterised by dark, deep

and structured soils. Anthropogenic disruptive events have contributed to deterioration of the vegetatal layer, particularly the lowland, non-perennial drainage habitat.

Broad-scale habitat types that are present within this area include:

⇒ Floodplain grassland: The lowland positions within the non-perennial drainage lines are characterised by a prominent, but depauperate and species poor, grass layer. The absence of shrub and trees from these parts is assumed to be the result of an altered vegetatal layer that developed subsequent to interference as a result of mining activities. The dominance of the grass *Cenchrus ciliaris*, provides some evidence thereof. Soils in these parts are dark, deep and strongly structured, but slopes are generally flat, and erosion is therefore not a significant threat in these parts. Seepage and raining events contribute to the periodic moist conditions that prevail in these areas. The absence of woody tree and shrub species is noted, and the prominence of herbaceous species, such as the grasses *Cenchrus ciliaris* and *Panicum maximum*, and the forbs *Abutilon fruticosum* and *Heliotropium* species is noted. Apart for the topographical placement as part of a drainage line, no specific floristic aspect of importance or sensitivity is noted for these parts. The poor species composition and deteriorated and altered status ultimately renders these portions moderate-low in floristic sensitivity (refer Figure 16).

⇒ Mixed woodland on quartzitic and calcareous soils: The upland, terrestrial woodland areas are characterised by a variable woodland that correlates with the regional ecological type (refer Sections 26.2 and 26.3). The variability of this type is an admixture of the two regional types and comprises a healthy mixture of woody species such as *Terminalia prunioides, Vachellia grandicornuta, Commiphora glandulosa, Colophospermum mopane* (at moderate abundance values and mostly in a shrub form) and *Grewia* species, and manifests a as woody layer with moderate density (<45 %) and height (<5 m). The herbaceous layer is, similarly, depauperate as a result of xeric conditions, thus highly variable and exhibit some evidence of deterioration as a result of severe and persistent grazing pressure. Typical grasses of this area include *Aristida rhiniochloa*, *Aristida adscensionis, Enneapogon cenchroides, Eragrostis lehmanniana* and *Schmidtia pappophoroides.* The composition of "poor quality" grass species reflects the shallow, stony and sandy nature of the soils, which renders it highly leached; nutrients drain from the topsoils (A horizon) and is therefore not accessible, or readily absorbed, by the grass layer, rendering it unpalatable and low in nutritional value. Individuals of the protected species *Adansonia digitata* (Baobab) and *Philenoptera violacea* (Apple leaf) were recorded within this footprint (refer Table 11). A moderate floristic sensitivity is ascribed to these parts of the site (refer Figure 16).

⇒ Riparian - Mopane thickets: Selected portions of this non-perennial stream is dominated by *Colophospermum mopane* thickets, manifesting as a closed tree stand with a cover abundance in excess of 80 % and trees with a height often exceeding 5 m. The species composition of these areas is poor, mostly as a result of the severe shade effect from the dominant Mopane thickets, while soil conditions are open/ bare and sandy, but with a highly humic A horizon. Occasional herbaceous species that are shade tolerant prevail in the lower stratum at low cover abundance values. It should be noted that, on a wider scale, these Mopane thickets exhibit a strong correlation with perennial rivers where soils tend to be sandy, and the moisture content of the soils is high for prolonged periods of the year (as opposed to occasional flooding and xeric conditions of smaller, non-perennial drainage lines. It therefore represents a habitat type of limited representation on a wider scale (refer Figure 2, recognisable as the dark green and wooded areas along larger rivers, within a xeric and 'brown' environment). Furthermore, opposed to the surrounding deciduous mixed woodland, the Mopane thickets are evergreen, providing some nutritional value for browsers during the dry winter period. It is estimated that the prominence of this Mopane thicket within this non-perennial drainage line of PCD 1 is the result of the prolonged wet conditions from nearby water retention mining infrastructure. Considering the limited regional

representation, but also a poor species composition absence of species of conservation concern within these parts (low habitat suitability), these portions are ascribed a moderate floristic sensitivity. Anecdotal observations indicate that the faunal component, notably medium and larger mammal species, utilize these areas extensively, and from an ecological perspective represents an important habitat, despite a moderately floristic status (refer Figure 16).

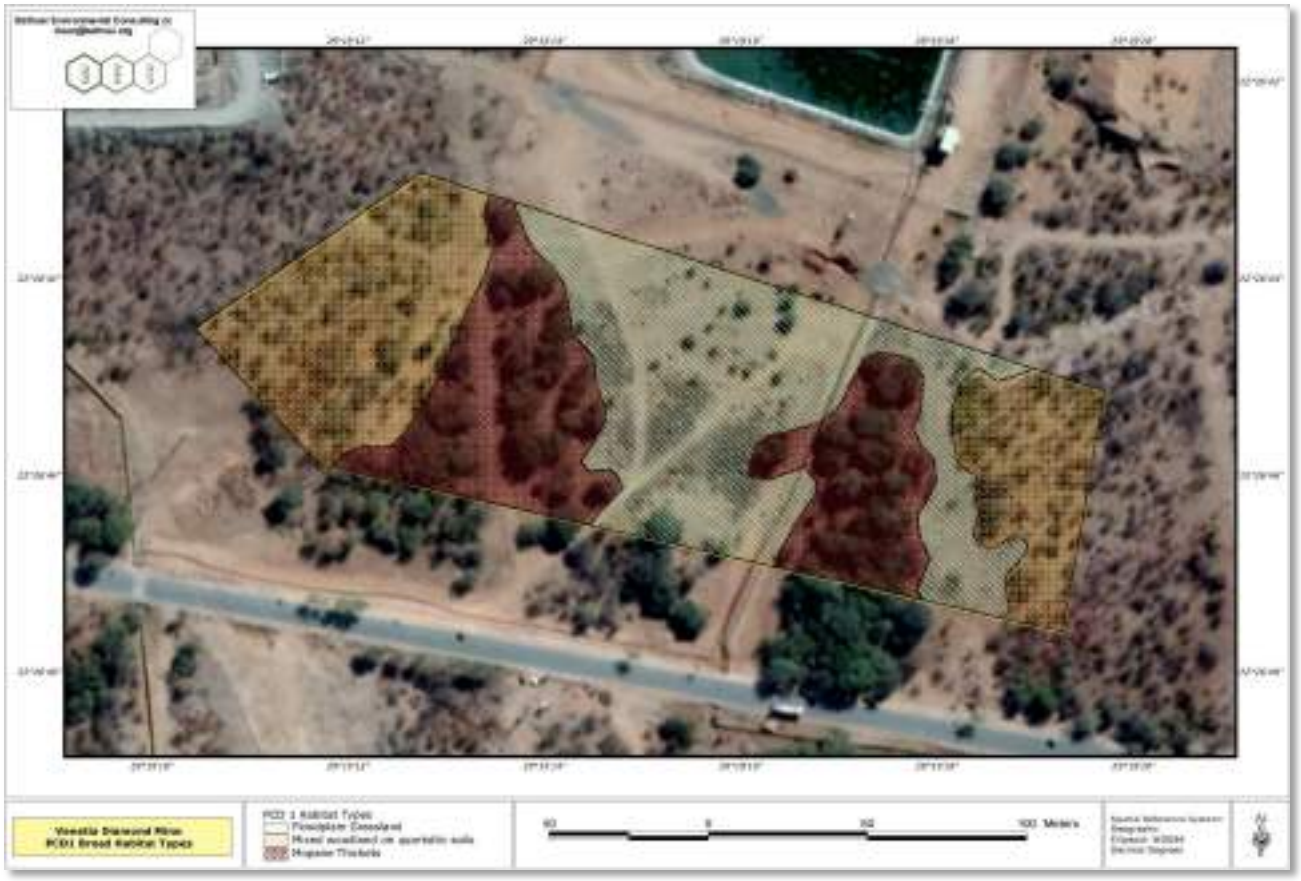


Figure 15: Broad-scale habitat types of PCD 1

Figure 16: Floristic sensitivity of habitat types of PCD 1

Table 11: List of plant species recorded in the PCD 1 site

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Dicoma tomentosa Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
	Melhania rehmannii Szyszyl.	Least Concern	John Deer Bossies (a)
Grasses	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
	Aristida congesta subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
	Aristida rhiniochloa Hochst.	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
	Aristida species		--
	Cenchrus ciliaris L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
	Melinis nerviglumis (Franch.) Zizka		Bristle-leaved red top (e)
	Melinis repens		Natal Red Top (e), Natal-rooipluim (a)
	Panicum maximum Jacq.		Buffalo Grass (e), Gewone Buffelsgras (a)
	Setaria verticillata (L.) P.Beauv.	Least Concern	Bur Britle Grass (e), Klitsgras (a)
Herbs	*Ceratotheca triloba* (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
	Datura inoxia Mill.	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Downy thorn apple (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
	Hibiscus micranthus L.f. var. *micranthus*		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
	Kyphocarpa angustifolia (Moq.) Lopr.		Silky Burweed (e)
Perennial herbs	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)
	Litogyne gariepina (DC.) Anderb.	Least Concern	Dwarf Sage (e), Blougifbossie (a)
Prostrate herb	*Cucumis zeyheri* Sond.		Wild Cucumber (e), Wildekomkommer (a)

Table 11: List of plant species recorded in the PCD 1 site			
Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Shrubs	*Grewia flava* DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
	Grewia flavescens Juss.	Least Concern	Bushman Raisin (e), Kruisbessie (a)
	Grewia species	Least Concern	--
Small trees	*Senegalia mellifera* (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.		Black Thorn (e), Swarthaak (a)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
	Ximenia caffra Sond. var. *caffra*	Least Concern	Large Sourplum (e), Grootsuurpruim (a)
Trees	***Adansonia digitata* L.**	**Protected Tree (National Forest Act, 1998)**	**Baobab (a), Cream-of-tartar-tree (e), Kremetartboom (a), Muvhuyu (v)**
	Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Commiphora glandulosa Schinz	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
	***Philenoptera violacea* (Klotzsch) Schrire**	**Least Concern (IUCN), Protected tree (National Forest Act, 1998)**	**Apple leaf (e), Appelblaar (a)**

Mixed woodland on stony, rocky soils

Mixed woodland on stony, rocky soils

Floodplain grassland

Closed Mopane thickets

Figure 17: Collage of images of habitat conditions within PCD 1

29.2 PCD 2

The PCD 2 site is situated entirely within the Venetia Mine property and comprises approximately 2.5 ha. It is situated immediately south of an existing waste rock storage areas and extensive parts of the site has been cleared from natural vegetation as a result of mining related activities and remaining vegetation bears evidence of the severity of direct and indirect impacts. Broad-scale habitat types that are present within this area include (refer **Figure 18**):

⇒ **Transformed and Deteriorated Land**: Extensive parts of PCD 2 area has been cleared from natural vegetation as a result of mining related activities. These areas comprises parts where waste rock and overburden materials are being stored as well as areas where activities have ceased for a period and pioneer type vegetation has recolonised the site. No natural vegetation remains, a low floristic sensitivity is ascribed (refer **Figure 19**).

⇒ **Mixed woodland (Severely Deteriorated):** Remaining areas of natural woodland have been affected adversely by surrounding mining related activities. In particular, the herbaceous stratum bears evidence of significant deterioration and appears depauperate and species poor. Soil conditions in these parts are dry and accumulating dust on the vegetation is severe. The herbaceous stratum is not representative of the regional ecological type and the likelihood of encountering any plant species of conservation concern in these parts is considered negligent (refer **Table 12**). Herbaceous species that were recorded in this area include the grasses *Eragrostis tef, Eragrostis nindensis, Enneapogon scoparius,* the invasive forbs *Flaveria bidentis*, *Datura inoxia* and *Calotropis procera* as well as *Abutilon fruticosa* and *Aptosimum* species. The shrub and tree component and layer of the remaining woodland is, similarly, considered poorly representative of the regional ecological type, comprising mostly of sub-dominant *Colophospermum mopane* and a low number of other locally indigenous shrub and small tree species, such as *Terminalia prunioides, Vachellia tortilis, Boscia foetida* and *Vachellia grandicornuta*. A moderate-low floristic sensitivity is ascribed to these parts of the site (refer **Figure 19**), mainly because remaining vegetation has retained a measure of the principal ecological type, albeit not significant.

Figure 18: Broad-scale habitat types of PCD 2

Figure 19: Floristic sensitivity of habitat types of PCD 2

Storage of materials and transformation of habitat

Clearance and transformation of natural woodland, note regrowth of pioneer species

Clearance and transformation of natural woodland, note regrowth of pioneer species

Severely deteriorated woodland habitat, note open and bare soils of undergrowth

Severely deteriorated habitat, bare soils

Severely deteriorated habitat, bare soils

Figure 20: Collage of images of habitat conditions within PCD 2

Table 12: List of plant species recorded in the PCD 2 site

Growth Form	Species Name	Conservation/ Invasive Status	Common Name
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Aptosimum species		--
Grasses	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
	Aristida species		--
	Cenchrus ciliaris L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Chloris virgata Sw.		Feather-top Chloris (e), Witpluim-chloris (a)
	Cynodon dactylon (L.) Pers.		Common Couch Grass (e), Gewone kweekgras (a)
	Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
	Eragrostis nindensis Ficalho & Hiern		Wether Love Grass (e), Hamelgras (a)
	Eragrostis tef (Zuccagni) Trotter		Teff (e), Tef (a)
	Melinis repens		Natal Red Top (e), Natal-rooipluim (a)
Herbs	*Datura inoxia* Mill.	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Downy thorn apple (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
Perennial herbs	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)
	Alternanthera pungens Humb.	Common weed	Khaki Weed (e), Dubbeltjie (a)
Shrubs	*Calotropis procera* (Aiton) R.Br.	Not evaluated, encroacher, exotic	Giant Milkweed (e), Apple of Sodom (e)
Small trees	*Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken		Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
Trees	*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

29.3 PCD 3

PCD 3 is situated partially within the Venetia Mine property (approx. 12.3 ha) and within the adjacent Venetia Limpopo Nature Reserve (approx. 9.1 ha), comprising an extent of 21.4 ha (refer **Figure 21**). Woodland situated within the Venetia perimeter exhibit evidence of the adverse impacts of mining related activities, including road clearance, seepage from nearby waste rock storage areas, land/ vegetation clearance and the infestation by pioneer vegetation, etc., and the physiognomy is generally a deteriorated form. In contrast, woodland habitat that is situated outside the

Venetia Mine perimeter (in the VLNR) exhibit attributes of natural and pristine status that is highly representative of the regional ecological type, i.e. Limpopo Ridge Bushveld) and was found to be comparatively species diverse, which is also a reflection of the habitat diversity that is encountered within these parts. The Beta Floristic Diversity for this site was 76 plant species recorded during the brief site inspection, reflecting the comparatively high habitat- and floristic diversity (refer **Table 13**).

Broad-scale habitat types that are present within this area include (refer **Figure 21**):

⇒ **Artificial Impoundment (Dam):** The non-perennial drainage line, which eventually drains into the Kolope River that is situated approximately 300 m to the west, was artificially dammed by the construction of a retaining wall and forms a retention dam of considerable size. Despite crucial and important ecological functionality that the provision of a near-permanent water source performs, the dam contains little vegetation, and a medium floristic status is therefore ascribed (refer **Figure 22**). It should be noted that the ecological sensitivity is likely to be considerably higher as it will also consider the faunal component and functionality as part of the ecological infrastructure on a local scale. Drainage from the waste rock storage areas in the upper parts (inside the Venetia Mine property) continuously feeds the dam. The age of this artificial dam is not known, from available imagery it is evident that it was constructed prior to 2003 (refer **Figure 23**). In comparison with recent imagery from 2020, the dynamic nature of the vegetation and expansion mining related activities can be noted (refer **Figure 24**). It should also be noted that this dam is performing an important role as a buffer between effects (effluents) from existing mining operation and the Kolope River. Should this area be approved for development, the protection of the Kolope River against impacts should be prioritised.

⇒ **Deteriorated Mixed Woodland:** Remaining portions of natural woodland from inside the Venetia Mine perimeter exhibit evidence of moderate deterioration, and therefore only a moderate correlation to the regional ecological type (i.e. the Limpopo Ridge Bushveld). This unit represents the terrestrial portions of the site, situated on slightly upslope topographical areas where soils are generally gravelly and stony; the resultant vegetation is therefore mostly sourish with poor quality grass species prominently represented, such as *Aristida* species, *Pogonarthria squarrosa, Schmidtia pappophoroides* and *Stipagrostis uniplumis.* Extensive parts of these deteriorated mixed woodland areas also indicates the effect of continual seepage from the nearby waste rock storage areas, effectively transforming these terrestrial woodland habitats into a mesic environment. The concentration of salts on the surface is evident in selected areas. The shrub and tree layer comprises a similar composition to the nearby natural woodland areas from the VLNR (refer next paragraph), exhibiting a comparatively high diversity of trees and shrubs, but a slightly elevated abundance and densities, which is best explained as encroachment that results from management principles as well as prolonged and elevated moisture conditions of the soils. Despite the presence of protected tree species (albeit at low numbers), only a moderate floristic sensitivity is ascribed to these portions (refer **Figure 22**). The loss of these portions of (moderately deteriorated) woodland habitat is not expected to result in severe losses on a local scale. However, the buffer role that these woodland areas perform between effects of the encroaching mining activities and sensitive woodland habitat form the adjacent VLNR is considered significant.

⇒ **Natural Mixed Woodland:** Natural terrestrial woodland within the VLNR exhibit compositional and diversity attributes that indicates a high correlation with the regional ecological type. The terrestrial environment is indicated by the upland topographical position on the undulating slopes, exhibiting soils of quartzitic and calcareous nature, manifesting as gravelly and highly drained (leached soils). While the herbaceous layer appears slightly depauperate, it generally a result of the leached conditions of the soils and is typical for the topographical placement on slopes and crests of the undulating plains. Typical grasses recorded

in these parts include *Aristida* species, *Cenchrus ciliaris, Dactyloctenium aegyptium, Digitaria eriantha, Enneapogon cenchroides, Eragrostis* species, *Panicum maximum, Stipagrostis uniplumis* and *Tricholaena monachne.* Forbs generally occur at moderate to low abundance levels, including species such as *Abutilon fruticosum, Blepharis diversispina, Dicoma tomentosa, Hibiscus micrantus* and *Tephrosia* species and also indicates some species changes that can be attributed to high utilisation. The shrub and tree layer is prominent and diverse, including prominent shrubs such as *Grewia* species, *Senegalia* species, *Commiphora mollis, Ximenia caffra* and *Ziziphus mucronata.* The tree component is, similarly, diverse and well developed, with co-dominant species such as *Boscia albitrunca, Combretum apiculatum, Colophospermum mopane* (at sub-dominant abundance levels), *Commiphora glandulosa, Senegalia* species, *Vachellia tortilis, V. grandicornuta,* and also include the occasional occurrence of the protected tree species *Boscia albitrunca* (Shepard's Tree)*, Combretum imberbe* (Leadwood) and *Philenoptera violacea* (Apple leaf). As a result of a high correlation with the regional ecological type, the presence of several protected tree individuals and a pristine status, a moderate-high floristic sensitivity is ascribed to these portions and the anticipated impacts of the proposed development within these parts are considered significant.

⇒ Riparian Mopane Thickets: The persistent presence of elevated moisture levels in the floodplains and non-perennial drainage lines that emanate from seepages from the mining waste rock storage areas, resulted in optimal conditions for the development of dense Mopane thickets in the lowland parts of the site. This encroacher species has become dominant in the low lying and mesic parts of the site and surrounds, notably to the exclusion of most of the original, natural woodland vegetation and the dynamic nature of this species and the resultant development of the thickets within a comparatively short period is illustrated in comparison of imagery from 2003 (refer Figure 23) and 2020 (refer Figure 24). The persistently wet soil conditions (and possibly accumulation of surface salts) have, in places within the Venetia Mine perimeter, resulted in drowning of some of the larger trees. Soils in these parts, mostly as a result of the topographical placement, is generally dark and structured, with a higher clay content. The species diversity of these parts, because of the dominance of Mopane shrubs and trees, and also because of the severe shade effect, is low, comprising occasional and low-abundance species. The nature of these non-perennial drainage lines also vary from shallow, flat and sandy plains to deeply incised channels with steep banks where the vegetation is strongly determined from the surrounding terrestrial environment. The floristic sensitivity is largely determined by the deterioration status, areas within the Venetia Mine perimeter exhibit a higher level of deterioration and a moderate floristic sensitivity is ascribed (refer Figure 22). In contrast, areas in the VLNR exhibit a more natural state and a moderate-high sensitivity is ascribed, ultimately rendering most of the area in the VLNR as highly sensitive, while areas within the Venetia Mine perimeter is considered lower in floristic sensitivity.

⇒ Transformed and Deteriorated Land: Extensive parts of PCD 3 area, notably the section within the Venetia Mine perimeter has been cleared from natural vegetation as a result of mining related activities and for the purpose of access and internal roads. The remaining vegetation on the edges of these areas comprise pioneer and 'poor quality' species that are typically associated with severe surface disturbances. As no natural vegetation remains, a low floristic sensitivity is ascribed to these parts (refer Figure 22).

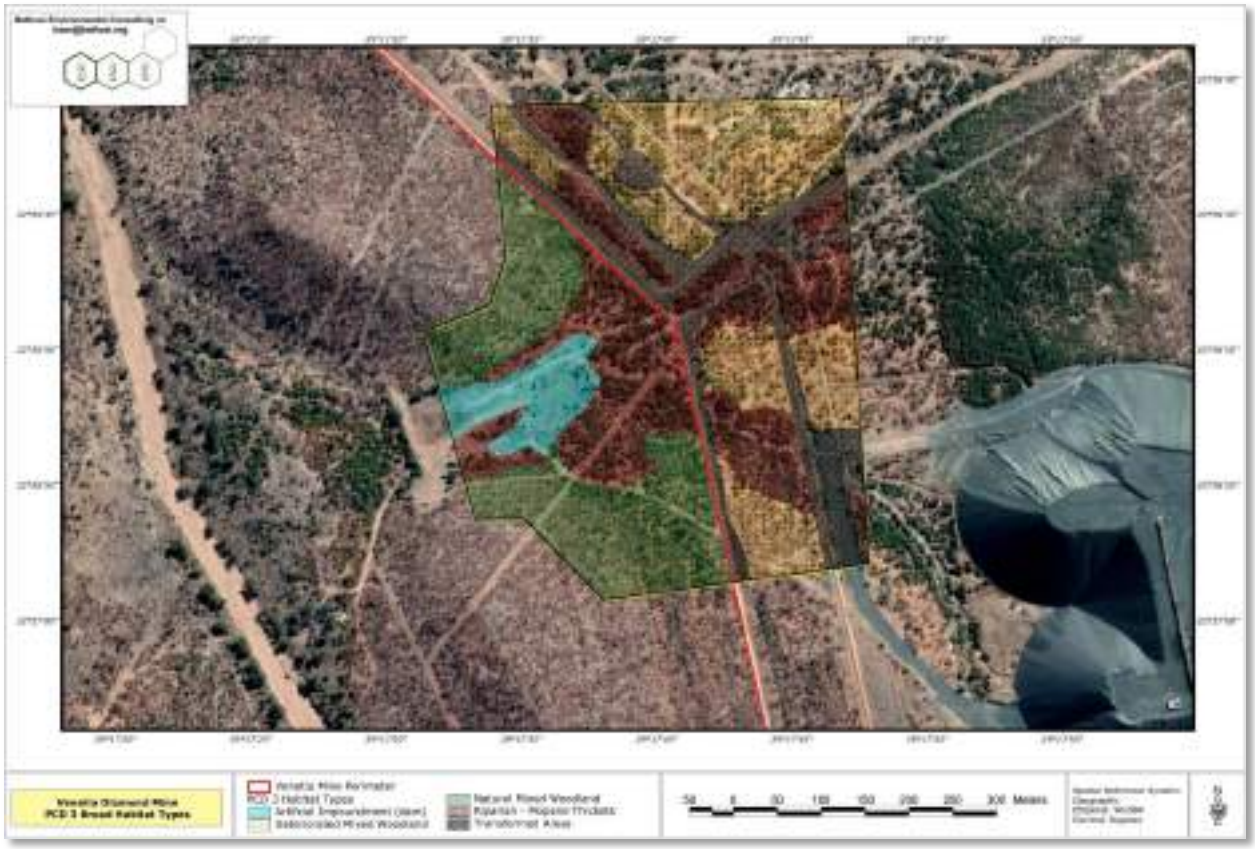


Figure 21: Broad-scale habitat types of CPD 3

Figure 22: Floristic sensitivity of habitat types of CPD 3

Figure 23: Habitat status and mining infrastructure from 2003

Figure 24: Habitat status and mining infrastructure from 2020

Table 13: List of plant species recorded in the PCD 3 site			
Growth Form	Species Name	Conservation/ Invasive Status	Common Name
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Blepharis diversispina (Nees) C.B.Clarke	Least Concern	Eyelash Flower (e), Rankklits (a)
	Dicoma tomentosa Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
	Geigeria acaulis (Sch.Bip.) Benth. & Hook.f. ex Oliv. & Hiern	Least Concern	Rosulate Geigeria (e), Perdebynessie (a)
	Melhania rehmannii Szyszyl.	Least Concern	John Deer Bossies (a)
Fern	*Selaginella dregei* (C.Presl) Hieron.		Resurrection Plant (e)
Grasses	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
	Aristida congesta subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
	Aristida congesta subsp. *congesta*		Tassel Three-awn (e), Katstertsteekgras (a)
	Aristida rhiniochloa Hochst.	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
	Cenchrus ciliaris L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Chloris virgata Sw.		Feather-top Chloris (e), Witpluim-chloris (a)
	Cynodon dactylon (L.) Pers.		Common Couch Grass (e), Gewone kweekgras (a)
	Dactyloctenium aegyptium (L.) Willd.		Common Crowfoot (e), Hoenderspoor (a)
	Dicanthium annulatum		Vlei Finger Grass (e), Vleivingergras (a)
	Digitaria eriantha Steud.		Finger grass (e), Finger gras (a)
	Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
	Eragrostis capensis (Thunb.) Trin.		Heart-seed love grass (e), Hartjiesgras (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
	Eragrostis species		--
	Eragrostis tef (Zuccagni) Trotter		Teff (e), Tef (a)
	Heteropogon contortus (L.) Roem. & Schult.		Spear grass (e), Assegaaigras (a)
	Panicum maximum Jacq.		Buffalo Grass (e), Gewone Buffelsgras (a)
	Pogonarthria squarrosa (Roem. & Schult.) Pilg.		Herringbone Grass (e), Sekelgras (a)
	Schizachyrium sanguineum (Retz.) Alston		Red Atumn Grass (e), Rooiherfsgras (a)
	Schmidtia pappophoroides Steud.	Least Concern	Sand Quick (e), Sandkweek (a)
	Stipagrostis uniplumis		Silky Bushman Grass (e)
	Themeda triandra Forssk.		Red grass (e), Rooigras (a)
	Tricholaena monachne (Trin.) Stapf & C.E.Hubb.		Blue-seed grass (e), Blousaadgras
Herbs	*Ceratotheca triloba* (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
	Corchorus asplenifolius Burch.	Least Concern	Gusha (e), Geel varingblaartjie (a), Ubangalala (z)
	Datura inoxia Mill.		Downy thorn apple (e)
	Evolvulus alsinoides (L.) L.		Blue Haze (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
	Hibiscus micranthus L.f. var. *micranthus*		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
	Kyphocarpa angustifolia (Moq.) Lopr.		Silky Burweed (e)
	Rhynchosia totta		Yellow Carpet Bean (e)
	Solanum panduriforme E.Mey.		Poison Apple (e), Gifappel (a)
	Tephrosia species		--
	Waltheria indica L.		Meidebossie (a)
Hydrophilic	*Phragmites mauritianus*	Least Concern	Lowveld Reed (e), Laveldfluitjiesriet (a)
Perennial herbs	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)

Table 13: List of plant species recorded in the PCD 3 site			
Growth Form	Species Name	Conservation/ Invasive Status	Common Name
	Indigofera heterotricha DC.	Least Concern	Hairy Indigo (e), Harige Indigofera (a)
	Litogyne gariepina (DC.) Anderb.	Least Concern	Dwarf Sage (e), Blougifbossie (a)
Prostrate herb	*Cucumis zeyheri* Sond.		Wild Cucumber (e), Wildekomkommer (a)
Sedge	*Cyperus longus* L. var. *tenuiflorus* (Rottb.) Boeck.	Least Concern	Sweet cyperus (e), Waterbiesie (a)
Shrubs	*Grewia bicolor* Juss. var. *bicolor*	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
	Grewia flava DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
	Grewia flavescens Juss.	Least Concern	Bushman Raisin (e), Kruisbessie (a)
	Grewia monticola Sond.	Least Concern	Silver raisin (e), Vaal rosyntjiebos (a)
	Rhigozum brevispinosum Kuntze	Least Concern	Short-thorn pomegranate (e), Kortdoringgranaat (a)
Small trees	*Commiphora mollis* (Oliv.) Engl.	Least Concern	Velvet Commiphora (e), Fluweel-kanniedood (a), Mokômoto (tw)
	Dalbergia melanoxylon Guill. & Perr.		Zebrawood (e), Sebrahout (a)
	Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
	Gymnosporia undata (Thunb.) Blakelock		Common Spike-thron (e), Gewone pendoring (a)
	Senegalia erubescens (Welw. ex Oliv.) Kyal. & Boatwr.	Least Concern	Blue Thorn (e), Blouhaak (a), Moloto (tw)
	Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.		Black Thorn (e), Swarthaak (a)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
	Ximenia caffra Sond. var. *caffra*	Least Concern	Large Sourplum (e), Grootsuurpruim (a)
	Ziziphus mucronata Willd. subsp. *mucronata*		Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)
Trees	***Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)**
	Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Combretum apiculatum Sond. subsp. *apiculatum*	Least Concern	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
	***Combretum imberbe* Wawra**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Leadwood (e), Hardekool (a), Motswiri (tw), Mudzwiri (v)**
	Combretum zeyheri Sond.		Large-fruited bushwillow (e), Raasblaar (a)
	Commiphora glandulosa Schinz	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
	Commiphora viminea Burtt Davy	Least Concern	Zebra-bark Corkwood (e), Zebrabas-kanniedood (a), Mutonyombidi (v)
	Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia*	Least Concern	Wild Pear (e), Drolpeer (a)
	Gardenia volkensii K.Schum. subsp. *volkensii* var. *volkensii*	Not evaluated (Least Concern)	Bushveld gardenia (e), Bosveldkatjiepiering (a)
	Kirkia acuminata Oliv.	Least Concern	White Kirkia (e), Witsering (a), Modumêla (tw)
	***Philenoptera violacea* (Klotzsch) Schrire**	**Least Concern (IUCN), Protected tree (National Forest Act, 1998)**	**Apple leaf (e), Appelblaar (a)**
	Senegalia caffra (Thunb.) P.J.H.Hurter & Mabb.	Least Concern	Common hook-thorn (e), Gewone haakdoring (a)
	Senegalia nigrescens (Oliv.) P.J.H.Hurter	Least Concern	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

Shallow drainage line with surrounding terrestrial woodland (VLNR)

Natural variable woodland on quartzitic soils (VLNR)

Inflow to dam with surrounding variable woodland (VLNR)

Artificial impoundment (VLNR)

Mopane thickets from Venetia Mine area

Nearby effluent from mining storage infrastructure (Venetia)

Areas that were cleared and revegetated (Venetia Mine)

Seepage areas, note accumulation of salts and dead Mopane trees

Non-perennial drainage line with surrounding Mopane thickets

Seepage areas, note growth of young Mopane individuals

Artificial drainage channel (Venetia Mine)

Seepage areas, note growth of young Mopane, bare soils

Figure 25: Collage of images of habitat conditions within PCD 3

29.4 PCD 4

The proposed PCD 4 site is situated within the Venetia Mine perimeter (approx. 1.6 ha) and comprises a portion of remaining mixed terrestrial woodland that is completely surrounded, and adversely affected by mining activities, including internal roads, storage areas and an informal drainage channel. This portion of land slopes towards the southeast and soils comprise shallow and gravelly types that is leached. The Beta Diversity of this site is low; a total of only 35 species was recorded (refer **Table 14**). Broad-scale habitat types of this site are illustrated in **Figure 26**, including:

⇒ **Transformed and Deteriorated Land**: Parts of the site have been cleared from natural vegetation as a result of mining related activities, and has since been recolonised by pioneer species, or are currently affected by mining-related activities, including storage of mining materials (refer **Figure 28**). As no natural vegetation remains, or only pioneer type vegetation is present, a low floristic sensitivity is ascribed to these parts (refer **Figure 27**).

⇒ **Mixed woodland (Deteriorated):** Remaining areas of natural woodland have been adversely affected by surrounding mining related activities. In particular, the herbaceous stratum bears evidence of significant deterioration and appears depauperate and species poor. Soil conditions in these parts are dry and accumulating dust on the vegetation is severe. The herbaceous stratum is not representative of the regional ecological type. In particular, a notable increase in the abundance of *Colophospermum mopane* is noted, which is also normally associated with a decreased in the diversity and abundance of herbaceous species. Species that were recorded from these parts include the grasses *Eragrostis lehmanniana, Enneapogon scoparius, Stipagrostis uniplumis* and the invasive forbs *Flaveria bidentis*, *Datura inoxia* and *Calotropis procera* as well as *Abutilon fruticosa.* The shrub and tree component and layer of the remaining woodland is, similarly, considered poorly representative of the regional ecological type, comprising mostly of dominant *Colophospermum mopane* and a low number of other locally indigenous shrub and small tree species, such as *Dichrostachys cinerea, Ehretia rigida, Terminalia prunioides, Grewia bicolor* and *Vachellia tortilis*. A moderate-low floristic sensitivity is ascribed

to these parts of the site (refer **Figure 27**), mainly because of the severity of impacts from surrounding mining activities and the poor floristic status.

Figure 26: Broad-scale habitat types of CPD 4

Figure 27: Floristic sensitivity of habitat types of PCD 4

Table 14: List of plant species recorded in the PCD 4 site

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Dwarf shrub	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Blepharis diversispina (Nees) C.B.Clarke	Least Concern	Eyelash Flower (e), Rankklits (a)
	Dicoma tomentosa Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
	Melhania rehmannii Szyszyl.	Least Concern	John Deer Bossies (a)
	Solanum lichtensteinii Willd.		Large Yellow Bitter Apple (e), Groot Geel Gifappel (a)
Grass	*Aristida congesta* subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
	Aristida rhiniochloa Hochst.	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
	Aristida species		--
	Dactyloctenium aegyptium (L.) Willd.		Common Crowfoot (e), Hoenderspoor (a)
	Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
	Melinis nerviglumis (Franch.) Zizka		Bristle-leaved red top (e)
	Setaria verticillata (L.) P.Beauv.	Least Concern	Bur Britle Grass (e), Klitsgras (a)
	Stipagrostis uniplumis		Silky Bushman Grass (e)
	Themeda triandra Forssk.		Red grass (e), Rooigras (a)
Herb	*Datura inoxia* Mill.		Downy thorn apple (e)
	Evolvulus alsinoides (L.) L.		Blue Haze (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
	Kyphocarpa angustifolia (Moq.) Lopr.		Silky Burweed (e)
Prostrate herb	*Alternanthera pungens* Humb.		Khaki Weed (e), Dubbeltjie (a)
	Tribulus terrestris L.		Common Dubbeltjie (e), Gewone

			Dubbeltjie (a)
Shrub	*Calotropis procera* (Aiton) R.Br.	Not evaluated, encroacher, exotic	Giant Milkweed (e), Apple of Sodom (e)
	Gomphocarpus fruticosus (L.) Aiton f.		Milkweed (e), Melkbos (a)
	Grewia bicolor Juss. var. *bicolor*	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
	Grewia monticola Sond.	Least Concern	Silver raisin (e), Vaal rosyntjiebos (a)
Small tree	*Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken		Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
	Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
	Ehretia rigida (Thunb.) Druce		Puzzle Bush (e), Deurmekaarbos (a)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
	Ximenia caffra Sond. var. *caffra*	Least Concern	Large Sourplum (e), Grootsuurpruim (a)
Tree	*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Commiphora glandulosa Schinz	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
	Croton gratissimus Burch. var. *gratissimus*	Least Concern	Lavender fever-berry (e), Laventelkoorsbessie (a)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

Existing mining activities

Variable woodland dominated by Mopane

Variable woodland

Variable woodland dominated by Mopane

Previously cleared areas recolonised by grasses and forbs

Previously cleared areas recolonised by grasses and forbs

Figure 28: Collage of images of habitat conditions within PCD 4

29.5 FRD 1 RWD

The proposed FRD 1 RWD site is situated within the Venetia Mine perimeter. The site comprises approximately 7.4 ha and is surrounded by existing waste rock storage areas, with limited connectivity to the southwest. The site also comprises 2 existing water storage facilities that will ultimately be expanded to increase capacity. The expansion areas to the northeast and southeast of the existing dams comprises land that has been severely affected by mining and land clearance activities, with a small remaining portion of severely deteriorated woodland. The Beta Diversity of this site is low; a total of only 20 species was recorded during the site inspection period (refer Table 15). Broad-scale habitat types of this site are illustrated in Figure 29, including:

⇒ Existing water storage facilities: Two separate existing dams are present within the site. The retention walls have been colonised by pioneer species while the shallow parts comprise stands of *Phragmites mauritianus.* As no natural vegetation are present in these parts, a low floristic sensitivity is ascribed to these parts (refer Figure 30).

⇒ Mixed woodland (Deteriorated): Remaining areas of woodland have been adversely affected by surrounding mining related activities. In particular, the herbaceous stratum bears evidence of significant deterioration and appears depauperate and species poor. Soil conditions in these parts are heavily modified as a result of persistent seepage from nearby waste rock storage areas, and accumulating dust on remaining vegetation is severe. The herbaceous stratum is not representative of the regional ecological type and appears heavily depleted and depauperate, mostly as a result of a densified *Colophospermum mopane* layer that developed as a result of elevated moisture conditions of the soils. Herbaceous species that were recorded include the grasses *Eragrostis lehmanniana, Dactyloctenium* giganteum*, Aristida* species and the invasive forbs *Flaveria bidentis*, *Datura inoxia* and *Calotropis procera.* The shrub and tree component and layer of the remaining woodland is, similarly, considered poorly representative of the regional ecological type, comprising mostly of dominant *Colophospermum mopane* and a low number of other locally indigenous shrub and small tree species, such as *Grewia bicolor* and *Vachellia grandicornuta, V. tortilis, Senegalia mellifera* and *Dichrostachys cinerea*. Parts of this unit comprises seepages where standing water have accumulated for prolonged periods and have subsequently developed in persistent reedbeds (*Phragmites mauritianus*). No plants of conservation concern were recorded within the deteriorated woodland areas and a moderate-low floristic sensitivity is ascribed (refer Figure 30), mainly because of the severity of impacts from surrounding mining activities and the poor floristic status.

⇒ Transformed and Deteriorated Land: Parts of the site have been cleared from natural vegetation as a result of mining related activities, and has since been recolonised by pioneer species, or are currently affected by

mining-related activities, including storage of mining materials (refer Figure 31). These areas also bear evidence of the effects of seepage from nearby waste rock storage areas and soil conditions appear heavily modified. Vegetation of these parts is severely depleted and comprise of scattered weeds and pioneer grasses and no longer bears any resemblance to natural vegetation. As such, a low floristic sensitivity is ascribed to these parts (refer Figure 30).

Figure 29: Broad-scale habitat types of FRD 1 RWD

Figure 30: Floristic sensitivity of habitat types within the FRD 1 RWD area

Table 15: List of plant species recorded in the FRD 1 RWD site

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Dwarf shrub	*Barleria senensis* Klotzsch	Least Concern	Mozambique Barleria (e), Mosambiekse Barleria (a)
Grasses	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
	Aristida congesta subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
	Cenchrus ciliaris L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Dactyloctenium giganteum Fisher & Schweick.		Giant Crowfoot (e), Reuse Hoenderspoor (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
Herbs	*Datura inoxia* Mill.		Downy thorn apple (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
Hydrophilic	*Phragmites mauritianus*	Least Concern	Lowveld Reed (e), Laveldfluitjiesriet (a)
Prostrate herbs	*Alternanthera pungens* Humb.		Khaki Weed (e), Dubbeltjie (a)
	Tribulus terrestris L.		Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Shrubs	*Calotropis procera* (Aiton) R.Br.	Not evaluated	Giant Milkweed (e), Apple of Sodom (e)
	Grewia bicolor Juss. var. *bicolor*	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
	Sesbania bispinosa	Currently unlisted	Prickly Sesban
Small trees	*Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
	Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.		Black Thorn (e), Swarthaak (a)
	Vachellia grandicornuta (Gerstner)	Least Concern	Horned thorn (e), Horingdoring (a),

	Seigler & Ebinger		Masaoka (tw)
Trees	*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Senegalia nigrescens (Oliv.) P.J.H.Hurter	Least Concern	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

Deteriorated mixed woodland

Transformed and deteriorated land

Transformed and deteriorated land

Existing water storage facilities

Existing water storage facilities

Existing water storage facilities

Figure 31: Collage of images of habitat conditions within FRD 1 RWD area

29.6 OMWSD N & S

This site comprises existing water storage facilities, which will be ultimately expanded for increased capacity (refer Figure 32, aerial imagery of the site only). The extent of the sites (collectively) is 13.0 ha. Resultant vegetation bears no resemblance to natural vegetation and include opportunistic and pioneer species that have colonised the retaining walls of the facilities. No specific surveys were therefore executed within these areas and a low floristic sensitivity is ascribed to the area (refer Figure 33).

Figure 32: Aerial imagery of the OMWSD N & S areas

Figure 33: Floristic sensitivity of the OMWSD N & S areas

OMWSD N& S

OMWSD N& S

Figure 34: Collage of images of habitat conditions within OMWSD N & S

29.7 OMWSD 3

The OMWSD 3 site is situated immediately downstream (north) of the OMWSD N & S area and upstream (south) from the PCD 1 site, comprising an area of approximately 8.5 ha. In addition to some internal mining access roads and transformed (cleared) land, remaining natural habitat correlates to the nearby PCD 1, manifesting as dense Mopane thickets in the lowland (riparian) parts and surrounding xeric mixed woodland (refer Figure 35) on rocky and stony slopes. These vegetation habitat types within the footprint reflects topographical placement (i.e. terrestrial slopes on shallow undulations and lowland thickets along the riparian lines), and are also characterised by varying soils; quartzitic and stony/ rocky soils are generally encountered on the terrestrial upland areas while the lowland drainage line and floodplains are typically characterised by dark, deep and structured soils. Anthropogenic disruptive events have contributed to deterioration of the vegetatal layer, particularly the lowland, non-perennial drainage habitat. Although only the northern section of this site could be accessed during the site inspection, a Beta Diversity of 48 plant species were recorded (refer Table 16), indicating a moderate correlation with the regional ecological types in areas that have are not severely deteriorated from surrounding mining- and associated activities.

Broad-scale habitat types that are present within this area include:

⇒ Mixed woodland on quartzitic and calcareous soils: The upland, terrestrial woodland areas are characterised by a variable woodland that correlates with the regional ecological type (refer Sections 26.1 and 26.2). The variability of this type is an admixture of the two regional types and comprises a healthy mixture of woody species such as *Terminalia prunioides, Vachellia grandicornuta, Commiphora glandulosa, Colophospermum mopane* (at moderate abundance values and mostly in a shrub form) and *Grewia* species, and manifests a as woody layer with moderate density (<45 %) and height (<5 m). The herbaceous layer is, similarly, depauperate as a result of xeric conditions, thus highly variable and exhibit some evidence of deterioration as a result of severe and persistent grazing pressure. Typical grasses of this area include *Aristida rhiniochloa*, *Aristida adscensionis, Enneapogon cenchroides, Eragrostis lehmanniana* and *Schmidtia pappophoroides.* The composition of "poor quality" grass species reflects the shallow, stony and sandy nature of the soils, which renders it highly leached; nutrients drain from the topsoils (A horizon) and is therefore not accessible, or readily absorbed, by the grass layer, rendering it unpalatable and low in nutritional value. Individuals of the protected species *Adansonia digitata* (Baobab) and *Philenoptera violacea* (Apple leaf) were recorded within this footprint (refer Table 16). A moderate floristic sensitivity is ascribed to these parts of the site (refer Figure 36).

⇒ Riparian - Mopane thickets: Selected portions of this non-perennial stream is dominated by *Colophospermum mopane* thickets, manifesting as a closed tree stand with a cover abundance in excess of 80 % and trees with a height often exceeding 5 m. The species composition of these areas is poor, mostly as a result of the severe

shade effect from the dominant Mopane thickets, while soil conditions are open/ bare and sandy, but with a highly humic A horizon. Occasional herbaceous species that are shade tolerant prevail in the lower stratum at low cover abundance values. It should be noted that, on a wider scale, these Mopane thickets exhibit a strong correlation with perennial rivers where soils tend to be sandy and the moisture content of the soils is high for prolonged periods of the year (as opposed to occasional flooding and xeric conditions of smaller, non-perennial drainage lines. It therefore represent a habitat type of limited representation on a wider scale (refer **Figure 2**, recognisable as the dark green and wooded areas along larger rivers, within a xeric and 'brown' environment). Furthermore, opposed to the surrounding deciduous mixed woodland, the Mopane thickets are evergreen, providing some nutritional value for browsers during the dry winter period. It is estimated that the prominence of this Mopane thicket within this non-perennial drainage line of PCD 1 is the result of the prolonged wet conditions from nearby water retention mining infrastructure. Considering the limited regional representation, but also a poor species composition absence of species of conservation concern within these parts (low habitat suitability), these portions are ascribed a moderate floristic sensitivity. Anecdotal observations indicate that the faunal component, notably medium and larger mammal species, utilize these areas extensively, and from an ecological perspective represents an important habitat, despite a moderately floristic status (refer **Figure 36**).

⇒ **Transformed and Deteriorated Land**: Parts of the site have been cleared from natural vegetation as a result of (mostly) internal mining access roads, and has since been recolonised by pioneer species, or are currently affected by mining-related activities. As little natural vegetation remains, or only pioneer type vegetation is present, a low floristic sensitivity is ascribed to these parts (refer **Figure 36**).

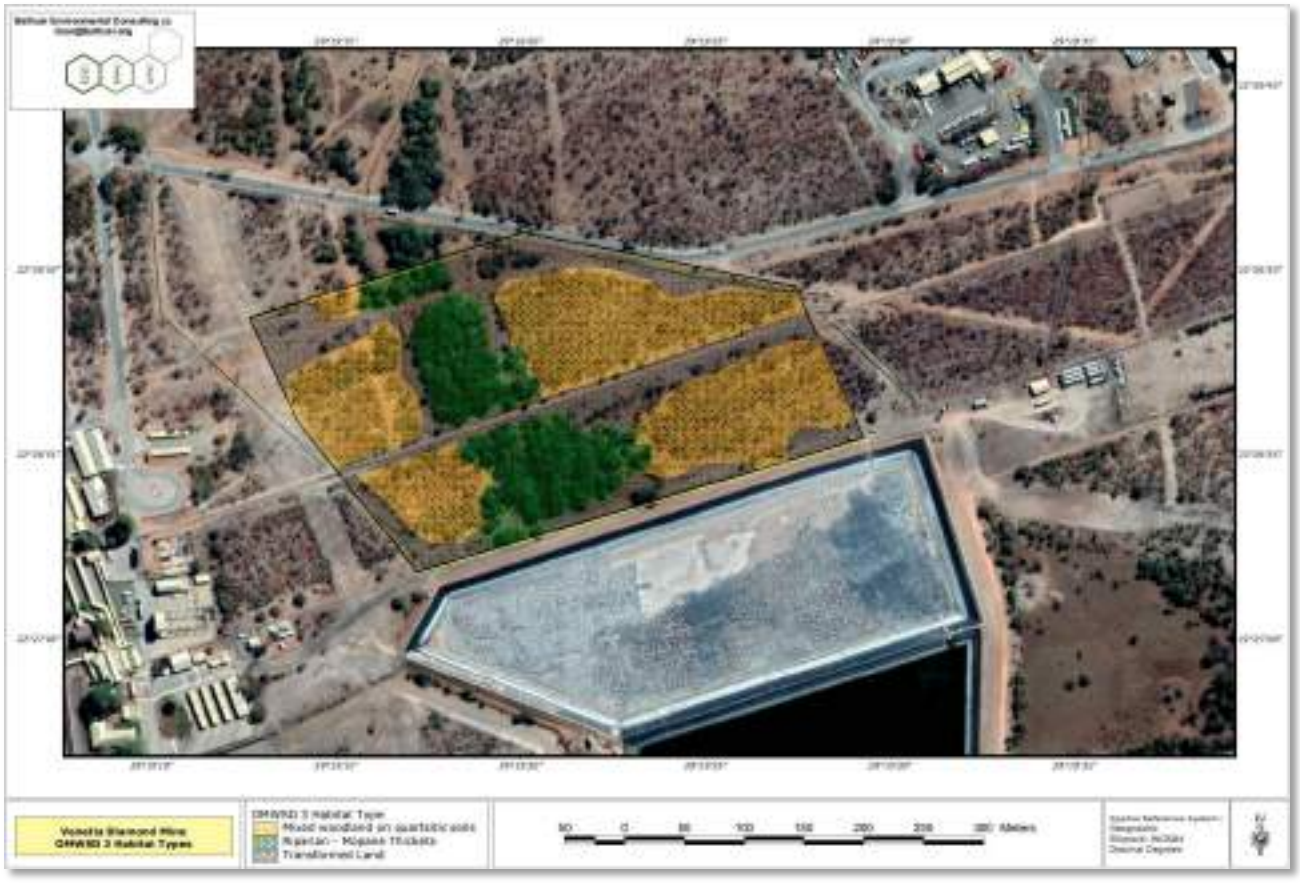


Figure 35: Broad-scale habitat types of OMWSD 3

Figure 36: Floristic sensitivity of habitat types of OMWSD 3

Table 16: List of plant species recorded in the OMWSD 3 site

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Climber	*Pergularia daemia*		Bobbejaankambro (a), Kgaba
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Dicoma tomentosa Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
	Melhania rehmannii Szyszyl.	Least Concern	John Deer Bossies (a)
Grasses	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
	Aristida congesta subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
	Aristida meridionalis Henrard		Giant three-awn (e), Langbeensteekgras (a)
	Aristida rhiniochloa Hochst.	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
	Aristida species		--
	Cenchrus ciliaris L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
	Eragrostis species		--
	Melinis nerviglumis (Franch.) Zizka		Bristle-leaved red top (e)
	Melinis repens		Natal Red Top (e), Natal-rooipluim (a)
	Panicum maximum Jacq.		Buffalo Grass (e), Gewone Buffelsgras (a)
	Setaria verticillata (L.) P.Beauv.	Least Concern	Bur Britle Grass (e), Klitsgras (a)
	Stipagrostis uniplumis		Silky Bushman Grass (e)
Herbs	*Ceratotheca triloba* (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
	Datura inoxia Mill.		Downy thorn apple (e)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)

Table 16: List of plant species recorded in the OMWSD 3 site			
Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
	Hibiscus micranthus L.f. var. *micranthus*		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
	Indigofera species		--
	Kyphocarpa angustifolia (Moq.) Lopr.		Silky Burweed (e)
	Tephrosia species		--
Perennial herbs	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)
	Litogyne gariepina (DC.) Anderb.	Least Concern	Dwarf Sage (e), Blougifbossie (a)
	Alternanthera pungens Humb.		Khaki Weed (e), Dubbeltjie (a)
	Cucumis zeyheri Sond.		Wild Cucumber (e), Wildekomkommer (a)
Shrubs	*Gomphocarpus fruticosus* (L.) Aiton f.		Milkweed (e), Melkbos (a)
	Grewia bicolor Juss. var. *bicolor*	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
	Grewia flava DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
	Grewia flavescens Juss.	Least Concern	Bushman Raisin (e), Kruisbessie (a)
	Grewia species	Least Concern	--
Small trees	*Boscia foetida* Schinz subsp. *rehmanniana* (Pestal.) Toelken		Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
	Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
	Senegalia mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.		Black Thorn (e), Swarthaak (a)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
	Ximenia caffra Sond. var. *caffra*	Least Concern	Large Sourplum (e), Grootsuurpruim (a)
Trees	*Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.	Least Concern (IUCN), Protected Tree (National Forest Act, 1998)	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)
	Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Commiphora glandulosa Schinz	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
	Kirkia acuminata Oliv.	Least Concern	White Kirkia (e), Witsering (a), Modumêla (tw)
	Senegalia nigrescens (Oliv.) P.J.H.Hurter	Least Concern	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

Mopane thickets alongside roads where runoff water accumulates, and high herbaceous load develops

Mixed terrestrial woodland with moderate high shrubs and low herbaceous load

Mixed terrestrial woodland with moderate high shrubs and low herbaceous load

Mopane thickets within lowland positions with bare soils due to high shade effect

Mopane thickets alongside roads where runoff water accumulates, and high herbaceous load develops

Mixed terrestrial woodland with moderate high shrubs and moderate herbaceous load

Figure 37: Collage of images of habitat conditions within OMWSD 3

29.8 OMWSD 4

The OMWSD 4 site is situated outside the Venetia Mine perimeter, immediately adjacent (east) of the OMWSD N & S sites and comprises approximately 3.8 ha. Principally it forms part of the non-perennial drainage line that was transformed during the life of the Venetia mine, specifically form the existing OMWSD N & S facility that resulted in the artificial impeding of normal, perennial water flow, and causing the seasonal (near permanent) water in the dam. Surrounding vegetation has also been affected by land clearance activities (assumed to be from the 'excavation of the dam), as can be noted from aerial imagery from 2006 (refer **Figure 38**), where much of the original woodland vegetation has been cleared; these areas have subsequently been recolonised by a secondary, depauperate and variable type. It is also evident from **Figure 38** (compare **Figure 39**, circa 2020) that the riparian woodland has densified along the non-perennial stream, mostly as a result of the elevated moisture levels in the soils. Soils in these parts are generally red or brown with a moderate to high clay content and slopes are less than 2 %.

As a result of the artificial nature of the area and the devastating effect of transformation, the Beta Diversity of the site is low; a total of only 19 plant taxa was recorded during the site inspection (refer **Table 17**).

Habitat types that are noted from this site include:

⇒ **Artificial Impoundment (Dam):** The non-perennial drainage line was artificially dammed through shallow excavation of topsoil and the construction of a retaining wall, (possibly to provide protection for the OMWSD N & S facility against seasonal flooding). Despite the crucial and important ecological functionality that the provision of a near-permanent water source performs, the dam contains little vegetation, and a medium-low floristic status is therefore ascribed (refer **Figure 40**). It should be noted that the ecological sensitivity is likely to be considerably higher as it will also consider the faunal component and functionality as part of the ecological infrastructure on a local scale. Normal -non-perennial drainage from upstream areas seasonally fills this dam.

⇒ **Deteriorated "Acacia" Woodland:** Subsequent to land clearance activities, including the removal of vegetation and shallow excavation, a secondary, depauperate microphyllous vegetation type developed on the fringes of the artificial dam. These areas are seasonally flooded and the mesic environment is characterised by elevated moisture content of the soils for prolonged periods of the year. The poor soil conditions provide for a depleted herbaceous layer, which comprises mostly herb species of a weedy disposition, and very few grass species. The shrub and tree layer is dominated by *Vachellia tortilis* and *V. grandicornuta* and other species such as *Grewia* species, *Terminalia prunioides, Combretum apiculatum* and the occasional presence of the protected *Philenoptera violacea.* As a result of the deteriorated and artificial nature this type, a Medium-low floristic sensitivity is ascribed.

⇒ **Riparian Thickets:** The persistent elevated moisture levels in the floodplains and non-perennial drainage lines causes optimal conditions for the development of dense Mopane thickets in the eastern parts of the site. This encroacher species has become dominant in the low lying and mesic parts of the site and surrounds, notably to the exclusion of most of the original, natural woodland vegetation and the dynamic nature of this species and the resultant development of the thickets within a comparatively short period is illustrated in comparison of imagery from 2006 (refer **Figure 38**) and 2020 (refer **Figure 39**). The species diversity of these parts, because of the dominance of Mopane shrubs and trees, and also because of the severe shade effect, is low, comprising occasional and low-abundance species. The floristic sensitivity, as it is primarily associated with a mesic environment, and also since it is fed from pristine (upstream) habitat, is considered moderate, despite a depleted species composition and the occasional presence of the protected species *Philenoptera violacea* and *Boscia albitrunca* (refer **Figure 40**).

Figure 38: Earlier land transformation within the OMWSD 4 site (c. 2006)

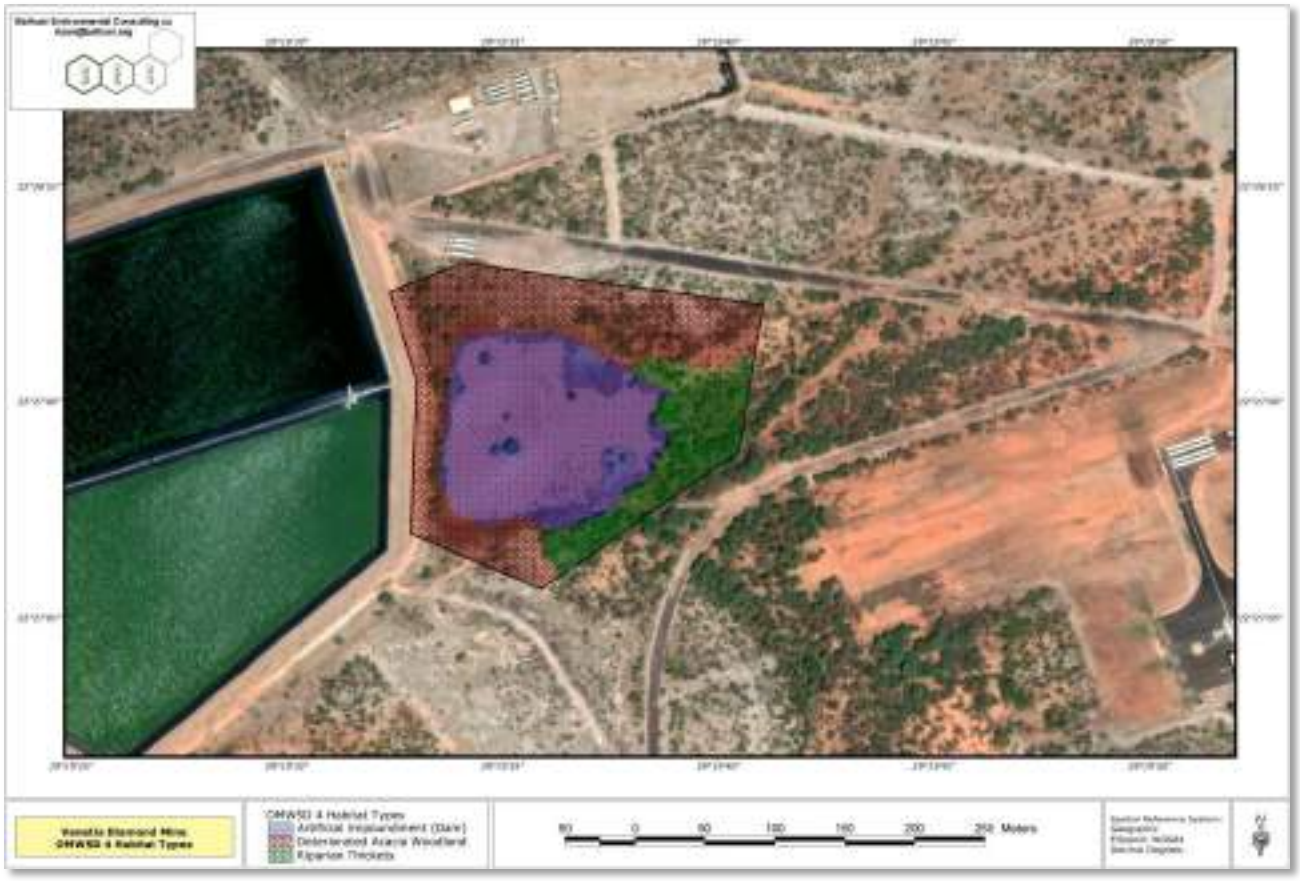


Figure 39: Broad-scale habitat types of OMWSD 4

Figure 40: Floristic sensitivity of habitat types of OMWSD 4


Artificial dam with seasonal water


Mixed, deteriorated woodland dominated by microphyllous species


Inflow into dam, seasonal water


Surrounding terrestrial woodland


Surrounding terrestrial woodland


Seasonal ponding along drainage line

Figure 41: Collage of images of habitat conditions within the OMWSD 4 site

Table 17: List of plant species recorded in the OMWSD 4 site

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Dicoma tomentosa Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
Grasses	*Eragrostis rotifer* Rendle		Pearly love grass (e), Vleipluimgras (a)
	Panicum maximum Jacq.		Buffalo Grass (e), Gewone Buffelsgras (a)
Herbs	*Ceratotheca triloba* (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
	Hibiscus micranthus L.f. var. *micranthus*		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
Perennial herb	*Litogyne gariepina* (DC.) Anderb.	Least Concern	Dwarf Sage (e), Blougifbossie (a)
Shrubs	*Calotropis procera* (Aiton) R.Br.	Not evaluated	Giant Milkweed (e), Apple of Sodom (e)
	Grewia bicolor Juss. var. *bicolor*	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
	Grewia flava DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Small trees	*Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
	Terminalia prunioides M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
Trees	*Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.	Least Concern (IUCN), Protected Tree (National Forest Act, 1998)	Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)
	Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)

Table 17: List of plant species recorded in the OMWSD 4 site			
Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
	Combretum apiculatum Sond. subsp. apiculatum	Least Concern	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
	Philenoptera violacea (Klotzsch) Schrire	Least Concern (IUCN), Protected tree (National Forest Act, 1998)	Apple leaf (e), Appelblaar (a)
	Vachellia grandicornuta (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
	Vachellia tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)
	Vachellia xanthophloea (Benth.) P.J.H.Hurter	Least Concern	Fever tree (e), Koorsboom (a)

29.9 SOUTHERN ACCESS ROAD TO PCD 3

The construction and operation of PCD 3 requires an upgrade and widening of the existing access road to the PCD 3 site; an estimated 10 – 15 m widening will be required. To allow for access of large construction vehicles, an additional allowance is also required. This road will be situated within the VLNR and will comprise, apart from the existing road, limited natural and sensitive woodland habitat that is situated directly adjacent to the existing road. As a result of the linear nature of the road; comprising approximately 3.5 km, the topographical variation of the landscape dictate that terrestrial woodland (lowland, rocky slopes and rocky crests) and riparian (non-perennial) and smaller drainage lines will be crossed. A total of 65 species was recorded during the brief inspection period (refer **Table 18**).

The following broad-scale habitat types will be affected by the proposed access road (refer **Figure 42**):

⇒ **Natural Mixed Woodland:** Natural terrestrial woodland spatially situated within the proposed access road within the VLNR exhibit compositional and diversity attributes that indicates a high correlation with the regional ecological type. The terrestrial environment is indicated by the upland topographical position on the undulating slopes, exhibiting a high variability in terms of slope, aspect, rockiness, and hence the vegetatal attributes as well. These variable woodland types follow the typical undulating landscape patterns, also comprising mosaical soil patterns and rockiness that vary between red and sandy soils within the low-lying areas and slopes and crests of quartzitic and calcareous nature on the slopes and crests. This suite of terrestrial woodland habitat types is typical to the regional ecological type and will inevitably exhibit similar sensitivity and floristic importance attributes. For the purpose of this assessment there is therefore no distinction made between the finer variations of this terrestrial woodland type and it is discussed collectively, although the smaller variations range between a closed mixed woodland on the lowland areas to open woodland broadleaf types on the slopes and crests of the undulating hills. Associated leached soils of the slopes and crests generally also imply a poor and sourish type that are occupied by a prominent layer of 'white' and unpalatable grasses. The floristic diversity of this woodland type is nonetheless considered moderate to high, reflecting regional floristic compositional and diversity patterns. Typical grasses recorded in these parts include *Aristida* species, *Cenchrus ciliaris, Dactyloctenium aegyptium, Digitaria eriantha, Enneapogon cenchroides, Eragrostis* species, *Panicum maximum, Stipagrostis uniplumis* and *Tricholaena monachne.* Forbs generally occur at moderate to low abundance levels, including species such as *Abutilon fruticosum, Blepharis diversispina, Dicoma tomentosa, Hibiscus micrantus* and *Tephrosia* species and also indicates some species changes that can be attributed to high utilisation. The shrub and tree layer is prominent and diverse, including prominent shrubs such as *Combretum apiculatum, Grewia* species, *Senegalia* species, *Commiphora mollis, Ximenia caffra* and *Ziziphus mucronata.* The tree component is, similarly, diverse and well developed, with co-dominant species such as *Boscia albitrunca, Combretum apiculatum, Colophospermum mopane* (at sub-dominant abundance levels), *Commiphora*

glandulosa, Senegalia species, *Vachellia tortilis, V. grandicornuta,* and also include the occasional occurrence of the protected tree species *Boscia albitrunca* (Shepard's Tree), *Combretum imberbe* (Leadwood), *Philenoptera violacea* (Apple leaf) and *Sclerocarya birrea* (Marula). As a result of a high correlation with the regional ecological type, the presence of several protected tree individuals and a pristine status, a moderate-high floristic sensitivity is ascribed to these portions and the anticipated impacts of the proposed development within these parts are considered significant (refer Figure 43).

⇒ **Riparian Woodland:** Lowland topographical positions are occupied by non-perennial drainage lines that are characterised by steep and deeply incised streambanks and sandy, or exposed, channel bottoms. As a result of notable slopes leading into the drainage lines, the surrounding terrestrial environment is often characterised by erosion of structured soils associated with lowland positions. These small drainage lines drains toward the Kolope River (approx. 600 m to the west). As a result of the abrupt nature of the drainage lines, physiognomy and composition is largely determined, and reflecting, the surrounding terrestrial woodland environment. However, localised variability is noted where the abundance of encroacher species, specifically Mopane, have increased to reflect elevated abundance values and a thicket physiognomy. From surrounding observations, this encroachment is a typical reaction on prolonged and persistent increased soil moisture levels. Despite a notable correlation in species composition between these features and the surrounding terrestrial environment, the physiognomy is atypical to the terrestrial environment and the association with a mesic environment is noted. The species diversity of these parts, because of the localised dominance of Mopane shrubs and trees, is not as high as surrounding terrestrial woodland habitats, but nonetheless considered highly representative of the regional ecological type. The floristic sensitivity, as a result of a high correlation to the regional types, as well as the association with a mesic environment, is considered moderately high (refer Figure 43).

Figure 42: Broad-scale habitat types along the Southern Access Road

Figure 43: Floristic sensitivity of habitat types along the Southern Access Road

Table 18: List of plant species recorded in the Southern Access Road towards PCD 3

Growth Form	Species Name	Conservation/ Invasive Status	Common Name
Dwarf shrub	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
Dwarf shrub	*Blepharis diversispina* (Nees) C.B.Clarke	Least Concern	Eyelash Flower (e), Rankklits (a)
Dwarf shrub	*Dicoma tomentosa* Cass.	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
Dwarf shrub	*Melhania rehmannii* Szyszyl.	Least Concern	John Deer Bossies (a)
Fern	*Selaginella dregei* (C.Presl) Hieron.		Resurrection Plant (e)
Grass	*Aristida adscensionis* L.		Annual Three-awn (e) Eenjarige Steekgras (a)
Grass	*Aristida congesta* subsp. *barbicollis*		Spreading Three-awn (e), Lossteekgras (a)
Grass	*Aristida congesta* subsp. *congesta*		Tassel Three-awn (e), Katstertsteekgras (a)
Grass	*Aristida meridionalis* Henrard		Giant three-awn (e), Langbeensteekgras (a)
Grass	*Aristida rhiniochloa* Hochst.	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
Grass	*Cenchrus ciliaris* L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
Grass	*Cynodon dactylon* (L.) Pers.		Common Couch Grass (e), Gewone kweekgras (a)
Grass	*Dactyloctenium aegyptium* (L.) Willd.		Common Crowfoot (e), Hoenderspoor (a)
Grass	*Dicanthium annulatum*		Vlei Finger Grass (e), Vleivingergras (a)
Grass	*Digitaria eriantha* Steud.		Finger grass (e), Finger gras (a)
Grass	*Enneapogon cenchroides* (Roem. & Schult.) C.E.Hubb.		Nine-awned gras (e), Negenaaldgras (a)
Grass	*Eragrostis capensis* (Thunb.) Trin.		Heart-seed love grass (e), Hartjiesgras (a)
Grass	*Eragrostis lehmanniana* Nees var. lehmanniana		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
Grass	*Eragrostis* species		--

Table 18: List of plant species recorded in the Southern Access Road towards PCD 3			
Growth Form	Species Name	Conservation/ Invasive Status	Common Name
Grass	*Heteropogon contortus* (L.) Roem. & Schult.		Spear grass (e), Assegaaigras (a)
Grass	*Panicum maximum* Jacq.		Buffalo Grass (e), Gewone Buffelsgras (a)
Grass	*Schizachyrium sanguineum* (Retz.) Alston		Red Atumn Grass (e), Rooiherfsgras (a)
Grass	*Schmidtia pappophoroides* Steud.	Least Concern	Sand Quick (e), Sandkweek (a)
Grass	*Stipagrostis uniplumis*		Silky Bushman Grass (e)
Grass	*Themeda triandra* Forssk.		Red grass (e), Rooigras (a)
Grass	*Tricholaena monachne* (Trin.) Stapf & C.E.Hubb.		Blue-seed grass (e), Blousaadgras
Herb	*Ceratotheca triloba* (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
Herb	*Corchorus asplenifolius* Burch.	Least Concern	Gusha (e), Geel varingblaartjie (a), Ubangalala (z)
Herb	*Datura inoxia* Mill.		Downy thorn apple (e)
Herb	*Evolvulus alsinoides* (L.) L.		Blue Haze (e)
Herb	*Flaveria bidentis* (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016).	Smelter's bush, Smelterbossie (a)
Herb	*Hibiscus micranthus* L.f. var. *micranthus*		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
Herb	*Indigofera* species		--
Herb	*Kyphocarpa angustifolia* (Moq.) Lopr.		Silky Burweed (e)
Herb	*Rhynchosia totta*		Yellow Carpet Bean (e)
Herb	*Solanum panduriforme* E.Mey.		Poison Apple (e), Gifappel (a)
Herb	*Tephrosia* species		--
Perennial herb	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)
Perennial herb	*Indigofera heterotricha* DC.	Least Concern	Hairy Indigo (e), Harige Indigofera (a)
Prostrate herb	*Cucumis zeyheri* Sond.		Wild Cucumber (e), Wildekomkommer (a)
Shrub	*Grewia bicolor* Juss. var. bicolor	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
Shrub	*Grewia flava* DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Shrub	*Grewia flavescens* Juss.	Least Concern	Bushman Raisin (e), Kruisbessie (a)
Shrub	*Grewia monticola* Sond.	Least Concern	Silver raisin (e), Vaal rosyntjiebos (a)
Shrub	*Rhigozum brevispinosum* Kuntze	Least Concern	Short-thorn pomegranate (e), Kortdoringgranaat (a)
Small tree	*Commiphora mollis* (Oliv.) Engl.	Least Concern	Velvet Commiphora (e), Fluweel-kanniedood (a), Mokômoto (tw)
Small tree	*Dichrostachys cinerea* (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
Small tree	*Gymnosporia undata* (Thunb.) Blakelock		Common Spike-thron (e), Gewone pendoring (a)
Small tree	*Senegalia erubescens* (Welw. ex Oliv.) Kyal. & Boatwr.	Least Concern	Blue Thorn (e), Blouhaak (a), Moloto (tw)
Small tree	*Terminalia prunioides* M.A.Lawson	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
Small tree	*Vachellia grandicornuta* (Gerstner) Seigler & Ebinger	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
Small tree	*Ziziphus mucronata* Willd. subsp. mucronata		Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)
Tree	***Boscia albitrunca* (Burch.) Gilg & Gilg-Ben.**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)**
Tree	*Colophospermum mopane* (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
Tree	*Combretum apiculatum* Sond. subsp. *apiculatum*	Least Concern	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
Tree	***Combretum imberbe* Wawra**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Leadwood (e), Hardekool (a), Motswiri (tw), Mudzwiri (v)**
Tree	*Combretum zeyheri* Sond.		Large-fruited bushwillow (e), Raasblaar (a)

Table 18: List of plant species recorded in the Southern Access Road towards PCD 3			
Growth Form	Species Name	Conservation/ Invasive Status	Common Name
Tree	*Commiphora glandulosa* Schinz	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
Tree	*Commiphora viminea* Burtt Davy	Least Concern	Zebra-bark Corkwood (e), Zebrabas-kanniedood (a), Mutonyombidi (v)
Tree	*Dombeya rotundifolia* (Hochst.) Planch. var. *rotundifolia*	Least Concern	Wild Pear (e), Drolpeer (a)
Tree	*Kirkia acuminata* Oliv.	Least Concern	White Kirkia (e), Witsering (a), Modumêla (tw)
Tree	***Philenoptera violacea*** **(Klotzsch) Schrire**	**Least Concern (IUCN), Protected tree (National Forest Act, 1998)**	**Apple leaf (e), Appelblaar (a)**
Tree	***Sclerocarya birrea*** **(A.Rich.) Hochst. ssp. caffra (Sond.) Kokwaro**	**Protected Tree (National Forest Act, 1998)**	**Marula (e), Maroela (a)**
Tree	*Senegalia nigrescens* (Oliv.) P.J.H.Hurter	Least Concern	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
Tree	*Vachellia tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)

Closed, variable woodland on lowland positions

Closed, variable woodland on lowland positions, note calcareous soils

Non-perennial drainage line with surrounding thicket type woodland, note sandy channel bottom

Non-perennial drainage line with surrounding thicket type woodland, note sandy channel bottom

Open variable (broadleaf) woodland on hillslopes

Open variable (broadleaf) woodland on hillslopes, note quartzitic soil types

Open variable (broadleaf) woodland on hillslopes, note quartzitic soil types

Open variable (broadleaf) woodland on hillslopes

Open variable (broadleaf) woodland on hillslopes

Open variable (broadleaf) woodland on hillslopes

Figure 44: Collage of images of habitat conditions along the proposed southern access road towards PCD 3

29.10 NORTHERN STORMWATER AND SEEPAGE ATTENUATION CHANNEL

The proposed seepage and stormwater attenuation channel along the northern perimeter of the Venetia Mine will comprise mostly of rehabilitated land, but importantly will cross two small non-perennial drainage lines that feeds northwards into the VLNR. The eastern drainage line originated south of the Venetia Mine, and originally formed part of the non-perennial drainage line that also feeds into the proposed OMWSD 4 site. Development of the Venetia Mine disrupted the natural flow of this drainage line. Reasoning for the attenuation channel is to provide protection for downstream areas against seepages from waste rock storage areas as the land slopes in a northern direction (into the adjacent mine area and VLNR). The Beta Diversity of these parts is comparatively low; only 30 plant taxa have been recorded during the brief site inspection (refer Table 19).

Habitat types that were identified along this proposed attenuation channel (refer Figure 45) include:

⇒ **Rehabilitated land:** Rehabilitation of land subsequent to transformative activities resulted in the colonisation of stabilised land by a prominent grass layer and scattered low trees. Prominent species in these parts include *Eragrostis tef* and *Cenchrus ciliaris* and other grass species that were used for rehabilitation purposes. The herbaceous layer comprise a moderate diversity, albeit at low abundance values, of forb species such as *Abutilon fruticosum, Melhania rehmannii, Aptosimum lineare, Flaveria bidentis*, Indigofera* species*, Tephrosia* species and *Cucumis zeyheri.* The secondary status of the vegetation will rapidly change as successional processes dictate, also with reference to available moisture for seeding and regrowth. A low floristic sensitivity is ascribed to these parts as a result of the altered and depleted status of the vegetation. A few isolated *Adansonia digitata* individuals are situated in proximity to the proposed channel; these individuals were planted as part of a search-and-rescue operation. A low floristic sensitivity is ascribed to these parts (refer Figure 46).

⇒ **Riparian Thickets:** Two (originally) non-perennial drainage lines were present before mining commenced. The western drainage line is comparatively small and originated from the mining footprint. In contrast, the eastern drainage line Persistent flow of effluents from nearby mining storage areas resulted in the

formation of shallow, wetland (marshy) conditions at the edge of the mine property that drains towards the north, eventually into the VLNR. Typically these areas are dominated by a prominent and dense layer of Mopane trees that have established subsequent to the changes in the moisture regimes of the drainage line, but the species composition of these parts is generally low. Soil conditions in these parts are permanently inundated and a high humic content of the A- horizon is noted. The smaller, western drainage line is also a result of persistent effluent from the southern mining activities, but is not as prominent as the eastern drainage line. The floristic composition of these areas are comparatively low; and a medium floristic sensitivity is ascribed (refer Figure 46), mostly relating to the ecological importance of this area to pristine habitat situated further north. It should be noted that the persistently inundated conditions within these drainage lines will likely result in a 'die-off' of the prominent Mopane trees, as can be noted in certain parts.

Figure 45: Broad-scale habitat types along the Northern Attenuation Channel

Figure 46: Floristic sensitivity of habitat types along the Northern Attenuation Channel

Table 19: List of plant species recorded along the Northern Attenuation Channel

Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
Dwarf shrubs	*Abutilon fruticosum* Guill. & Perr.	Least Concern	Shrubby Abutilon (e)
	Melhania rehmannii Szyszyl.	Least Concern	John Deer Bossies (a)
	Solanum lichtensteinii Willd.		Large Yellow Bitter Apple (e), Groot Geel Gifappel (a)
Grasses	*Cenchrus ciliaris* L.		Blue Buffalo Grass (e), Bloubuffelgras (a)
	Dicanthium annulatum		Vlei Finger Grass (e), Vleivingergras (a)
	Eragrostis lehmanniana Nees var. *lehmanniana*		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
	Eragrostis tef (Zuccagni) Trotter		Teff (e), Tef (a)
	Melinis repens		Natal Red Top (e), Natal-rooipluim (a)
	Schmidtia pappophoroides Steud.	Least Concern	Sand Quick (e), Sandkweek (a)
	Setaria verticillata (L.) P.Beauv.	Least Concern	Bur Britle Grass (e), Klitsgras (a)
Herbs	*Aptosimum lineare* Marloth & Engl.		--
	Ceratotheca triloba (Bernh.) Hook.f.		Wild Foxglove (e), Vingerhoedblom (a)
	Corchorus asplenifolius Burch.	Least Concern	Gusha (e), Geel varingblaartjie (a), Ubangalala (z)
	Flaveria bidentis (L.) Kuntze	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016)	Smelter's bush, Smelterbossie (a)
	Indigofera species		--
	Tephrosia species		--
	Waltheria indica L.		Meidebossie (a)
Perennial herbs	*Heliotropium* species	Least concern	String of stars (e), Hamelstertjie (a)
	Indigofera heterotricha DC.	Least Concern	Hairy Indigo (e), Harige Indigofera (a)
	Litogyne gariepina (DC.) Anderb.	Least Concern	Dwarf Sage (e), Blougifbossie (a)
Prostrate herbs	*Alternanthera pungens* Humb.		Khaki Weed (e), Dubbeltjie (a)
	Cucumis zeyheri Sond.		Wild Cucumber (e), Wildekomkommer (a)

Table 19: List of plant species recorded along the Northern Attenuation Channel			
Growth Form	*Species Name*	*Conservation/ Invasive Status*	*Common Name*
	Tribulus terrestris L.		Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Sedge	*Cyperus longus* L. var. *tenuiflorus* (Rottb.) Boeck.	Least Concern	Sweet cyperus (e), Waterbiesie (a)
Shrubs	*Grewia flava* DC.	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
	Grewia species	Least Concern	--
Small tree	*Dichrostachys cinerea* (L.) Wight & Arn. subsp. africana Brenan & Brummitt	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
Trees	Adansonia digitata L.	Protected Tree (National Forest Act, 1998)	Baobab (a), Cream-of-tartar-tree (e), Kremetartboom (a), Muvhuyu (v)
	Colophospermum mopane (J.Kirk ex Benth.) J.Kirk ex J.Léonard	Least Concern	Mopane (e), Mopane (a), Mopane (tw)
	Sterculia rogersii N.E.Br.	Least Concern	Star-chestnut (e), Sterkastaiing (a), Mukakate (v)

Prominent Mopane layer in riparian areas (east, note dry soils)

Perennial nature of small drainage line (east) resulting from effluent from nearby mining areas

Marshy conditions created by persistent flow from mining areas (east)

Rehabilitated areas with prominent grass layer

Rehabilitated areas with prominent grass layer

Rehabilitated areas with prominent grass layer, note ponding of water resulting from surface flow from mining areas

Western drainage line, note die-off of Mopanes due to persistent inundation

Western drainage line, note die-off of Mopanes due to persistent inundation and formation reed stands

Effluent exiting the northern perimeter of the mine

Rehabilitated areas with nearby mining infrastructure

Figure 47: Collage of images of habitat conditions along the proposed attenuation channel

29.11 ANNOTATIONS ON "EASTERN SECTION"

A request was submitted to provide comments pertaining to an 'eastern section' that comprises, partly, a section of the Venetia Mine and the adjacent VLNR. It should be noted that these comments are provided from anecdotal observations that were made during a brief, and wide-scale inspection along the major access roads within the area. No detailed observations were made to the extent of the floristic composition and plant species of conservation concern and all comments should be interpreted with caution. Furthermore, as no indication were provided for any infrastructure that are planned for this area, comments will be restricted to brief discussions and indication of the estimated floristic importance and sensitivity. This area will also not be included in the quantification of impacts that are anticipated from the proposed developments on the floristic receiving environment.

The eastern section comprises a portion of the existing Venetia Mine, as well as a significant portion of the adjacent VLNR. The disparity between the 'inside' and 'outside' areas are exemplified by a highly variable floristic composition and the effects that mining-related activities have had on the vegetation, also reflecting regional floristic patterns. Localised areas of transformation are noted and minor changes that accompany these activities, such as the densification of Mopane with continued and long-term elevated moisture conditions of the soils around areas pertaining to mining activities, notably in the southern part of the area. While most of the remaining natural woodland (within the Venetia Mine property) have retained most of the natural character that correlates to the regional ecological type, i.e. both the Musina Mopane Bushveld and the Limpopo Ridge Bushveld (refer Sections 26.1 and 26.2).

Physiognomic units that were observed within this area include the following:

Transformed areas and deteriorated woodland: Areas associated with mining-related activities situated within the Venetia Mine perimeter as well as nearby woodland habitat that have been affected (although not necessarily decimated) by mining-related habitat. Noted from aerial imagery is the effects that long-term wind dispersion of dust have had on the appearance of the habitat. The predominantly southwestern winds of the region disperse dust from the waste dumps for short distances (< 2 km), providing for low impacts on the vegetation. These areas are generally estimated to exhibit floristic attributes of moderate to poor status and

sensitivity, but because of the nodal and isolated nature of these areas, are generally not considered suited for large-scale developments and activities.

Mopane thickets: Densification of the shrub layer, notably the Mopane trees, is a typical response to elevated soil moisture conditions for prolonged periods. The densification of the Mopane layer is generally at the expense of the 'normal' herbaceous and tree/ shrub layer (diversity) and a comparatively poor species diversity is often recorded from these areas. While this habitat type is often a response to anthropogenic activities and changes related to mining activities, the presence of similar areas is noted along the major river systems of the region. It therefore represents a habitat type of limited regional representation and is considered comparatively sensitive. The sensitivity ascribed to these areas are often a reflection of the ecological importance of the riparian habitat with which it is associated.

Riparian woodland and associated habitat: The Matotwane River is situated within this eastern portion and comprises a pristine, natural and highly sensitive riparian environment that exhibit a high correlation to the wetland and riparian types of the regional vegetation. This river drains northwards, eventually into the Limpopo River. The floristic and ecological environment of this river exhibit a typical suite of numerous micro- and broad-scale habitat types that are frequently associated with a major riparian habitat of the region, ranging from isolated and embedded reedbeds, open shallow floodplains, sandy banks with steep riverbanks, rapids across rocky and stony streambeds, etc. The natural status of this ecosystem is also indicated by the absence of invasive and 'poor quality' species, including trees such as the Mopane that tends to densify within an altered and deteriorated environment, as well as the herbaceous component. The presence of several protected tree species, including *Adansonia digitata* (Baobab), *Sclerocarya birrea* (Marula), *Combretum apiculatum* (Leadwood) and *Philenoptera violacea* (Apple leaf) were noted from a comparatively small portion of the river (which also included observations from the immediate surrounding terrestrial woodland environment). Any impacts within this ecosystem, beit direct, or indirect from nearby activities, that are likely to affect this ecosystem, is considered unacceptable and should be avoided at all costs. The importance and sensitivity of this environment is also enhanced by the spatial inclusion within the VLNR, forming a critical component of the local and regional ecological infrastructure. A high floristic status and sensitivity is therefore ascribed to this ecosystem.

Natural Terrestrial woodland types: Natural, terrestrial woodland surrounding the Matotwane River exhibit a high correlation with the regional ecological types and few impacts, other than limited peripheral and indirect impacts from nearby mining-related activities can be noted. Specifically, terrestrial woodland habitat that is situated within the VLNR is considered particularly pristine, assumedly to have been managed for conservation purposes and not being subjected to intensive management actions, as could be noted from nearby terrestrial woodland that is spatially included within the Venetia Mine property. Although the differences might be considered minor, the importance of the remaining woodland within the Venetia Mine property performs a critically important function as a buffer between the adjacent VLNR conservation area and effects from mining activities. Despite only a moderate-high ecological sensitivity being ascribed to these terrestrial woodland parts, the ecological importance is considered high, notably parts that are situated within the VLNR.

Figure 48: Broad scale habitat types of the Eastern Area

Figure 49: Floristic sensitivity of habitat types of the Eastern Area

	
Terrestrial woodland environment	Riparian woodland environment, note Baobab on streambank
	
Riparian woodland environment	Riparian woodland environment, not Leadwood on streambank
	
Terrestrial woodland environment	Terrestrial woodland environment

Figure 50: Collage of images of habitat conditions within the Eastern Area

30 BOTANICAL IMPACT ASSESSMENT

The approach to determine a quantified severity of the anticipated impacts is presented in Appendix 6. Quantification of impacts are presented in Table 20

30.1 NATURE OF IMPACTS

30.1.1 DIRECT IMPACTS

The largest extent of impacts within the botanical environment is likely to stem from direct (physical) effects of land clearing activities and associated habitat losses. Typically, with activities that involve the complete removal or existing vegetation, these impacts are locally destructive and devastating. Impacts of a direct nature therefore include the variety of effects on natural habitat types, locally endemic species, populations and species and populations of conservation importance, as well as habitat that is associated with these species. Also included are effects on overall floristic species richness, diversity, and abundance. These impacts also frequently include effects on genetic variability, population dynamics, overall species existence or health. Lastly, losses of sensitive habitat, spatially restricted habitat types, and protected habitat types are also included in this category.

These impacts are measurable and easy to identify; effects are mostly predictable and immediately visible (after the fact) and can therefore be established or predicted with an acceptable level of certainty. It is however notoriously difficult to prevent (apart from preventing the activity in its entirety by means of the "No-Go Option") while predictions on future ecosystem changes are more problematic and variable.

Impacts of a direct nature on the floristic environment include the following:

Impact 1: Impacts on/ losses of conservation important and protected plant species (individuals, stands, populations) as well as habitat that is associated with these plant of conservation consideration;

Impact 2: Losses, and deterioration, of natural and sensitive habitat types, including essential habitat refugia, atypical and unique/ restricted habitat types; and

Impact 3: Depletion of local floristic diversity and loss of rare species or flora communities.

In particular, the potential impacts relating to the spatial placement of haul roads between Area 2 and Area 3 is expected to result in particularly severe and unacceptable impacts on floristic sensitive habitat, notably the grassland habitat that is associated with crests and slopes of the low mountains. Although these impacts are spatially situated outside the perimeter of the respective sites, comments to the effect will be provided as it forms an integral part of the planned operation.

30.1.2 INDIRECT IMPACTS

Indirect impacts are not always immediately evident and can consequently not be measured at a specific moment in time. These 'spill-over effects' or 'edge effects' are spatially (realising outside the site perimeter) and temporally (occurring sometime after the actual impact, in future, ranging from immediate to several years) removed from the actual activity. Manifestations thereof are typically more subtle and not as locally devastating as direct impacts. The extent is most often at a scale that is larger than the actual site where the activity is undertaken, but it is usually restricted to a local scale (< 2 km), rarely regional.

A measure of estimation, extrapolation, or interpretation and specialist knowledge is therefore required to evaluate the significance of indirect impacts and it is usually an integrated factor of the sensitivity of the receiving surrounding environment, correlated against the severity and realistic expectations (based on experience) of the development. Indirect impacts typically result in adverse effects or deterioration of the surrounding areas, with an effect that

diminishes from the edge of the impact, which is determined by the specific vectors of transport. For example, considering the nature of rivers, some impacts are 'carried' much further than others. For example, impacts that are related to increased dust levels might adversely affect a radius of approximately 2 km, contaminated water and alien and invasive species (seeds) that are carried by rivers might affect areas as far away as 20 km, or more). Notwithstanding the vector, in most cases it is the ecological functionality of the surrounding area that is adversely affected, as opposed to impacts on species level.

One of the most important effects of indirect impacts is the alteration of biophysical characteristics of the surrounding areas through the introduction and proliferation of species with an exotic nature or encroachment characteristics, changes in topographical features, etc. Lastly, the aesthetic appeal of the region, although a personal and highly debatable attribute, is regarded a potential receiver of landscape changes, declining with continued transformation of natural land and addition of industrial landscapes and skylines, lights, infrastructure, etc.

Impacts of an indirect and induced nature generally include the following:

Impact 4: Deterioration and changes to untransformed habitat in the surrounds, with specific reference to sensitive habitat types and habitat types of limited representation on a local scale;

Impact 5: Disruption of important ecological processes, services, and infrastructure and altered ecological functionality (including fire, erosion) of surrounding areas and natural habitat;

Impact 6: Introduction of exotic and invasive species to the area, or exacerbating the spread of existing infestations; and

Impact 7: Exacerbated decline in the aesthetic appeal of the landscape.

30.1.3 Induced and Cumulative Impacts

Induced and impacts of a cumulative nature have little direct relationship with the activity, but is reasonably anticipated to realise because of the presence of project. Cumulative impacts represent the totality of impacts in a given area resulting from this activity and related (similar projects or activities that could conceivably be regarded as 'spin-offs' from this project), viewed in context of past projects and other reasonably foreseeable future anthropogenic disruptive activities in the immediate region and how these activities impact upon the ecology of a region. The exact nature, duration, significance, and scale of cumulative impacts are difficult to quantify and also extremely problematic to mitigate against. However, cumulative impacts are significant and require consideration during this process of mitigating impacts and managing the natural ecological environment of the region.

Anticipated cumulative impacts of the proposed project on the ecology of the region include:

Impact 8: Inappropriate harvesting of natural resources and exacerbation of pressure on natural resources due to increased human encroachment, accessibility to the site, also considering changes in land use of surrounding areas that are not compatible to conservation efforts;

Impact 9: Exacerbation of existing levels of habitat fragmentation and isolation, considering past, present and reasonably foreseeable future anthropogenic disruptive activities in the immediate region, with specific reference to mining activities; and

Impact 10: Cumulative impacts on local/ regional and national conservation efforts, targets, and obligations (loss of natural habitat).

30.2 Quantification of Impacts

Impacts are collectively quantified for each of the respective areas, as per Table 20.

Table 20: Quantification of Impacts on the Botanical Environment

Area	Aspect Affected	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
								Probability	Magnitude	Significance		Probability	Magnitude	Significance
PCD 1	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, mostly local scale, not anticipate exceeding mine perimeter	2	2	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		2	1	Low		2	1	Low
PCD 2	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, mostly local scale, not anticipate exceeding mine perimeter	2	2	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		2	1	Low		2	1	Low
PCD 3 (A)	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Medium	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	3	3	Medium	Avoid (buffer area) & Control	3	2	Medium
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		3	3	Medium		3	2	Medium
PCD 3 (B)	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	5	4	High	Avoid (buffer area) & Control	4	3	High
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		4	4	High		4	3	High
PCD 3 (C) Preferred	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	5	4	High	Avoid (buffer area) & Control, recommended mitigation approach	3	3	High
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		4	4	High		4	3	High
PCD 3 (D)	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Medium	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	3	3	Medium	Avoid (buffer area) & Control	3	2	Medium
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		3	3	Medium		3	2	Medium

Table 20: Quantification of Impacts on the Botanical Environment

Area	Aspect	Activity	Potential Impact	Reversibility	Irreplaceable	Phase	Size and scale of	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
PCD 4	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, mostly local scale, not anticipate exceeding mine perimeter	2	2	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		2	1	Low		2	1	Low
FRD 1 RWD	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, mostly local scale, not anticipate exceeding mine perimeter	2	2	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		1	1	Low		1	1	Low
OMWSD N&S	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Low	Construction and operational and residual	No loss of natural habitat, existing infrastructure, but impacts might extend to nearby natural habitat, moderate to low significance	2	2	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Low	Residual and Post-Operational		2	1	Low		2	1	Low
OMWSD 3	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Medium	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate exceeding mine perimeter, impacts anticipated to be of moderate significance, but local	3	2	Medium	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		2	2	Low		2	1	Low
OMWSD 4	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	Medium	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will possibly exceed local area, significance of impacts anticipated to be moderately severe on local scale	3	3	Medium	Avoid (buffer area) & Control, recommended mitigation approach	2	2	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		2	2	Low		2	1	Low
Northern Attenuation Channel	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	High	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate exceeding mine perimeter, impacts anticipated to be of moderate significance, but local	2	1	Low	Avoid (buffer area) & Control, recommended mitigation approach	2	1	Low
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		1	1	Low		1	1	Low

Table 20: Quantification of Impacts on the Botanical Environment

Area	Aspect	Activity	Potential Impact	Reversibility	Irreplaceable	Phase	Size and scale of	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
Southern Access Road	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be moderately severe on local scale	3	3	High	Avoid (buffer area) & Control, recommended mitigation approach	3	2	Medium
			Cumulative Impacts on the botanical and ecological environment	Low	Medium	Residual and Post-Operational		3	2	Medium		2	1	Low
Eastern Area	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botanical and ecological environment	Low	High	Construction and operational and residual	Loss of extensive and sensitive areas of natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local and larger scale	5	4	High	Avoid (buffer area) & Control, recommended mitigation approach	5	4	High
			Cumulative Impacts on the botanical and ecological environment	Low	High	Residual and Post-Operational		5	4	High		5	4	High

Table 21: Measures to rehabilitate the Botanical Environment

No.	*Aspect affected*	*Activity*	*Potential Impact*	*Phase*	*Mitigation type*	*Impact management actions / Mitigation measures*	*Impact management outcome*	*Standard to be Achieved*	*Time period for implementation*
1	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation (all sites)	Direct and Indirect Impacts on the botanical and ecological environment	Construction and operational and residual	Avoid & Control	1. Final walkdown to identify and geolocate protected plant species for permitting purposes. No protected plant species may be affected, removed, excavated, relocated, or impacted in any manner, except under a valid permit granted by the relevant authority and under the supervision of the appointed EO. 2. Apply for and acquire permits from DFFE (and possibly LEDET) for removal of protected plant species. 3. Develop a biodiversity monitoring programme to establish long-term trends of floristic and faunal diversity patterns and latent and immediate effects of mining on these receiving environments. 4. Implement an integrated alien plant control program, which identify species that pose the greatest threats, in terms of habitat transformation, within the development areas, and considers all appropriate chemical, mechanical, biological and cultural control methods to effectively control the species. 5. Prioritise erosion control during the planning phase where slopes, runoff from paved and tarmac areas and stormwater control measures need to be highlighted and planned to prevent erosion of	Demarcation and management of all fenced and development areas, including no-go areas. Identification of target/protected plant species and relocation/rescue of individuals; where possible. Record-keeping of all related-applications and relocations. Acquisition of relevant permits to remove plant taxa. All open space areas and development areas are free of declared of alien vegetation/ or frequency	Avoid impacts to no-go areas and adjacent VLNR. Alien control should be achieved as per threshold level or recommendations specified in the AIP management plan. The ECO to manage/liaise with certified PCO. Conduct yearly assessments to determine the ecological condition of the rehabilitated as well as natural habitat units on development areas and adjacent areas.	Demarcation and fencing of development sites should commence prior to construction activities. Screening of development areas for target species by ECO should be implemented prior to construction. Re-location or rescue of taxa prior to construction. Alien control should be continuous (during operation and rehabilitation).

Table 21: Measures to rehabilitate the Botanical Environment

No.	Aspect affected	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome	Standard to be Achieved	Time period for implementation
						surrounding natural areas. 6. Demarcate development areas; no personnel or construction vehicle shall be allowed to unlawfully access neighbouring properties for any purpose whatsoever, with specific reference to the VLNR area. 7. The **PCD 3** site shall be demarcated by permanent fencing to prevent any access for animals to these areas. Typical fencing employed for security purposes around the Venetia Mine is considered adequate. 8. Cleared vegetation and debris that has not been utilised must be collected and disposed through an appropriate manner. 9. No painting or marking of rocks or vegetation (trees) to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. All temporary markings will be removed upon completion of the construction. 10. Collection of branches, wood (dead or alive), shrubs or any vegetation for fire making purposes is strictly prohibited. 11. Open fires at site is prohibited, including the burning of waste material. The irresponsible use of welding equipment, oxy-acetylene torches, and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines. 12. Provide temporary and suitable on-site ablution, sanitation, litter and waste management and hazardous materials management facilities until such time that adequate permanent and operational facilities can be provided. Ablution anywhere other than in provided ablutions shall not be permitted. Under no circumstances shall use of the veld for ablution purposes be permitted. 13. A periodic clean-up of the surrounding natural environment should be undertaken to remove litter and prevent unwanted deterioration of the surrounding natural environment. 14. Implement site induction for contractors and workers to familiarize them with all aspects relating to environmental components of the project.	of infestation is controlled at acceptable levels. Any herbicide application to take place by Certified Pesticide Control Operator. Induction of labour and staff on specific environmental issues related to the development sites.		Veld condition monitoring should be conducted annually (in summer). Produce annual report (for at least four consecutive years) on the ecological *status quo* of the development sites and immediate surroundings.

Table 21: Measures to rehabilitate the Botanical Environment

No.	*Aspect affected*	*Activity*	*Potential Impact*	*Phase*	*Mitigation type*	*Impact management actions / Mitigation measures*	*Impact management outcome*	*Standard to be Achieved*	*Time period for implementation*
						15. Use of locally indigenous plant species for landscaping purposes is strongly recommended. Under no circumstances shall exotic and invasive plants be used for landscaping purposes.			

30.2.2 IMPACT SIGNIFICANCE – PCD 1

As the largest part of the site comprises woodland habitat of a comparatively natural status, impacts of a moderate significance is reasonably anticipated. The most significant impact relates to the presence of protected tree species within the footprint. It is emphasised that permits need to be issued by DFFE prior to any impacts on these individuals. The relocation of the Baobab individuals is recommended as a site-specific mitigation measure. The known presence of invasive and encroacher species within the site and immediate surrounds presents a (moderate level) threat to surrounding natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. As part of this site comprises a non-perennial drainage line, albeit severely compromised and deteriorated, ecological processes are likely to be affected to a minor extent. The loss of natural woodland habitat is not considered significant on a regional scale, mostly as the proposed site is situated within the existing Venetia Mine property and comprises a comparatively small extent. The application of the recommended mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptable significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.3 IMPACT SIGNIFICANCE – PCD 2

Very little natural habitat remains within this proposed footprint and the potential threat to sensitive and unique floristic attributes on a local and regional scale is considered minimal. The presence of several encroacher and invasive plant species within the site and immediate surrounds provides for a low level threat to nearby natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. The application of the recommended mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptably low significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.4 IMPACT SIGNIFICANCE – PCD 3

The spatial placement of this proposed site results in a highly dimorphic nature of anticipated impacts on the floristic receiving environment. Habitat within the Venetia Mine property provides for moderate to severe deteriorated levels and the anticipated impacts are not considered significant and easily controlled. Isolated occurrences of protected trees is subject to permitting requirements. However, terrestrial and riparian woodland types, as well as the informal impoundment, that are situated in the Venetia Limpopo Nature Reserve is representative of the regional types and therefore considered sensitive, notably as it is situated within the existing reserve as well as being in spatial proximity to the Kolope River, which is considered a significant and sensitive part of the ecological infrastructure of the region. Peripheral, indirect and induced impacts on this system can therefore be reasonably be anticipated. It is emphasised that the informal impoundment is currently performing an important function as a buffer between the Kolope River and effects from the nearby mining activities. Aerial imagery (refer Figure 23) provides evidence of effluents from multiple sources flowing into this informal impoundment and the functionality of this impoundment for flood attenuation and filtering purposes is considered important. The presence of a moderate number of protected tree species within the natural terrestrial woodland is also noted and permitting requirements need to be met prior to any impacts. The uncontrolled spread of peripheral impacts, notably invasive plants species, into the VLNR and the Kolope River is a major consideration, and the implementation of a dedicated monitoring and control programme is strongly recommended. While the loss of natural habitat is not considered significant in terms of surface area, indirect impacts and cumulative losses and encroachment onto sensitive ecosystems is considered significant. The protection of the nearby ecosystems and containment of impacts and effluents should therefore be prioritised.

While impacts of a significant nature is reasonably anticipated, the implementation of the recommended mitigation approach is expected to result in reasonably and acceptable amelioration of impacts. However, as a result of potentially devastating impacts from uncontrolled impacts from the development and operation of this PCD, the implementation of a dedicated and rigorous monitoring programme is strongly recommended for early identification and treatment of unexpected impacts.

30.2.5 IMPACT SIGNIFICANCE – PCD 4

Very little natural habitat remains within this proposed footprint and the potential threat to sensitive and unique floristic attributes on a local and regional scale is considered minimal. The presence of several encroacher and invasive plant species within the site and immediate surrounds provides for a low level threat to nearby natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. The application of the recommended mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptably low significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.6 IMPACT SIGNIFICANCE – FRD 1 RWD

Very little natural habitat remains within this proposed footprint and the potential threat to sensitive and unique floristic attributes on a local and regional scale is considered minimal. The presence of several encroacher and invasive plant species within the site and immediate surrounds provides for a low level threat to nearby natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. The application of the recommended mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptably low significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.7 IMPACT SIGNIFICANCE – OMWSD N & S

Very little natural habitat remains within this proposed footprint and the potential threat to sensitive and unique floristic attributes on a local and regional scale is considered minimal. The presence of several encroacher and invasive plant species within the site and immediate surrounds provides for a low level threat to nearby natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. The application of the recommended mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptably low significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.8 IMPACT SIGNIFICANCE – OMWSD 3

As the largest part of the site comprises woodland habitat of a comparatively natural status, impacts of a moderate significance is reasonably anticipated. The most significant impact relates to the presence of protected tree species within the footprint. It is emphasised that permits need to be issued by DFFE prior to any impacts on these individuals. The relocation of the Baobab individuals is recommended as a site-specific mitigation measure. The known presence of invasive and encroacher species within the site and immediate surrounds presents a (moderate level) threat to surrounding natural habitat and the control of these species as part of the dedicated AIP management programme for the mine is strongly recommended. As part of this site comprises a non-perennial drainage line, albeit severely compromised and deteriorated, ecological processes are likely to be affected to a minor extent. The loss of natural woodland habitat is not considered significant on a regional scale, mostly as the proposed site is situated within the existing Venetia Mine property and comprises a comparatively small extent. The application of the recommended

mitigation approach (refer Section G) is therefore expected to result in amelioration of anticipated impacts to an acceptable significance level and no impact of unacceptable significance is anticipated from development of this proposed site.

30.2.9 IMPACT SIGNIFICANCE – OMWSD 4

Although the proposed site comprise only a small extent of natural habitat (mostly an informal impoundment), the ecological functionality is considered important on a local and regional scale. While likely to be more important in terms of the faunal components, the loss of the retention and filtering ability of the larger system is considered significant since the proposed river diversion will feed directly into the Kolope River (refer Figure 9). The losses of a low number of protected trees are noted, but is not considered significant on a local or regional scale. The inappropriate spread of invasive plant species should be monitored and controlled through an AIP management plan.

30.2.10 IMPACT SIGNIFICANCE – SOUTHERN ACCESS ROAD TO PCD 3

While the proposed activity will approximately only require the widening of the existing road by 10 – 15 m, it is emphasised that the affected habitat comprises natural woodland habitat that is spatially situated within a conservation area, and impacts relating to the loss of natural habitat, notably also a number of protected tree species, is considered significant, specifically as 2 river crossings will be required. Technical feasibility of relocating the road into the mine perimeter has been recommended, but is not considered possible due to construction vehicle constraints. The presence of construction vehicles, although only during the construction period, is likely to result in the exacerbation of invasive species and due control and monitoring is strongly recommended. The implementation of a generic mitigation approach will result in adequate amelioration of anticipated impacts, but periodic monitoring should inform management actions against observed impacts.

30.2.11 IMPACT SIGNIFICANCE – NORTHERN STORMWATER AND SEEPAGE ATTENUATION CHANNEL

Apart from the riparian environments, extremely little natural habitat remain within this proposed development footprint and no significant impacts are anticipated. The implementation of a generic mitigation approach, together with a period monitoring activity and natural surrounds, will inform management of observed impacts.

30.3 RECOMMENDED PROTOCOL FOR THE BOTANICAL MONITORING PROGRAMME (AS PART OF THE BIODIVERSITY MONITORING PROGRAMME)

Through implementation and execution of a botanical monitoring programme, the anticipated and actual impacts of the proposed activities within the floristic environment can be established and monitored. Collated information data and results will contribute towards a responsive management approach to minimize the impact footprints and associated spheres of influence.

Frequency: annual
Responsibilities client, Environmental Manager, appointed specialist(s);

The following phases are relevant:

1 Pre- construction environment – the baseline ecological report will suffice in highlighting existing conditions and terrestrial botanical attributes;

2 Construction phase – implementation of the botanical monitoring protocol at a frequency of at least annually, taking cognisance of seasonal variations; and

3 Post-construction environment – execution of the botanical monitoring protocol annually until such time that closure has been granted by the authorities.

While the details of a monitoring plan is subject to negotiations prior to appointment, the following aspects (inter alia) should form part of the monitoring protocol, as a minimum:

⇒ Fixed point monitoring should be applied as the preferred method of monitoring. The selection of monitoring points should consider the spatial layout of mining activities and infrastructure in relation to sensitive environments, also taking note of control points to provide a comparative assessment;

⇒ All data gathered should be measurable (qualitative and quantitative) – attention should be provided to species diversity and abundance;

⇒ Monitoring report should be repeatable and temporally and spatially comparable, with specific reference to seasonal variation;

⇒ Data, when compared to previous sets, should show spatial and temporal trends; and

⇒ General habitat unit overviews should also be undertaken to augment quantitative data.

The recommended terrestrial biodiversity monitoring protocol will comprise the following aspects, or a variation thereof:

1. Alien and Invasive plant species monitoring; and
2. Vegetation/ ecological monitoring.

These aspects should ideally be executed during an optimal period of the year, considering seasonal variation in vegetation attributes. Ultimately, the objectives are to demonstrate the stability of the surrounding environment and sensitive receptors, monitoring results should therefore ideally be repeated during the same time of year. The responsibility of the implementation and auditing of monitoring performance would remain with the client, notably the Environmental Manager.

Requirements for the appointed specialists should conform to the guidelines of the South African Council for Natural Scientific Professions Act (2019), and specifically adhere to regulations pertaining to the minimum requirements as per the National Environmental Management Act, 1998 (Act No. 107 of 1998).

30.3.1 Alien and Invasive Plant Management Plan

⇒ Conduct a brief assessment of the legal framework pertaining to the management, responsibilities and requirements of the landowner pertaining to the occurrence of alien and invasive plants on the property and immediate surrounds;

⇒ Undertake a site assessment/ ground-truth to identify and record alien invasive vegetation, identify threats to the ecology of the area, etc.;

⇒ Compile GIS spatial maps to support the Control Compilation of an AIS Plan as per the requirements of the AIS Regulations, 2015 and Invasive Species List, 2016;

⇒ Spatially map the parcels of land within the immediate surrounds of the mining footprint, with reference to land use activities;

⇒ Compile a working inventory of Invasive Species for each management unit compartment;

⇒ Describe the prioritization of the land parcels in the management unit compartments in accordance with the categories as per the Alien and Invasive Listing, 2016;

⇒ Provide targets and timelines for the Control Plan;
⇒ Provide responsibilities and reporting requirements of the Control Plan;
⇒ Provide control and/or eradication methods for identified invasive species in the Control Plan;
⇒ Indicate how the Control Plan will be monitored and evaluated as part of the vegetation monitoring plan;
⇒ Provide a suitable report for implementation as part of the EMP for the development; and
⇒ Execute the AIP monitoring protocol on an annual basis.

Monitoring of the presence, abundance, and diversity of alien and invasive plants on the site, while forming an integral part of the terrestrial monitoring programme, is partly the responsibility of the following persons:

1 Environmental Manager (Project);
2 Subcontractor responsible for alien and invasive plant control; and
3 Vegetation/ Ecology Monitoring Programme subcontractor.

30.3.2 Vegetation/ Ecological Monitoring Protocol

As part of the proposed (annual) Monitoring Programme, the following aspects will be executed:

⇒ Selection of a suitable number of sampling points that is representative of the mining activities within a natural, receiving environment, with particular reference to sensitive habitat types and species of conservation concern;
⇒ Annual monitoring of vegetatal aspects during the active mining phase, including aspects of diversity, compositional and structural attributes as well as accumulation of impacts within nearby habitat;
⇒ Prevalence and continued persistence of plants of conservation concern;
⇒ Prevalence and continued persistence of plants with ethno-botanical properties;
⇒ Prevalence and management of alien and invasive plant species; and
⇒ Land change/ habitat loss and transformation.

30.4 Concluding Statement and Professional Opinion as required by Appendix 6 of the Regulations and Assessment of the Presence of Indigenous Vegetation and Habitat Sensitivity

The general area provides for a physiognomically homogenous savannoid landscape and ecosystem that is characterised by locally variable broad-scale and micro-habitat types that has their origin from the continuum and interrelationship of slopes, geomorphological attributes, topographical heterogeneity and moisture regimes. Nodal areas of deterioration are largely restricted within a defined and demarcated area (i.e. Venetia Mine property), exhibiting typical and expected responses to developmental, transformative and disruptive activities.

A brief assessment of the ecological receiving environment within the respective sites indicated a moderate floristic sensitivity that resulted from long-term impacts caused by mining-related activities and the continued decline in the status of the vegetation. Remaining areas of woodland habitat exhibit a moderate correlation with regional ecological types, but locally sensitive parts that are situated within the VLNR were identified as areas of concern.

A review of the anticipated impacts from the proposed development on the floristic receiving environment indicates that none of the anticipated impacts (if managed and mitigated correctly) can be highlighted or construed to represent unacceptable or severe threats to sensitive floristic elements within the study areas and immediate surrounds. However, caution is advised in the case of PCD 3 footprint that is situated in spatial proximity to the Kolope River, as well as forming part of the VLNR. As with most anthropogenic developments, the decimation of natural habitat is an unfortunate prerequisite and the localised reduction in abundance of plants and natural habitat represent typical and anticipated consequences of a reasonable significance.

The following key consideration are presented in support of the Professional Opinion:

⇒ Ecological attributes of the study site are regarded common and ubiquitous to the wider region;

⇒ No threatened plant species were recorded within the site during the site investigation, or are considered highly likely to occur within any of the development footprints;

⇒ A low number of protected species were recorded within the site during the site investigation;

⇒ No habitat type within the site are regarded restricted on a local or wider scale. The site also does not exhibit any biophysical feature of rarity or elevated ecological importance or sensitivity;

⇒ The proposed development footprints comprise mostly woodland habitat that exhibit moderate levels of deterioration;

⇒ The loss of deteriorated habitat from the site is not expected to result in significant, or unacceptable, impacts on provincial biodiversity conservation efforts;

⇒ The loss of these portions of woodland habitat is also not anticipated to result in significant changes or disruptions to ecological processes on a local or regional scale;

⇒ Specific caution is however advised for PCD 3 site and the access road towards this site as it is situated within a conservation area; and

⇒ The application of the recommended mitigation approach is expected to ameliorate anticipated impacts to an acceptable low level.

It is therefore the considered opinion, based on results of this botanical investigation, that no specific objections are raised to the proposed development. This opinion is based on the explicit understanding that the recommended mitigation approach is timeously and comprehensively implemented and also adhered to during all stages of the development.

SECTION F: FAUNAL AND AVIFAUNAL ATTRIBUTES OF THE AREA

31 TERMS OF REFERENCE FOR THE FAUNAL AND AVIFAUNAL ASSESSMENT

The study aims to provide a description of the terrestrial faunal and avian diversity as delineated on the accompanied maps. The main objective of the study is therefore to provide an overview of the faunal diversity on the project area and to provide a description of the potential occurrence of conservation important taxa. Specific tasks that were undertaken during the assessment included:

⇒ Identification of bird and terrestrial faunal compositions on the study sites and their association with particular broad-scale habitats and in context of identified floristic communities;

⇒ Providing an evaluation of their importance in a local, regional or national context, especially "rare" and/or threatened species;

⇒ Identification of habitat units or discrete habitat areas that are considered locally important for faunal species that are threatened or near-threatened (Red Data);

⇒ An evaluation of the importance of the site as foraging/roosting/breeding habitat for charismatic (iconic) bird species and large mammalian carnivores (such as Leopard *Panthera pardus*) and large birds of prey;

⇒ A brief examination of the ecological relationships/associations between recorded species and taxa, and the different habitat types in which they are found; and

⇒ An identification of any specific areas in the study site that may require special protective measures to avoid future degradation or environmental damage.

32 ANNOTATIONS ON THE NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL

Regulation 16(1)(v) of the Environmental Impact Assessment Regulations, 20145 (EIA Regulations) provides that an applicant for Environmental Authorisation is required to submit a report generated by the Screening Tool as part of its application. On 5 July 2019, the Minister of Environmental Affairs, Forestry and Fisheries published a notice in the Government Gazette giving notice that the use of the Screening Tool is compulsory for all applicants to submit a report generated by the Screening Tool from 90 days of the date of publication of that notice.

The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas. The Screening Tool report will indicate the (preliminary) environmental sensitivities that intersect with the proposed development footprint as defined by the applicant as well as the relevant Protocols that the applicant would need to adhere to.

As the Screening Tool contains datasets that are mapped at a national scale, there may be areas where the Screening Tool erroneously assigns, or misses, environmental sensitivities because of mapping resolution and a high paucity of available and accurate data. Broad-scale site investigations will provide for an augmented and site-specific evaluation of the accuracy and 'infilling' of obvious and large-scale inaccuracies. Information extracted from the National Web-based Environmental Screening Tool (Department of Environmental Affairs, 2020), indicated the following aspects (inter alia) pertaining to the terrestrial ecological component of the project (report generated 2020/06/18):

⇒ Terrestrial Biodiversity Impact Assessment; and

⇒ Animal Species Assessment.

Results of the National Web-based Environmental Screening Tool indicated a high and medium sensitivity for animals of conservation importance to occur (refer Figure 51).

Table 22: Faunal results of the National Environmental Screening Tool	
Sensitivity	*Feature (s)*
High	Mammalia-*Lycaon pictus* (African Wild Dog)
High	Mammalia-*Panthera leo* (Lion)
High	Mammalia-*Smutsia temminckii* (Temminck's Ground Pangolin)
Medium	Sensitive species 2[2]
Medium	Insecta – *Anthene minima minima* (Little Ciliate Blue)
Medium	Mammalia-*Dasymys robertsii* (Robert's Marsh Rat)
Medium	Mammalia-*Lycaon pictus* ((African Wild Dog)

Figure 51: Animal species sensitivity of the wider study area

[2] National Screening Tool report includes lists of bird, mammal, reptile, amphibian, invertebrate, and plant species of conservation concern that are known or expected to occur on the proposed development footprint. Some of these SCC are sensitive to illegal harvesting or trade. Such species have had their names obscured and are listed as sensitive plant unique number/ sensitive animal unique number. As these species were listed in the Screening Tool Report, the Specialist submitted a request to SANBI and were provided with the names of the relevant species to assist with survey and identification of these species from the site. As per the best practise guideline that accompanies the protocol and screening tool, please, remember that the name of the sensitive species may not appear in the final EIA report nor any of the specialist reports released into the public domain. It should be referred to as sensitive plant or sensitive animal and its threat status may be included, e.g. critically endangered sensitive plant or endangered sensitive animal.

33 METHODS AND APPROACH

The faunal assemblage attributes on the proposed study site were investigated on the 19th to 23rd April 2021 with the objective to evaluate the terrestrial vertebrate faunal structure, composition, and conservation value of the natural habitat units on the study site.

33.1 LITERATURE REVIEW AND DATABASE ACQUISITION

Mammals

⇒ The potential (expected) occurrence and conservation status of mammal taxa were based on the IUCN Red List (2021) and the national Red Data Book by Child et al. (2016), while mammalian nomenclature was informed by Stuart and Stuart (2015) and Child et al. (2016), unless otherwise indicated.

⇒ The historical and extant (contemporary) distribution ranges of mammal taxa sympatric to the study site were sourced from MammalMap (c. 2229AD and bordering grids; refer **Figure 52**) and the online dataset of iNaturalist along with applicable field guides, in particular Stuart & Stuart (2015), Skinner & Chimimba (2005), Child et al. (2016) and Friedmann & Daly (2004).

⇒ Additional information was also sourced from the environmental teal/staff at Venetia mine.

Avifauna

⇒ Hockey et al. (2005), Harrison et al. (1997) and Del Hoyo et al. (1992-2011) were consulted for general information on the life history attributes of the relevant bird species. They also provide basic distributional information at small geographic scales.

⇒ Marnewick et al. (2015) was consulted for information regarding the biogeographic affinities (sensu Important Bird and Biodiversity Areas) of selected bird species that could be present on the study site.

⇒ The conservation status of bird species was categorised according to the global IUCN Red List of threatened species (IUCN, 2021) and the regional conservation assessment of Taylor et al. (2015).

⇒ Distributional data was sourced from the South African Bird Atlas Project (SABAP1) and verified against Harrison et al. (1997) for species corresponding to the quarter-degree grid cell (QDGC) 2229AD (although all eight bordering pentad grids were also investigated; refer **Figure 53**). The information was subsequently modified according to the prevalent habitat types present on the study area. The SABAP1 data provides a "snapshot" of the abundance and composition of species recorded within a quarter degree grid cell (QDGC) which was the sampling unit chosen (corresponding to an area of approximately 15 min latitude and 15 min longitude). It should be noted that the atlas data employs reporting rates that were calculated from observer cards submitted by the public as well as citizen scientists. It therefore provides an indication of the thoroughness of which the QDGCs were surveyed between 1987 and 1991.

⇒ Additional distributional data was also sourced from the SABAP2 database (http://www.sabap2.adu.org.za). The information was then modified according to the prevalent habitat types present on the study area. Since bird distributions are dynamic (based on landscape changes such as fragmentation and climate change), SABAP2 was launched in 2007 from SABAP1 with the main difference being that all sampling is done at a finer scale known as pentad grids (5 min latitude x 5 min longitude, equating to 9 pentads within a QDGC). Therefore, the data is considered more site-specific, recent, and more comparable with observations made during the site survey (due to increased standardisation of data collection). The pentad grid that are relevant to the current project includes 2225_2915. In addition, the pentad grids adjacent the study site were also inspected during the assessment (c. 2220_2910, 2220_2915, 2220_2920, 2225_2910, 2225_2920, 2230_2910, 2230_2915 and 2230_2920; refer **Figure 53**).

⇒ The choice of scientific nomenclature, taxonomy and common names were recommended by the International Ornithological Committee (the IOC World Bird Names, version 11.2), unless otherwise specified (see www.worldbirdnames.org; Gill et al., 2020).

Herpetofauna

⇒ Red List categories for reptile species were chosen according to the conservation assessment conducted by Bates et al. (2014).

⇒ Red List categories and listings of amphibian taxa follow Minter et al. (2004) and Measey (2010).

⇒ The distribution of reptile and amphibian species were verified against the ADU's database consisting of ReptileMap and FrogMap (c. 2229AD and the eight bordering grids; refer **Figure 52**) along with the online web-based database iNaturalist.

Invertebrate Taxa of Conservation Concern

⇒ The occurrence of threatened butterfly taxa (if applicable) was based on Woodhall (2005), while Mecenero et al. (2013) was consulted regarding their conservation status.

⇒ The SABCA database (c. LepiMap) provided a preliminary list of butterflies for the study area (2229AD, including bordering grids; see refer **Figure 52**).

⇒ The online web-based database iNaturalist was also consulted.

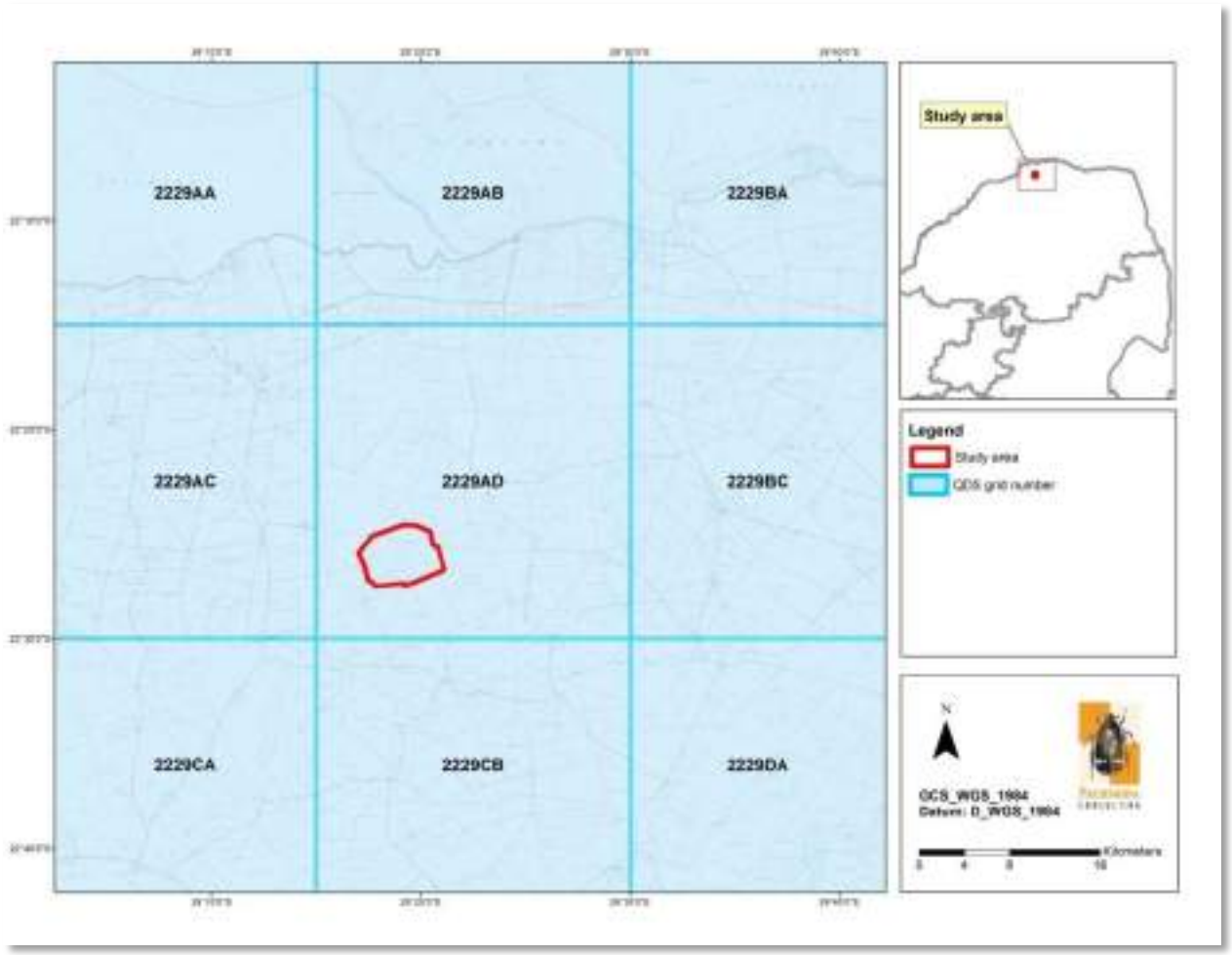


Figure 52: Quarter-degree grid squares (sensu ADU and SABAP1) relevant to the wider study area

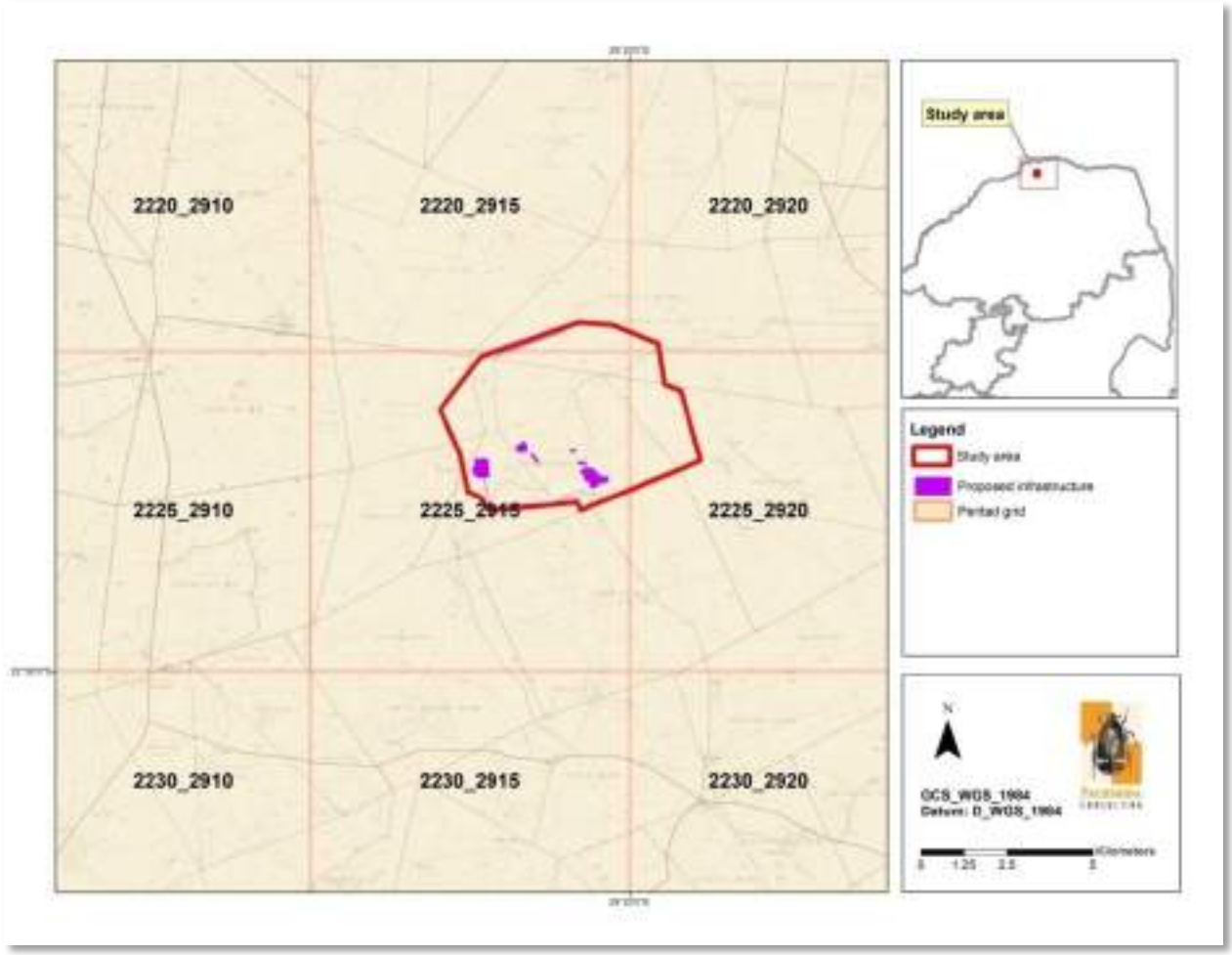


Figure 53: Pentad grids (sensu SABAP2) relevant to the wider study area

33.2 FIELD SURVEYS

Mammals

The following methods were considered during the fieldwork:

⇒ *Likelihood of Occurrence*: There is a high likelihood that not all mammal species known to occur on the lease area will be recorded during the baseline survey. Therefore, a 'Likelihood of Occurrence' review was applied. A summary of expected and observed mammals, as well as those species of conservation concern were provided, with a simple probability of occurrence attached.

⇒ *Camera trapping*: Four camera traps were deployed based on available cover and habitat diversity in the area along with the potential of detecting mammal taxa[3] (refer **Figure 54** and **Figure 55**). In addition, the localities were chosen to minimise the risk of possible theft.

⇒ *Scats and pellets*: Mammal scats and owl pellets were used to identify the presence of mammal taxa and to identify rodent taxa present in the study area. Scats and droppings were randomly acquired and identified during field surveys.

⇒ *Ad hoc observations*: All mammals observed during the survey were noted along with their geographic coordinates and habitat preference. Observations were obtained by means of driving, walking and active searching.

[3] The localities for camera trap deployment were dependent on dominant habitat, the probability for detecting nocturnal mammals and accessibility Areas with human and/or areas of high mining activities were avoided to prevent possible tampering, theft, or damage to the traps.

⇒ *Additional observations*: Particular notice was given to important dispersal or migratory routes and spoor within the study area or within the immediate region. These will invariably be relative to larger herbivores and carnivores.

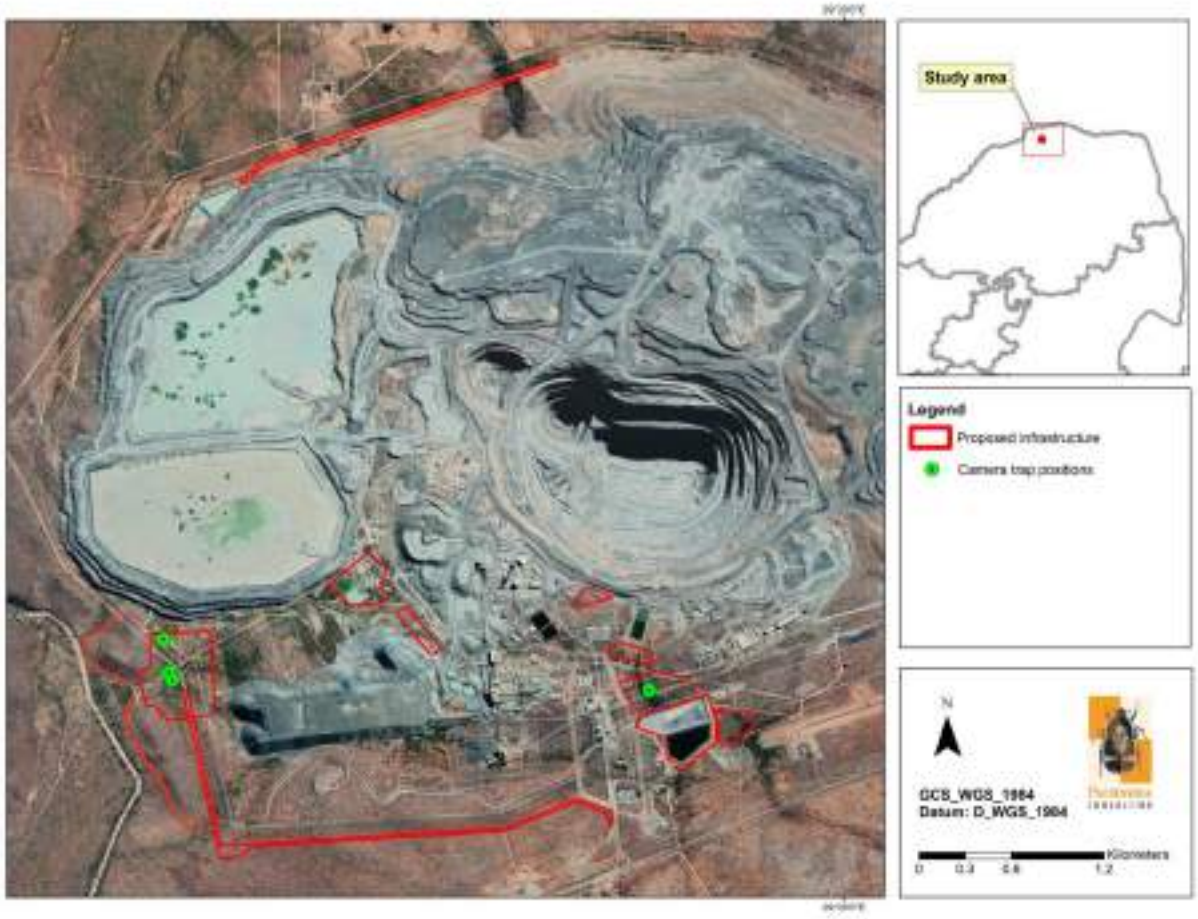


Figure 54: Satellite image of the study area illustrating the spatial localities of remote trail cameras

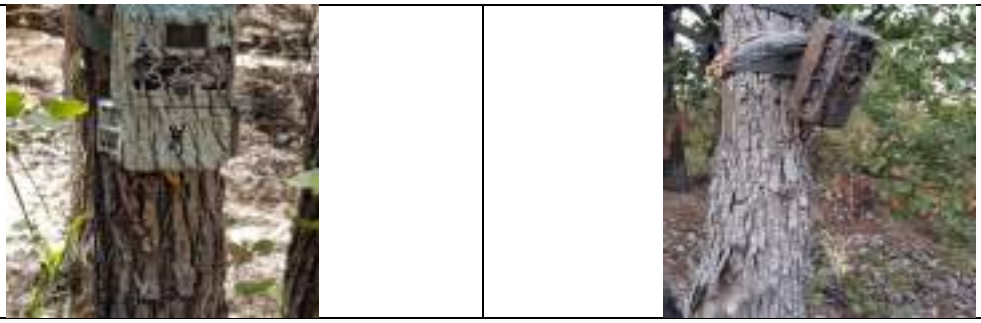


Figure 55: Examples of remote trail cameras deployed near PCD3 and the proposed southern access road.

Avifauna

The baseline avifaunal survey was conducted by means of the following survey techniques:

Random (ad hoc) surveys:

To obtain an inventory of bird species present, all bird species observed/detected while moving between vegetation sampling points were identified and noted. Particular attention was devoted to habitat that is considered suitable for roosting, foraging and nesting purposes for species of conservation concern (e.g. threatened or near threatened species).

Playback/broadcasting and recording of bird vocalisations:

The probability of detecting skulking/ elusive species or species for which the distribution ranges are insufficiently known in the area was verified by playback of bird calls/songs wherever suitable habitat was detected. Special care was taken to keep disturbance to a minimum and not to affect the bird's natural behaviour (e.g. to prevent unnecessary habituation).

Invertebrate Taxa of Conservation Concern

The occurrence of threatened butterfly taxa was verified on areas comprising of suitable habitat by means of standard handnetting procedures. In addition, such taxa were also verified by means digital photography (using a digital SLR camera with a 300 mm, f2.8 telephoto lens fitted with a 1.4x extender.

Herpetofauna

Possible burrows, or likely reptile habitat (termitaria, stumps, or rocks) were inspected for any inhabitants. Amphibians were also identified by their vocalisations (if any) and through likely habitat types (e.g. water features, drainage lines, etc.). The main approach used for the identification of reptile species involved direct searching techniques by turning rocks and logs.

33.3 FAUNAL IMPORTANCE AND SENSITIVITY

The ecological sensitivity of any piece of land is based on its inherent ecosystem service (e.g. wetlands) and overall preservation of biodiversity. In addition, the sensitivity of any piece of land is a key consideration when identifying impacts.

33.4 ECOLOGICAL FUNCTIONALITY & CONNECTIVITY AND BIODIVERSITY IMPORTANCE

The extent to which a site is ecologically connected to surrounding areas is an important determinant of its sensitivity. Systems with a high degree of landscape connectivity amongst one another are perceived to be more sensitive and will be those contributing to better ecosystem service (e.g. wetlands) or overall preservation of biodiversity. Therefore, any environmental management plan must include mitigation measures to ensure that negative environmental impacts do not interfere with the natural ecological process of the area.

Biodiversity importance relates to species diversity, endemism (unique species or unique processes) and the high occurrence of threatened and protected species or ecosystems protected by legislation.

33.5 SENSITIVITY SCALE

High Sensitive ecosystems with either low inherent resistance or low resilience towards disturbance factors or highly dynamic systems considered being important for the maintenance of ecosystem integrity. Most of these systems represent ecosystems with high connectivity with other important ecological systems OR with high species diversity and usually provide suitable habitat for a number of threatened or rare species. These areas should be protected;

Moderate These are slightly modified systems which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems OR ecosystems with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species; and

Low Degraded and highly disturbed/transformed systems with little ecological function and are generally poor in species diversity (many species are exotic or weeds).

34 RESULTS & DISCUSSION

34.1 MAMMALS

34.1.1 TAXONOMIC OVERVIEW & DIVERSITY

According to the presence of suitable habitat and the extant (or known) distribution ranges of mammal taxa in the study area (sensu MammalMap), the expected mammal richness on the study site and immediate surroundings is approximately 79 species (refer Table 21), which include the Giant Cane Rat (*Thryonomys swinderianus*), which were not previously recorded from the QDS that overlaps with the study area. It implies comparatively high mammal richness for the study areas explained by the position of the VLNR adjacent to the proposed PDC3 and south access road footprints. Basically all the expected species occur within the VLNR, which contributes considerably to the high expected richness for the area. However, a definite decrease in species richness on the study area is expected along a west to east gradient (from PCD3 towards PCD4), with a higher number of species expected from PCD3 when compared to PCD1 and PCD4, which both are located within areas that are severely affected by intensive mining activities and considerable movement and presence of personnel and mining vehicles.

Of the 79 expected species, 52 mammal species (c. 67 % of the total number of expected species) exhibit a high probability to occur within the proposed footprint sites, especially on PCD3 and the proposed south access road. In addition, 14 species exhibit moderate probabilities of occurrence, while 13 of the expected species indicate low probabilities of occurrence, although some of these were observed within the VLNR during the site visit (e.g. Lion *Panthera leo* and Elephant *Loxodonta africana*). Species that exhibit low probabilities either share distribution ranges peripheral to the study area or ecological information on their life histories and taxonomy are scant, thereby rendering their presence on the site as uncertain or questionable, even though suitable habitat is present. Many of these species are however known to be (periodically or opportunistically) present within the VLNR (e.g. African Wild Dog *Lycaon pictus*).

Those taxa with the highest number of records for the wider study area (dominant taxa - sensu MammalMap) include charismatic carnivores, scavengers and pachyderms such as African Wild Dog (*Lycaon pictus* - 1,647records), Black-backed Jackal (*Canis mesomelas* - 364 records), Lion (*Panthera leo* - 94 records), Cheetah (*Acinonyx jubatus* - 76 records), Leopard (*Panthera pardus* - 46 records), Brown Hyaena (*Parahyaena brunnea* - 47 records) and other smaller taxa such the African Savanna Hare (*Lepus saxatilis* - 65 records). Most of these records are biased towards census and research programmes that were (and some are still current) focussed on the VLNR, which is part of the De Beers funded research initiatives.

A total of twenty-one species (21) were confirmed during the site visit, which represent 40 % of the anticipated richness with a high probability to occur. This observed diversity includes the following) (refer **Table 22** and **Figure 56**):

⇒ two (2) rodents;
⇒ five (5) bovid antelopes;
⇒ one (1) equid (zebra);
⇒ one (1) canid (jackals);
⇒ two (2) primates (monkeys and baboons);
⇒ one (1) herpestid (mongoose);
⇒ one (1) leporid (hares and rabbits);
⇒ one (1) macroscelid (sengi);
⇒ one (1) suid (pigs);
⇒ one (1) hyaenid (hyaenas);
⇒ one (1) sciurid (squirrel);
⇒ one (1) viverrid (civets); and
⇒ three (3) carnivores (cats).

Apart from those species confirmed on the study area (within the proposed footprint sites), the Lion (*Panthera leo*) and Elephant (*Loxodonta africana*) were observed from the adjacent VLNR, although not within the physical footprint sites. During the site visit it became evident that large-bodied game and large carnivore species were common (frequently observed) on the study area, although these occur mostly on areas adjacent to the VLNR.

Table 23: An inventory of mammalian taxa predicted to occur on the study site (and immediate surroundings)
*based on the presence of suitable habitat and with known distribution ranges sympatric to the site (sensu MammalMap and professional judgement). *- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Probability of Occurrence*
Bovidae	*Aepyceros melampus*	Impala	Least Concern	High (confirmed)
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern	Low
Bovidae	*Connochaetes taurinus*	Blue Wildebeest	Least Concern	High (confirmed)
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	Least Concern	High
Bovidae	*Oreotragus oreotragus*	Klipspringer	Least Concern	Low
Bovidae	*Oryx gazella*	Gemsbok	Least Concern	Moderate
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern	High
Bovidae	*Sylvicapra grimmia*	Common Duiker	Least Concern	High (confirmed)
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern	High (confirmed)
Bovidae	*Tragelaphus scriptus*	Bushbuck	Least Concern	High
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern	High (confirmed)
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern	High (confirmed)
Canidae	*Lycaon pictus*	African wild dog	Endangered	Low
Canidae	*Otocyon megalotis*	Bat-eared Fox	Least Concern	Moderate
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern	High (confirmed)
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern	High (confirmed)
Elephantidae	*Loxodonta africana*	African Bush Elephant	Least Concern	Moderate (confirmed from VLNR)
Equidae	*Equus quagga*	Plains Zebra	Least Concern	High (confirmed)
Felidae	*Acinonyx jubatus*	Cheetah	Vulnerable	Low
Felidae	*Caracal caracal*	Caracal	Least Concern	High
Felidae	*Felis catus*	Domestic Cat	Introduced	High
Felidae	*Felis silvestris*	African Wildcat	Least Concern	High
Felidae	*Leptailurus serval*	Serval	Near Threatened	High (confirmed)
Felidae	*Panthera leo*	Lion	Least Concern	Low (confirmed from VLNR)
Felidae	*Panthera pardus*	Leopard	Vulnerable	High (confirmed)
Galagidae	*Galago moholi*	Lesser Galago	Least Concern	High
Giraffidae	*Giraffa giraffa giraffa*	Giraffe	Least Concern	Low

Table 23: An inventory of mammalian taxa predicted to occur on the study site (and immediate surroundings)
*based on the presence of suitable habitat and with known distribution ranges sympatric to the site (sensu MammalMap and professional judgement). *- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Probability of Occurrence*
Gliridae	*Graphiurus (Graphiurus) murinus*	Woodland Dormouse	Least Concern	High
Gliridae	*Graphiurus (Graphiurus) platyops*	Rock Dormouse	Least Concern	Moderate
Herpestidae	*Helogale parvula*	Dwarf Mongoose	Least Concern	High
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern	High
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern	High (confirmed)
Hippopotamidae	*Hippopotamus amphibius*	Hippopotamus	Least Concern	Low
Hipposideridae	*Hipposideros caffer*	Sundevall's Leaf-nosed Bat	Least Concern	Low
Hyaenidae	*Crocuta crocuta*	Spotted Hyaena	Near Threatened	Moderate
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened	High (confirmed)
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern	Low
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	High (confirmed)
Leporidae	*Lepus victoriae (saxatilis)*	African Savanna Hare	Least Concern	High (confirmed)
Macroscelididae	*Elephantulus brachyrhynchus*	Short-snouted Sengi	Least Concern	High
Macroscelididae	*Elephantulus intufi*	Bushveld Sengi	Least Concern	High
Macroscelididae	*Elephantulus myurus*	Eastern Rock Sengi	Least Concern	High (confirmed)
Manidae	*Smutsia temminckii*	Temminck's Ground Pangolin	Vulnerable	Low
Molossidae	*Chaerephon pumilus*	Little Free-tailed Bat	Least Concern	Low-Moderate
Molossidae	*Mops (Mops) midas*	Midas' Free-tailed Bat	Least Concern	High
Molossidae	*Sauromys petrophilus*	Roberts's Flat-headed Bat	Least Concern	Moderate
Molossidae	*Tadarida aegyptiaca*	Egyptian Free-tailed Bat	Least Concern	High
Muridae	*Acomys (Acomys) spinosissimus*	Southern African Spiny Mouse	Least Concern	Moderate
Muridae	*Aethomys chrysophilus*	Red Veld Aethomys	Least Concern	High
Muridae	*Aethomys ineptus*	Tete Veld Aethomys	Least Concern	Moderate
Muridae	*Micaelamys namaquensis*	Namaqua Rock Mouse	Least Concern	High
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern	High
Muridae	*Gerbilliscus paeba*	Hairy-footed Gerbil	Least Concern	Moderate
Muridae	*Grammomys dolichurus*	Woodland Mouse	Least Concern	Moderate
Muridae	*Lemniscomys rosalia*	Single-Striped Grass Mouse	Least Concern	High
Muridae	*Mastomys coucha*	Multimammate Mouse	Least Concern	Low
Muridae	*Mus (Nannomys) minutoides*	Pygmy Mouse	Least Concern	Moderate-High
Muridae	*Thallomys paedulcus*	Tree Rat	Least Concern	High
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern	High
Nesomyidae	*Cricetomys ansorgei*	Giant Rat	Least Concern	Moderate
Nesomyidae	*Saccostomus campestris*	Pouched Mouse	Least Concern	High
Nesomyidae	*Steatomys pratensis*	Fat Mouse	Least Concern	High
Nycteridae	*Nycteris thebaica*	Egyptian Slit-faced Bat	Least Concern	High
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern	High
Pedetidae	*Pedetes capensis*	Springhare	Least Concern	High
Procaviidae	*Procavia capensis*	Rock Hyrax	Least Concern	Low
Pteropodidae	*Epomophorus wahlbergi*	Wahlberg's Epauletted Fruit Bat	Least Concern	High
Sciuridae	*Paraxerus cepapi*	Tree Squirrel	Least Concern	High (confirmed)
Sciuridae	*Xerus inauris*	South African Ground Squirrel	Least Concern	High
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern	High
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern	High (confirmed)
Suidae	*Potamochoerus larvatus koiropotamus*	Bushpig	Least Concern	High
Thryonomidae	*Thryonomys swinderianus*	Giant Cane Rat	Least Concern	High (confirmed)
Vespertilionidae	*Neoromicia capensis*	Cape Serotine Bat	Least Concern	High
Vespertilionidae	*Nycticeinops schlieffeni*	Schlieffen's Bat	Least Concern	Moderate
Vespertilionidae	*Pipistrellus (Pipistrellus) rusticus*	Rusty Bat	Least Concern	Moderate
Viverridae	*Civettictis civetta*	African Civet	Least Concern	High (confirmed)
Viverridae	*Genetta genetta*	Small-spotted Genet	Least Concern	High
Viverridae	*Genetta maculata*	Rusty-spotted Genet	Least Concern	High

Table 24: An inventory of observed mammalian taxa recorded on the study site during the April 2021 site visit
**- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Observed indicators*

Table 24: An inventory of observed mammalian taxa recorded on the study site during the April 2021 site visit
**- sensu Child et al (2016)*

Family	*Scientific name*	*Common name*	*Conservation Status**	*Observed indicators*
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet Monkey	Least Concern	Visual sightings, camera trapped
Felidae	*Leptailurus serval*	Serval	Near Threatened	Spoor
Felidae	*Felis catus*	Domestic Cat	Introduced	Visual sightings
Bovidae	*Connochaetes taurinus*	Blue Wildebeest	Least Concern	Camera trapped, visual sightings
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	Spoor, quills
Bovidae	*Sylvicapra grimmia*	Common Duiker	Least Concern	Visual sightings & camera trapped
Sciuridae	*Paraxerus cepapi*	Tree Squirrel	Least Concern	Visual sightings
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern	Visual sightings, spoor and camera trapped
Macroscelididae	*Elephantulus myurus*	Eastern Rock Sengi	Least Concern	Visual sightings
Herpestidae	*Mungos mungo*	Banded Mongoose	Least Concern	Visual sightings
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern	Visual sightings, camera trapped
Viverridae	*Civettictis civetta*	African Civet	Least Concern	Visual sightings, spoor
Equidae	*Equus quagga*	Plains Zebra	Least Concern	Visual sightings, camera trapped
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern	Camera trapped, visual sightings
Bovidae	*Aepyceros melampus*	Impala	Least Concern	Camera trapped and visual sightings
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern	Visual sightings, camera trapped
Felidae	*Panthera pardus*	Leopard	Vulnerable	Camera trapped and spoor
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened	Camera trapped, spoor
Leporidae	*Lepus victoriae (saxatilis)*	African Savanna Hare	Least Concern	Visual sightings, droppings
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern	Camera trapped
Thryonomidae	*Thryonomys swinderianus*	Giant Cane Rat	Least Concern	Visual sightings
Felidae	*Panthera leo*	Lion	Least Concern	Visual sightings (VLNR only)
Elephantidae	*Loxodonta africana*	African Bush Elephant	Least Concern	Dung (VLNR only)

Lion (*Panthera leo*) - from VLNR

Vervet Monkey (*Chlorocebus pygerythrus*)

Domestic Cat (*Felis catus*)

Brown Hyaena (*Parahyaena brunnea*)

Common Warthog (*Phacochoerus africanus)*

Plains Zebra (*Equus quagga*)

Blue Wildebeest (*Connochaetes taurinus*)

Elephant dung (*Loxodonta africana*) - at VLNR

Leopard (*Panthera pardus*), young individual

Leopard (*Panthera pardus*), male

Leopard (*Panthera pardus*), male and female


Cape Porcupine (*Hystrix africaeaustralis*)

Figure 56: Examples of observed mammal and indicators

34.1.2 BIODIVERSITY VALUE AND ECOLOGICAL CONSIDERATIONS

The following key observations were made:

⇒ It is evident that the mammal richness on the study site was high, which is best explained by the nearby spatial position of the VLNR.

⇒ Domestic cats (*Felis catis*) are prevalent on the study area (within the Venetia Mine perimeter) and may pose an eminent threat to the extant small vertebrate fauna within the wider area. The occurrence of domestic cats may also result in genetic contamination of the indigenous feline population, in particular African Wild Cat (F. *sylvestris*), due to inbreeding.

⇒ The high ecological connectivity of some of the proposed footprint sites (e.g. PCD3 and the southern access road) with the nearby VLNR explains a high richness of mammal species at these particular areas, with an eastward decrease in richness (e.g. at PCD1 and PCD4).

⇒ The nearby VLNR provide habitat for many charismatic and large-bodies carnivores, scavengers and pachyderms such as African Wild Dog (*Lycaon pictus*), Lion (*Panthera leo* - 94 records), Cheetah (*Acinonyx jubatus*), Leopard (*Panthera pardus*), Brown Hyaena (*Parahyaena brunnea*) and Elephant (*Loxodonta africana*), with some overspill of these species into the study area (e.g. the western and southern parts of the study area).

34.1.3 THREATENED AND NEAR-THREATENED MAMMAL TAXA

Four regionally threatened and three near threatened mammal species are known to be present in the wider study region (sensu MammalMap; Child et al., 2016) (refer Table 21). Three of these species (Leopard *Panthera pardus*, Serval *Leptailurus serval* and Brown Hyaena *Parahyaena brunnea*) exhibit a high probability of occurrence, and were positively confirmed during the site visit on the study area (mainly from PCD3 and the proposed southern road.

Another two species, the Lion *(Panthera leo*) and African Elephant (*Loxodonta africana*) are categorised on a national (regional) level as least concern (Child et al., 2016), but were elevated to global threatened categories, with the Lion being globally vulnerable (Bauer et al., 2016) and the African Elephant being globally endangered (Gobush et al., 2021) by the IUCN (2021). Reasons for the elevation of the conservation status of these species were based on new molecular studies that have shown prominent differences in the phylogeography between disparate sub-populations that warrant the treatment of distinct "species" among the population elsewhere in Africa. For this reason, the IUCN has decided to treat the two elephant subspecies*, L. a. africana* (African Savanna Elephant) and *L. a. cyclotis* (African Forest Elephant) as two different species. A similar approach is proposed for the lion population, with splitting *Panthera l. leo* from West, Central and North Africa, from *P l. melanochaita* that occur in South and East Africa. However, the national sub-population of both the Lion and Elephant have remained stable or has even increased in large, protected areas, with most of the national population being adequately conservation in protected areas and national parks (Miller et al., 2016; Selier et al., 1016). Irrespective of their least concern national conservation status, it is evident that both species remain dependant on conservation initiatives. The Lion and Elephant were both confirmed from the VLNR, although being absent from the proposed study areas. Since both species are often involved in human-animal conflict, it is strongly recommended that security measures and access control measures prevent these species from accessing the actual development sites.

The following regionally threatened and near threatened species have also been confirmed on the study area or have a high probability of occurrence:

a. Serval (*Leptailurus serval*)

The Serval is listed as least concern on the global IUCN Red List although Child *et al*. (2016) listed it as near threatened. Servals show a wide distribution range, although they are limited by their obligate preference for surface water. Therefore, they are always found near water and in areas with sufficient shelter such as tall grass (Skinner & Smithers, 1990) with an abundance of suitable prey – mainly Murid rodents (e.g. genera *Mastomys*, *Mus* and *Otomys*).

This species is a specialised rodent hunter and appears to be moderately tolerant to agricultural activities, adapting readily to abandoned cultivation areas that are occupied by secondary vegetation, provided that they are not persecuted or persistently disturbed (in Wilson & Mittermeier, 2009). Evidence based on extensive camera trapping on the western Mpumalanga Highveld (pers. obs.) suggests that Servals are widespread, occurring in moist grassland and floodplains bordering dams, pans, streams, and seeps. This species was confirmed from the moist vegetation bordering the inundated dam at PCD3. It could potentially also occur in wet or moist vegetation at OMWSD4.

b. Brown Hyaena (*Parahyaena brunnea*)

The Brown Hyaena is listed as near threatened on the global IUCN Red List (Wiesel et al., 2008) since it requires extensive areas (sometimes in excess of 1,000 km^2) to maintain a viable population, especially where inter-specific competition for resources is fierce with other predator taxa. Such massive home ranges often coincide with livestock and agricultural areas where they are heavily persecuted by farmers. These persecution impacts and the loss of habitat due to agricultural intensification are some of the primary threats to this species.

It was confirmed from various parts of the study area, most notably PCD3 and the proposed southern access road by means of infrared cameras. This species could utilise virtually every habitat type on the study area due to its opportunistic behaviour. Brown Hyaena has also been recorded from habitat corresponding to QDS 2229AD (c. 47 records, last record was 2020) (sensu MammalMap).

c. Leopard (*Panthera pardus*)

The Leopard, although a widespread and adaptable species, is listed as vulnerable (Child et al., 2016). The global population estimate for *P. pardus* is unknown or very unreliable, which is responsible for its placement in a threatened category. Furthermore, increased competition for space along with frequent human encounters (near human settlements) has seriously reduced the global number of subpopulations.

Leopard was confirmed on the study area, with three individuals photographed (by means of infrared cameras), including male, female and a sub-adult cub (refer **Figure 57**), within the Venetia Mine perimeter (OMWSD 3). Leopard is considered as a regular foraging visitor to the area due to the stable prey base within the mine perimeter (antelope, murid rodents and primates) and regular observations, which include 46 records corresponding to the QDG that is sympatric to the study area. The potential human-animal conflict situations that the persistent presence of these animals within proximity to personnel and office infrastructure should receive immediate attention.

Figure 57: Evidence of three Leopard individuals from within the Venetia Mine perimeter
Note arrows for evidence (red arrow – male, blue arrow – sub-adult, yellow arrow – female)

d. Notes regarding Species Listed by the Environmental Screening Tool

There are no recent records or observations of Robert's Marsh Rat (*Dasymys robertsii*) from the study area (sensu MammalMap). The Robert's Marsh Rat (*Dasymys robertsii*) is listed as regionally vulnerable (sensu Child et al., 2016), although Taylor (1998) stated that it is probably not as rare as previously thought, at least within KwaZulu-Natal where the KZN population is considered form part of the genetically distinct species *D. cf incomtus*. Marsh rats have been recorded in a wide variety of habitat types, although it prefers well-vegetated wetland habitat. Skinner and Smithers (1990) also reported that they also utilise reedbeds along rivers and streams. It is therefore possible that this species

was previously overlooked based on its shy and elusive habits and life history traits which explains its ominous absence from many parts of South Africa, especially the highveld region. However, the probability that this species could occur on any of the proposed study sites is low when considering the ephemeral (highly seasonal) nature of the wetland habitat on the study area along the natural drainage lines (PCD1 and OMWSD3) and small impoundments (e.g. PCD3 and OMWSD4).

The occurrence of the endangered African Wild Dog (*Lycaon pictus*) and the vulnerable Temminck's Ground Pangolin (*Smutsia temminckii*) on the study sites are regarded as highly occasional and opportunistic, although both species have been recorded from the VLNR (sensu MammalMap). The Wild Dog have regularly been observed in the nearby VLNR (c. 1,647 records corresponding to QDS 2229AD), thereby suggesting that it could on occasion occur at PCD3, the proposed southern access and even northern mine perimeter. The sub-population in the area probably stems from a free-roaming wild population that occurs in the northern parts of the Limpopo Province (Davies-Mostert et al., 2016).

The Ground Pangolin is poorly known (Pietersen et al., 2016) with sporadic occurrences to the wider study area (only two records, last being 2009), but may occur in the VLNR although it remains highly unobtrusive and are seldom seen (it was not recorded by means of camera traps).
The near threatened Spotted Hyaena (*Crocuta crocuta*) deserves special mentioning, since it is also present at the VLNR, and may sporadically occur on the study area (c. seven records for 2229AD, most recent record from 2020).

34.2 AMPHIBIANS

34.2.1 TAXONOMIC OVERVIEW & DIVERSITY

The amphibian richness on the study site is considered low, with 14 frog species expected to occur. Only 11 of these have high probability of occurrence) on the study sites, of which three species were confirmed during the survey (refer Table 24). Some of the study site (e.g. PCD3) when inundated provides breeding habitat for obligate or "true" aquatic frog species such as Tropical Platanna (*Amietia delalandii*) and also offers ephemeral foraging and breeding habitat for widespread species such as Southern Foam Nest Frog (*Chiromantis xerampelina*), Plain Grass Frog (*Ptychadena anchietae*) and Bubbling Kassina (*Kassina senegalensis*).

Table 25: An inventory of frog taxa predicted to occur on the study area (and immediate surroundings)
based on the presence of suitable habitat and with known distribution ranges sympatric to the site (sensu FrogMap and professional judgement)

Family	*Scientific name*	*Common name*	*Conservation Status*	*Probability of occurrence*
Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern	High
Bufonidae	*Sclerophrys pusilla*	Flatbacked Toad	Least Concern	High
Hemisotidae	*Hemisus marmoratus*	Mottled Shovel-nosed Frog	Least Concern	High
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern	High
Microhylidae	*Phrynomantis bifasciatus*	Banded Rubber Frog	Least Concern	High
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	Least Concern	Moderate
Pipidae	*Xenopus muelleri*	Tropical Platanna	Least Concern	High (confirmed)
Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog	Least Concern	High (confirmed)
Ptychadenidae	*Ptychadena mossambica*	Broad-banded Grass Frog	Least Concern	High
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern	High
Pyxicephalidae	*Pyxicephalus edulis*	African Bull Frog	Least Concern	Moderate-High
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern	High
Pyxicephalidae	*Tomopterna marmorata*	Russet-backed Sand Frog	Least Concern	Moderate
Rhacophoridae	*Chiromantis xerampelina*	Southern Foam Nest Frog	Least Concern	High (confirmed)

34.2.2 THREATENED AND NEAR THREATENED FROG SPECIES

No frog species of conservation concern is expected to be present on the study area.

34.3 REPTILES

34.3.1 TAXONOMIC OVERVIEW & DIVERSITY

The reptile composition on the study site is poorly known with only 33 species currently known from the wider study area (c. QDS 2229AD, sensu ReptileMap, including personal observations) (refer **Table 25**). The expected reptile richness is underestimated for the study site (and surrounds), and predicted that the richness may be double the known richness. Both the Boomslang (*Dispholidus typus*) and Water Monitor (*Varanus niloticus*) were confirmed from the wider study area, which were not previously recorded from the area (sensu ReptileMap).

Table 26: An inventory of reptile taxa that are sympatric to the study area and occur within QGS 2229AD (sensu ReptileMap) (inclusive of personal observations)

Family	*Scientific name*	*Common name*	*Conservation Status*
Agamidae	*Agama armata*	Peters' Ground Agama	Least Concern
Amphisbaenidae	*Monopeltis sphenorhynchus*	Slender Worm Lizard	Least Concern
Colubridae	*Dispholidus typus*	Boomslang	Least Concern
Cordylidae	*Cordylus jonesii*	Jones' Girdled Lizard	Least Concern
Cordylidae	*Platysaurus intermedius rhodesianus*	Zimbabwe Flat Lizard	Least Concern
Crocodylidae	*Crocodylus niloticus*	Nile Crocodile	Vulnerable (Bates et al., 2014), Globally Least Concern (IUCN, 2021)
Elapidae	*Elapsoidea boulengeri*	Boulenger's Garter Snake	Least Concern
Gekkonidae	*Chondrodactylus turneri*	Turner's Gecko	Least Concern
Gekkonidae	*Hemidactylus mabouia*	Common Tropical House Gecko	Least Concern
Gekkonidae	*Lygodactylus bradfieldi*	Bradfield's Dwarf Gecko	Least Concern
Gekkonidae	*Lygodactylus capensis*	Common Dwarf Gecko	Least Concern
Gekkonidae	*Pachydactylus punctatus*	Speckled Gecko	Least Concern
Gerrhosauridae	*Gerrhosaurus intermedius*	Eastern Black-lined Plated Lizard	Least Concern
Gerrhosauridae	*Matobosaurus validus*	Common Giant Plated Lizard	Least Concern
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	Least Concern
Lacertidae	*Meroles squamulosus*	Common Rough-scaled Lizard	Least Concern
Lacertidae	*Nucras holubi*	Holub's Sandveld Lizard	Least Concern
Lacertidae	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	Least Concern
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern
Lamprophiidae	*Psammophis subtaeniatus*	Western Yellow-bellied Sand Snake	Least Concern
Pelomedusidae	*Pelusios sinuatus*	Serrated Hinged Terrapin	Least Concern
Pythonidae	*Python natalensis*	Southern African Python	Least Concern
Scincidae	*Mochlus sundevallii*	Sundevall's Writhing Skink	Least Concern
Scincidae	*Panaspis maculicollis*	Spotted-neck Snake-eyed Skink	Least Concern
Scincidae	*Trachylepis damarana*	Damara Variable Skink	Least Concern
Scincidae	*Trachylepis margaritifera*	Rainbow Skink	Least Concern
Scincidae	*Trachylepis punctulata*	Speckled Sand Skink	Least Concern
Scincidae	*Trachylepis striata*	Striped Skink	Least Concern
Scincidae	*Trachylepis varia sensu lato*	Common Variable Skink Complex	Least Concern
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern
Varanidae	*Varanus niloticus*	Water Monitor	Least Concern
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern

34.3.2 THREATENED AND NEAR THREATENED REPTILE SPECIES

The Nile Crocodile (*Crocodilus niloticus*) is the only reptile species of conservation concern that was observed on the study area. It is categorised as vulnerable during the 2014 SARCA assessment (sensu Bates et al., 2014), although a recent global assessment downlisted it to the least concern category (IUCN, 2021). A single individual was observed from an inundated dam at the PCD3 site. In the event that development has to take at PCD3, all specimens will require relocation to the nearest suitable habitat (e.g. VLNR) with the necessary permission and permits from the local conservation authority.

34.4 BUTTERFLY TAXA OF CONSERVATION CONCERN

The results of a screening report as per the outcome of the Environmental Screening Tool (21/06/2021) produced a medium sensitivity for the animal theme on the study site with the potential occurrence of one diurnal butterfly species: Little Ciliate Blue (*Anthene minima minima*). This species is globally least concern, although listed as a national priority butterfly species since it occurs in low densities. It is a small cryptic butterfly species that is easily confused with other similar-looking "blue" butterfly species of the family Lyceanidae, especially due to its habit of congregating at the tops of tree where it joins other small or tiny lycaenids (which makes it difficult to detect among other similar-looking species). Although widespread, it occurs on low numbers where it has been recorded from scattered records in KwaZulu-Natal, northern Limpopo and Mpumalanga. It is 'on the wing' from September to April, where the adults are believed to breed on *Vachellia* tree species (thorn trees).

It was not recorded on the study area, although suitable breeding habitat occurs, which is also very widespread and abundant in the area. In addition, it was not collected or observed from 2229AD or any of the QD squares that are located adjacent to 2229AD (sensu Mecenero et al., 2013). The nearest collection records are from areas south of the study area, which appear to coincide with habitat that is associated with the Soutpansberg mountain range and adjacent plains (Figure 58). The only members of the genus *Anthene* that were observed during the site visit include *A. definita* (Steel-blue Ciliate Blue) and *A. amarah* (Black-striped Ciliate Blue). Therefore, the occurrence of *A. minima* on the study area remains undetermined, even though suitable habitat was present. It is not possible to comment on its probability of occurrence on the study area in the absence of further detailed sampling programmes owing that it has not been collected from nearby habitat and that it is easily overlooked, as well as the fact that larval host plant taxa are widespread in the area.

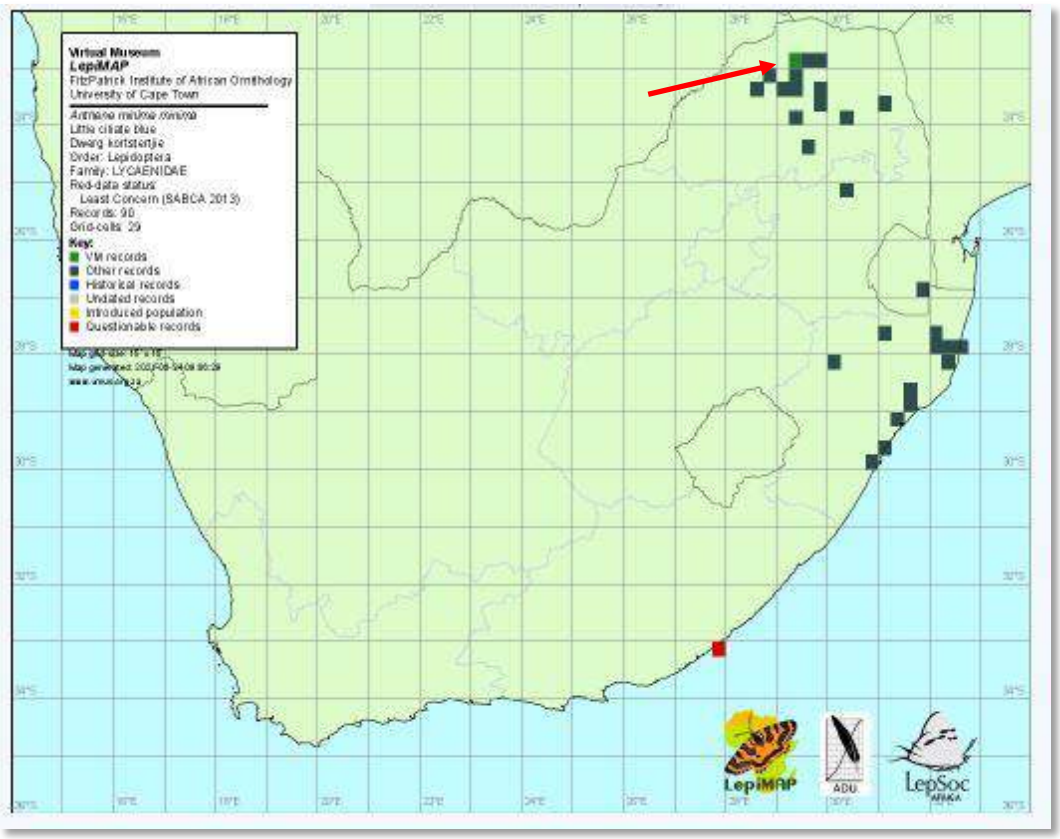


Figure 58: The extant distribution range of *Anthene minima minima* in South Africa
red arrow indicates the approximate position of the study area; map courtesy and copyright of LepiMap, LepSoc and ADU

Banded Groundling (*Brachythemis leucosticta)*

Spotted Joker (*Byblia ilthyia*)

White-barred Emperor (*Charaxes brutus natalensis*)

Green-marbled Sandman (*Gomalia elma elma*)

Common Vagrant (*Catopsilla florella*)

Broad-bordered Grass Yellow (*Eurema brigitta brigitta*)

Spotted Sailor (*Neptis saclava marpessa*)

Yellow pansy (*Junonia hierta cebrene*)

Figure 59: Selected images of invertebrates photographed from the study sites
** Identifications provided where possible*

34.5 AVIFAUNA (BIRDS)

34.5.1 SPECIES RICHNESS AND SUMMARY STATISTICS

Approximately 213 bird species are expected to occur on the wider study area (including adjacent habitat), of which 111 species were observed during the site visit (April 2021) (refer **Appendix 7** and **Table 26**).

The expected richness was inferred from the South African Bird Atlas Project[4] (SABAP2; www.sabap2.birdmap.africa), professional judgement and the presence of suitable habitat on the study site. This equates to 22 % of the approximate 979[5] species listed for the southern African subregion[6] (and approximately 254 % of the 855 species recorded within South Africa[7]). Although 111 species were recorded on the study sites and immediate surroundings (e.g. adjacent part of VLNR), the average richness for pentad grid 2225_2915 (sympatric to the study area) is lower than the observed richness at 51 species according to three submitted cards, with 30 species being the highest number recorded during two hours. In addition, a mean of 26.6 species is recorded for each full protocol card submitted[8] (e.g. when observations took two hours and longer) when the eight adjacent grids are included. The low bird species numbers and number of cards submitted to SABAP2 clearly illustrates that the avifauna at the study area has been poorly documented. This statement is supported by 13 bird species that was recorded during the site visit on the study area which have not been previously recorded from any of the nine pentad grids that define the wider study area. Many of these species are in fact widespread species, although approximately 50 % are facultative waterbird species which were all observed from inundated dams and ponds on the study area (e.g. PCD3).

According to **Table 26**, the study site is poorly represented by biome-restricted[9] (also refer **Table 27**) and regional endemic species, while also being unable to support any local endemic species (species endemic to South Africa). It supports only two regional endemic species and 14 near-endemic species confined to southern Africa, and contains five Biome restricted species that are confined to the Zambezian Woodlands and Kalahari-Highveld. Therefore, the study

[4] The expected richness statistic was derived (and adjusted) from pentad grid 2225_2915 including the eight adjacent grids totalling 202 bird species (based on 21 full protocol cards and 52 ad hoc cards.
[5] *sensu* www.zestforbirds.co.za (Hardaker, 2019).
[6] A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, Swaziland and Lesotho).
[7] With reference to South Africa (including Lesotho and Swaziland (BirdLife South Africa, 2018).
[8] Based on 21 full protocol cards, range= 24 - 93 bird species.
[9] A species with a breeding distribution confined to one biome. Many biome-restricted species are also endemic to southern Africa.

area is not considered as an important endemic bird area, or "hotspot" area which could sustain avian speciation over evolutionary times.

Of the 213 expected bird species, seven are threatened and/or near threatened species, of which the endangered Martial Eagle (*Polemaetus bellicosus*) was the only threatened bird species observed from habitat nearby the study area (at the VLNR).

Table 27: Summary table of the total number of species, Red listed species to occur in the study area (according to Taylor et al., 2015 and the IUCN, 2021), endemics and biome-restricted species (Marnewick et al., 2015) expected (sensu SABAP2)

Description	*Expected Richness Value (study area and surroundings)****	*Observed Richness Value (study area and surroundings)*****
Total number of species*	213 (22 %)	111 (52 %)
Number of Red Listed species*	7 (5 %)	1 (14 %)
Number of biome-restricted species –Kalahari-Highveld and Zambezian Biomes*	5 (36 %)	3 (60 %)
Number of local endemics (BirdLife SA, 2018)*	0 (n/a)	0 (n/a)
Number of local near-endemics (BirdLife SA, 2018)*	0 (n/a)	0 (n/a)
Number of regional endemics (Hockey *et al.,* 2005)**	2 (2 %)	2 (100 %)
Number of regional near-endemics (Hockey *et al.,* 2005)**	14 (23 %)	8 (57 %)

* only species in the geographic boundaries of South Africa (including Lesotho and eSwatini) were considered

** only species in the geographic boundaries of southern Africa (including Namibia, Botswana, Zimbabwe, and Mozambique south of the Zambezi River) were considered

*** Percentage values in brackets refer to totals compared against the South African avifauna (*sensu* BirdLife SA, 2018)

**** Percentage values in brackets refer to totals compared against the expected number of species in the study area

Table 28: Observed biome-restricted species (Marnewick et al, 2015) on the study area

Species	*Kalahari-Highveld*	*Zambezian*	*Frequency of occurrence*
Barred Wren-Warbler (*Calamonastes fasciolatus*)	X		Fairly common resident
Kalahari Scrub Robin (*Cercotrichas paena*)	X		Uncommon resident
Kurrichane Thrush (*Turdus libonyanus*)		X	Common resident
White-throated Robin-chat (*Cossypha humeralis*)		X	Common resident
White-bellied Sunbird (*Cinnyris talatala*)		X	Common resident

34.5.2 THREATENED AND NEAR THREATENED SPECIES

Table 28 provides an overview of bird species of conservation concern that could occur on the study site based on their distribution ranges and the presence of suitable habitat. According to Table 28, a total of seven (7) species have been recorded in the wider study area (sensu SABAP2 and personal observations) which include five (5) globally threatened species, one (1) globally near threatened species and one (1) regionally near threatened species.

The globally/regionally endangered Martial Eagle (*Polemaetus bellicosus*) was the only species observed in the wider study area during the site visit. However, it was only observed at the nearby VLNR with an active nest recorded at approximately 4 km west of the PCD3 site.

The regionally near threatened Greater Painted Snipe (*Rostratula benghalensis*) is regarded as an irregular visitor to the study area depending on rainfall cycles and the flooding op ephemeral pools and depressions. Although a regular breeding visitor to the nearby Mapungubwe National Park, it could occur on occasion at the pond at PCD3 during exceptional high rainfall events.

The remaining five species include large scavenger birds of prey, the Secretarybird (*Sagittarius serpentarius*) and the Kori Bustard (*Ardeotis kori*) that are fairly regularly observed in the wider study area, especially in the nearby Mapungubwe National Park and the VLNR. However, these are regarded as high irregular visitors to the proposed study areas. Disturbances associated with mining-related activities are probably responsible for the displacement of most of these species from the proposed study sites.

Table 29: Bird species of 'conservation concern' that have been recorded in the wider study area based on their known distribution range (sensu SABAP2) and the availability of suitable habitat

Red list categories according to the IUCN (2021)* and Taylor et al. (2015)**. Reporting rates were derived from the mean for pentad grid 2225_2915 as well as the eight surrounding grids. Species highlighted in grey were confirmed during the surveys.

Species	*Global Conservation Status**	*Regional Conservation Status***	*SABAP2 mean reporting rate*	*Preferred Habitat*	*Occurrence Status*
Aquila rapax (Tawny Eagle)	Vulnerable	Endangered	22.22	Lowveld and Kalahari savannas, especially game farming areas and protected areas with game species.	An irregular foraging visitor to the study sites. Its occurrence depends on the presence of carcasses. Probably more abundant in the adjacent VLNR. Last observed record from SABAP2 on the study area was 2015.
Ardeotis kori (Kori Bustard)	Near threatened	Near threatened	11.11	Open lowland savanna and karroid shrub.	An uncommon foraging visitor to the study sites. Probably more abundant in the adjacent VLNR. Last observed record from SABAP2 on the study area was 2019.
Gyps africanus (White-backed Vulture)	Critically Endangered	Critically Endangered	27.78	Breed on tall, flat-topped trees. Mainly restricted to large rural or game farming areas and protected areas with game species.	Regarded as regular foraging visitors to the study area, although irregular on the study sites itself. Its occurrence depends on the presence of carcasses. Probably more abundant in the adjacent VLNR. Last observed record from SABAP2 on the study area was 2014.
Polemaetus bellicosus (Martial Eagle)	Endangered	Endangered	1.64 (ad hoc reporting rate)	Varied, from open karroid shrub to lowland savanna.	An uncommon foraging visitor to the study sites. Breed on adjacent VLNR, with an active nest approx. 4 km west of PCD3.
Rostratula benghalensis (Greater Painted Snipe)	-	Near threatened	5.55	Seasonal flooded wetlands and pools in savanna.	An uncommon visitor to ephemeral ponds and depressions when flooded. Last observed record from SABAP2 on the study area was 2019.
Sagittarius serpentarius (Secretarybird)	Endangered	Vulnerable	5.56	Prefers open grassland or lightly wooded habitat.	Regarded as a highly irregular foraging visitor to the study sites - probably displaced from the mining area due to mine-related activities. Could occur on the adjacent VLNR, where it will share the same habitat with Kori Bustard. Last observed record from SABAP2 on the study area was 2009.
Terathopius ecaudatus (Bateleur)	Endangered	Endangered	11.11	Lowveld and savannas, especially game farming areas and protected areas with game species.	An irregular foraging visitor to the study sites. Its occurrence depends on the presence of carcasses. Probably more abundant in the adjacent VLNR. Last observed record from SABAP2 on the study area was 2016.

Red-billed Quelea (*Quelea quelea*)

Brown-hooded Kingfisher (*Halcyon albiventris*)

Grey-backed Camaroptera (*Camaroptera brevicaudata*)

Long-billed Crombec (*Sylvietta rufescens*)

Red-billed Firefinch (*Lagonosticta senegala*)

Little Bee-eater (*Merops pusillus*)

African Pipit (*Anthus cinnamomeus*)

Lilac-breasted Roller (*Coracias caudatus*)

Pearl-spotted Owlet (*Glaucidium perlatumi*)

White-crested Helmetshrike (*Prionops plumatus*)

Chestnut-backed Sparrow-Lark (*Eremopterix leucotis*)

Southern Pied Babbler (*Turdoides bicolor*)

Familiar Chat (*Oenanthe familiaris*)

Chinspot Batis (Batis molitor)

White-throated Robin-Chat (*Cossypha humeralis*)

Black-backed Puffback (*Dryoscopus cubla*)

Dark-capped Bulbul (*Pycnonotus tricolor*)

Pale Chanting Goshawk (*Melierax canorus*)

Green-winged Pytilia (*Pytilia melba*)

Namaqua Dove (*Oena capensis*)

Wahlberg's Eagle (*Hieraaetus wahlbergi*)

African Harrier-hawk (*Polyboroides typus*)

Red-billed Buffalo Weaver (*Bubalornis niger*)

Sabota Lark (*Calendulauda sabota*)

Figure 60: Selected images of bird species recorded from the study area

34.5.3 Important Bird and Biodiversity Areas

The study site does not overlap with any Important Bird and Biodiversity Area (IBA), with the nearest IBA (c. Mapungubwe; SA001) being 17 km north of the study area (sensu Marnewick et al., 2015).

34.6 Faunal Importance (Ecological Sensitivity)

The fauna importance of the study sites was based on the inherent biodiversity value and ecological function of the respective habitat units corresponding to each site. Major emphasis was placed on the following functional aspects during the sensitivity grading process:

⇒ *Presence of habitat of high vertical heterogeneity*: Area with intact mixed of riparian woodland tend have taller tree canopies. Habitat containing taller canopy structure, will provide a higher niche space for bird and arboreal animal species though an ecological process of niche packing. Therefore, it allows species with similar guilds (e.g. insectivorous foliage gleaners in birds) to co-occur without too much inter-specific competition for recourses. The result is that more species could occur in habitat with high vertical heterogeneity.

⇒ *Presence of specialised habitat*: The presence of wetland or aquatic habitat (including functional manmade impoundments) provide habitat for stenotropic animals species with high affinities to either moist conditions or inundated habitat. Many of these habitat units are either spatially limited (azonal) and hence uncommon in the region. Typical species include facultative wetland taxa, such as shorebirds and waterbirds, which will collectively contribute towards the overall species diversity in the area.

⇒ *Ecological connectivity*: Intact habitat that are located along drainage lines, as well as habitat on the periphery of the mine area that "linked" to the VLNR will promote animal dispersal, thereby allow for more species to utilise the habitat units at a particular site.

The faunal importance of each proposed site is illustrated in Figures 61 to 65.

34.6.1 Pollution Control Dam 1 (PCD 1)

The following sensitivity ratings apply to the habitat units on PCD1:

Habitat Unit	Description	Sensitivity Rating
Mixed woodland on quartzitic soils	Woodland with low faunal richness although the edaphic soil properties allows structural foundation for burrowing species. The habitat shows some ecological connectivity with similar habitat, although fragmented and surrounded by mining activities. It is mainly colonised by generalist fauna species.	Medium
Mopane thickets	Although located along a drainage line, this habitat is isolated by mine infrastructure (OMWSD N & S) and represents a "cull-de-sac" for animal dispersal. It is mainly colonised by generalist and widespread fauna species.	Medium-low
Flooded grassland	Although providing moist and inundated conditions, the habitat is artificial in origin and contains effluent/overspill from nearby pollution control dams. It does not support any species of conservation concern and the general fauna richness was low.	Medium-low

34.6.2 Pollution Control Dam 2 (PCD 2)

The following sensitivity ratings apply to the habitat units on PCD2:

Habitat Unit	Description	Sensitivity Rating
Transformed and deteriorated areas	Transformed habitat with little value for native fauna species. It provides habitat for pioneer species, and also introduced species.	Low
Mixed woodland	Highly isolated and fragmented due to existing mine infrastructure, and disrupted ecological connectivity with nearby natural habitat. It is mainly colonised by generalist and widespread fauna species.	Low

34.6.3 POLLUTION CONTROL DAM 3 (PCD 3)

The following sensitivity ratings apply to the habitat units on PCD3:

Habitat Unit	Description	Sensitivity Rating
Artificial Impoundment (dam)	The inundated condition of the dam provides ephemeral habitat for waterbird and shorebird taxa that would have been absent from the study area. It also provides freshwater conditions, including and foraging habitat (c. Nile Crocodile C*rocodilus niloticus*) and breeding habitat for herpetofauna species with aquatic life histories (e.g. foam-nest frogs and monitor lizards). This habitat augments the fauna richness on the study area.	High
Natural Mixed Woodland	Natural intact woodland with high vertical heterogeneity thereby facilitating avifaunal richness. The high ecological connectivity of this habitat with the adjacent VLNR provides opportunities for large charismatic carnivores and scavenger mammal taxa of conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea*) to utilise the area.	Medium-High
Riparian - Mopane Thickets	The high ecological connectivity of this habitat with the adjacent VLNR provides opportunities for large charismatic carnivores and scavenger mammal taxa of conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea*) to utilise the area. It also provides a dispersal corridor for aquatic species between the dam and the nearby Kolope River located within the VLNR.	Medium-High
Transformed areas	These include mainly servitudes and infrastructure with a low contributing towards faunal richness.	Low

34.6.4 POLLUTION CONTROL DAM 4 (PCD 4)

The following sensitivity ratings apply to the habitat units on PCD4:

Habitat Unit	Description	Sensitivity Rating
Deteriorated mixed woodland	Highly isolated and fragmented due to existing mine infrastructure, and disrupted ecological connectivity with nearby natural habitat. It is mainly colonised by generalist and widespread fauna species.	Low
Transformed land	These include mainly servitudes and infrastructure with a low contributing towards faunal richness.	Low

34.6.5 FINE RESIDUE DAM 1 RETURN WATER DAM (FRD 1 RWD)

The following sensitivity ratings apply to the habitat units on FRD 1 RWD:

Habitat Unit	Description	Sensitivity Rating
Deteriorated mixed woodland	Highly isolated and fragmented due to existing mine infrastructure, and disrupted ecological connectivity with nearby natural habitat. It is mainly colonised by generalist and widespread fauna species.	Low
Existing water retention facilities	Open surface water lacking emergent or inundated vegetation. Fauna, especially waterbird taxa is irregular foraging visitors due to the "sterile" nature of the structure.	Low
Transformed areas	These include mainly servitudes and infrastructure with a low contributing towards faunal richness.	Low

34.6.6 ON-MINE WATER STORAGE DAM NORTH & SOUTH COMPARTMENT (OMWSD N&S)

The following sensitivity ratings apply to the habitat units on OMWSD N&S:

Habitat Unit	Description	Sensitivity Rating
Existing water retention facility	Open surface water lacking emergent or inundated vegetation. Fauna, especially waterbird taxa is irregular foraging visitors due to the "sterile" nature of the structure.	Low

34.6.7 ON-MINE WATER STORAGE DAM 3 (OMWSD 3)

The following sensitivity ratings apply to the habitat units on OMWSD 3:

Habitat Unit	Description	Sensitivity Rating
Mixed woodland on quartzitic soils	Woodland with low faunal richness although the edaphic soil properties allows structural foundation for burrowing species. The habitat shows some ecological connectivity with similar habitat, although fragmented and surrounded by mining activities. It is mainly colonised by generalist fauna species.	Medium
Riparian - Mopane thickets	Although located along a drainage line, this habitat is isolated by mine infrastructure (OMWSD N & S) and represents a "cull-de-sac" for animal dispersal. It is mainly colonised by generalist and widespread fauna species.	Medium-low
Transformed land	These include mainly servitudes and infrastructure with a low contributing towards faunal richness.	Low

34.6.8 ON-MINE WATER STORAGE DAM 4 (OMWSD 4)

The following sensitivity ratings apply to the habitat units on OMWSD 3:

Habitat Unit	Description	Sensitivity Rating
Artificial Impoundment (dam)	The inundated condition of the dam provides ephemeral habitat for waterbird and shorebird taxa that would have been absent from the study area. It also provides potential freshwater conditions and foraging habitat (c. Nile Crocodile Cr*ocodilus niloticus*), including breeding habitat for herpetofauna species with aquatic life histories (e.g. foam-nest frogs and monitor lizards). This habitat augments the fauna richness on the study area, although the richness is expected to be lower when compared to similar habitat at PCD3 due to ongoing disturbances caused by mining-related activities.	Medium-high
Deteriorated *Acacia* woodland	Woodland with low faunal richness although the Acacia trees provide a potential larval host plant for butterfly taxa (e.g. genus *Anthene*). The habitat shows some ecological connectivity with similar habitat, although surrounded by mining activities in the north and southwest. It is mainly colonised by generalist fauna species.	Medium
Riparian - Mopane Thickets	The ecological connectivity of this habitat with adjacent habitat is fairly high and also provides connectivity to the VLNR via a seasonal drainage system to the south. It provides a dispersal corridor for aquatic species between the dam and the VLNR.	Medium-high

34.6.9 SOUTH ACCESS ROAD

The following sensitivity ratings apply to the habitat units on the south access road:

Habitat Unit	Description	Sensitivity Rating
Terrestrial Woodland	Natural intact woodland with high vertical heterogeneity thereby facilitating avifaunal and mammal richness. The high ecological connectivity of this habitat with the adjacent VLNR provides opportunities for large charismatic carnivores and scavenger mammal taxa of conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea*) to utilise the area.	Medium-High
Riparian Woodland	Natural intact woodland with high vertical heterogeneity thereby facilitating avifaunal and mammal richness . The high ecological connectivity of this habitat with the adjacent VLNR provides opportunities for large charismatic carnivores and scavenger mammal taxa of conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea*) to utilise the area.	Medium-High

34.6.10 NORTHERN STORMWATER AND SEEPAGE ATTENUATION CHANNEL

The following sensitivity ratings apply to the habitat units on northern stormwater and seepage attenuation channel:

Habitat Unit	Description	Sensitivity Rating
Riparian thickets	The ecological connectivity of this habitat with adjacent habitat is fairly high and also provides connectivity to the VLNR via a seasonal drainage system to the north. However, animal dispersal to the south is limited due to the mine pit. These thickets	Medium

	will allow displaced fauna during construction and mine-related activities to escape/move away.	
Rehabilitated land	Pioneer and secondary habitat for pioneer and secondary species, also introduced species. The residing species consists mainly of generalist and widespread fauna species.	Low

34.6.11 "EASTERN AREA"

The following sensitivity ratings apply to the habitat units on the "eastern area":

Habitat Unit	Description	Sensitivity Rating
Natural Terrestrial Woodland and Mopane Thickets	Natural intact woodland with high vertical heterogeneity thereby facilitating avifaunal richness. The high ecological connectivity of this habitat and the VLNR provides opportunities for large charismatic carnivores and scavenger mammal taxa of conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea*) to utilise the area.	Medium-High
Riparian and Associated Habitat	The high intact ecological connectivity of this habitat with the adjacent VLNR provides opportunities for a high richness of bird and mammal taxa to disperse across the VLNR to areas located north and south of the "eastern area". It also provides opportunities for large charismatic mammal taxa, including species of concern conservation concern (e.g. *Leopard Panthera pardus* and Brown Hyaena *Parahyaena brunnea* and Elephant Loxodonta africana) to utilise the area. The tree canopy also provides potential roosting and breeding habitat for large bird of prey species.	High
Deteriorated terrestrial woodland	Degraded habitat due to previous mine related activities although ecologically connected with eastern VLNR It does provide ephemeral foraging habitat for fauna species from VLNR.	Medium-low
Transformed areas	Pioneer and secondary habitat for pioneer and secondary species, also introduced species. The residing species consists mainly of generalist and widespread fauna species.	Low

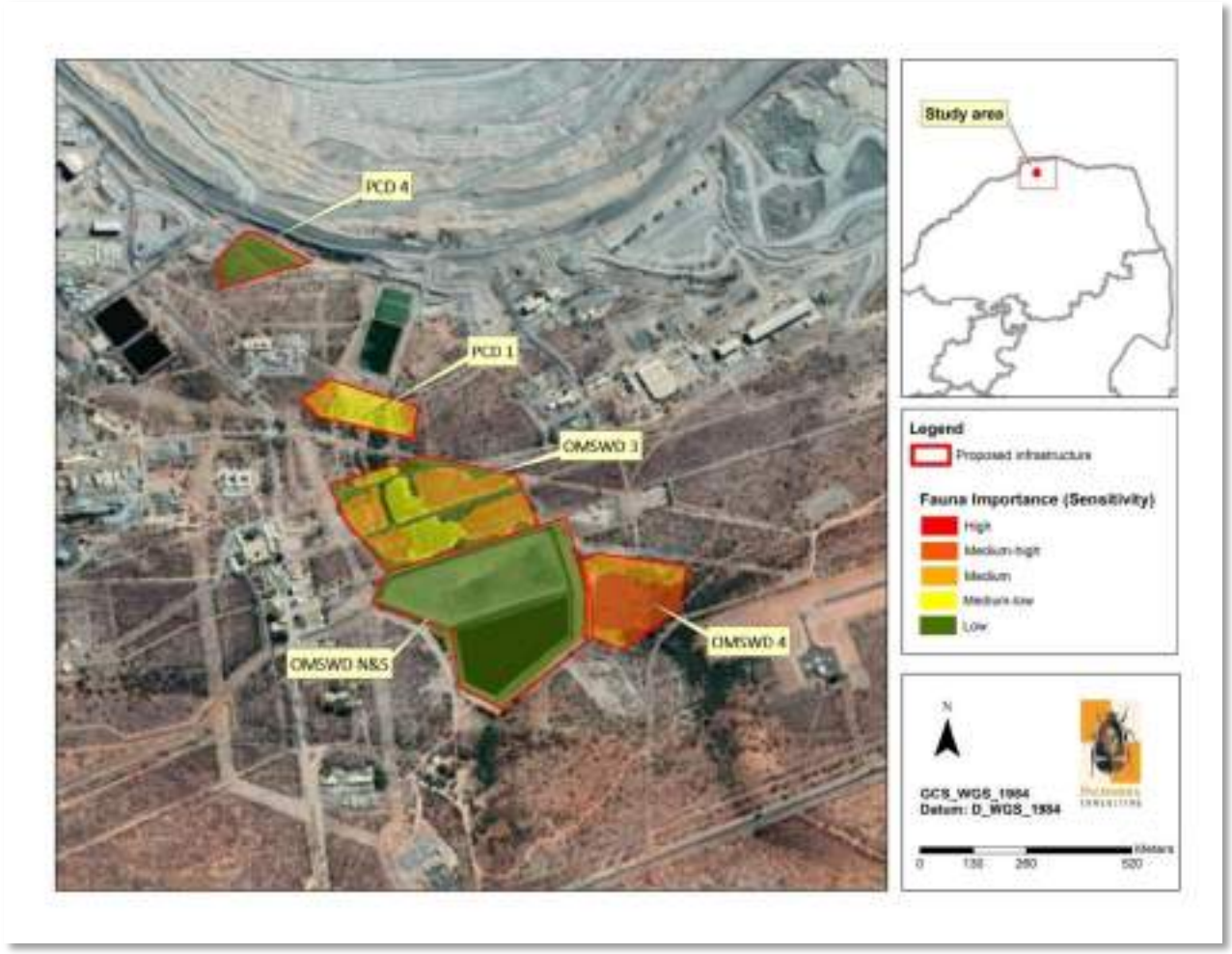


Figure 61: Faunal importance and function (ecological sensitivity) based on the occurrence of terrestrial fauna on PCD1, PCD4, OMWSD N&S, OMWSD3 and OMWSD4

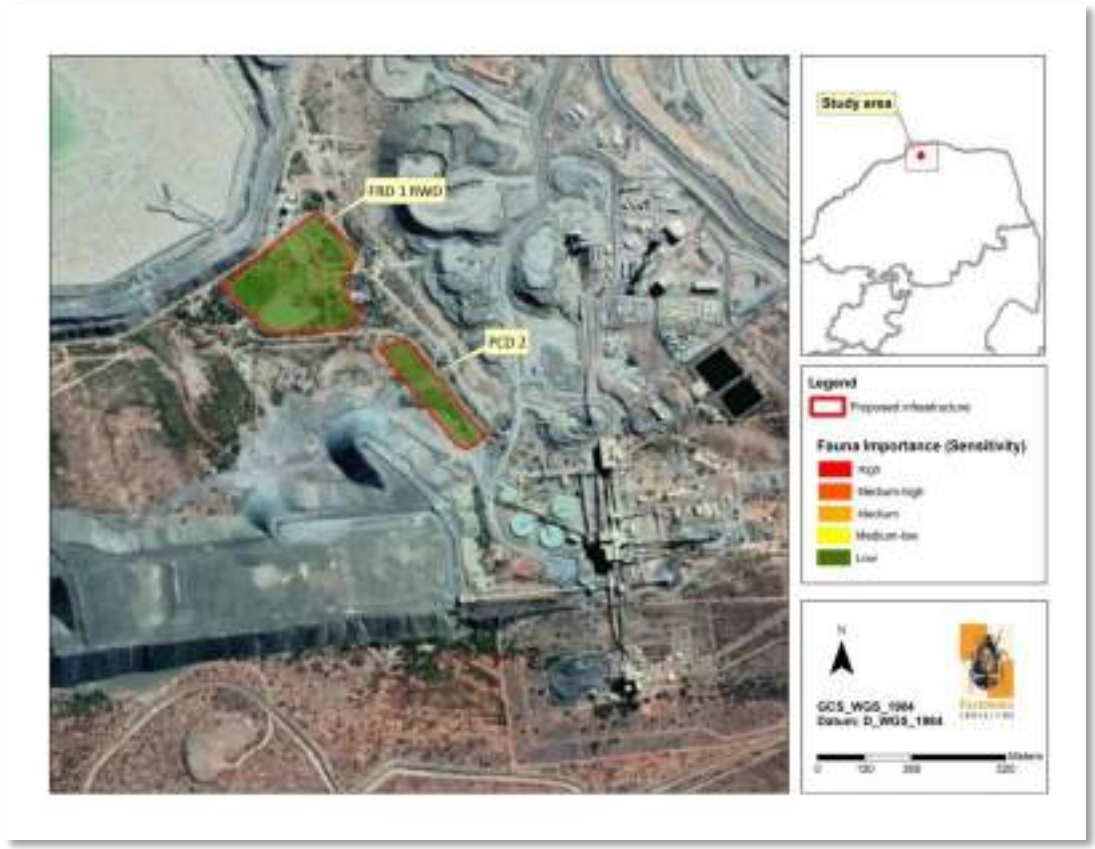


Figure 62: Faunal importance and function (ecological sensitivity) based on the occurrence of terrestrial fauna on PCD2 and FRD 1 RWD

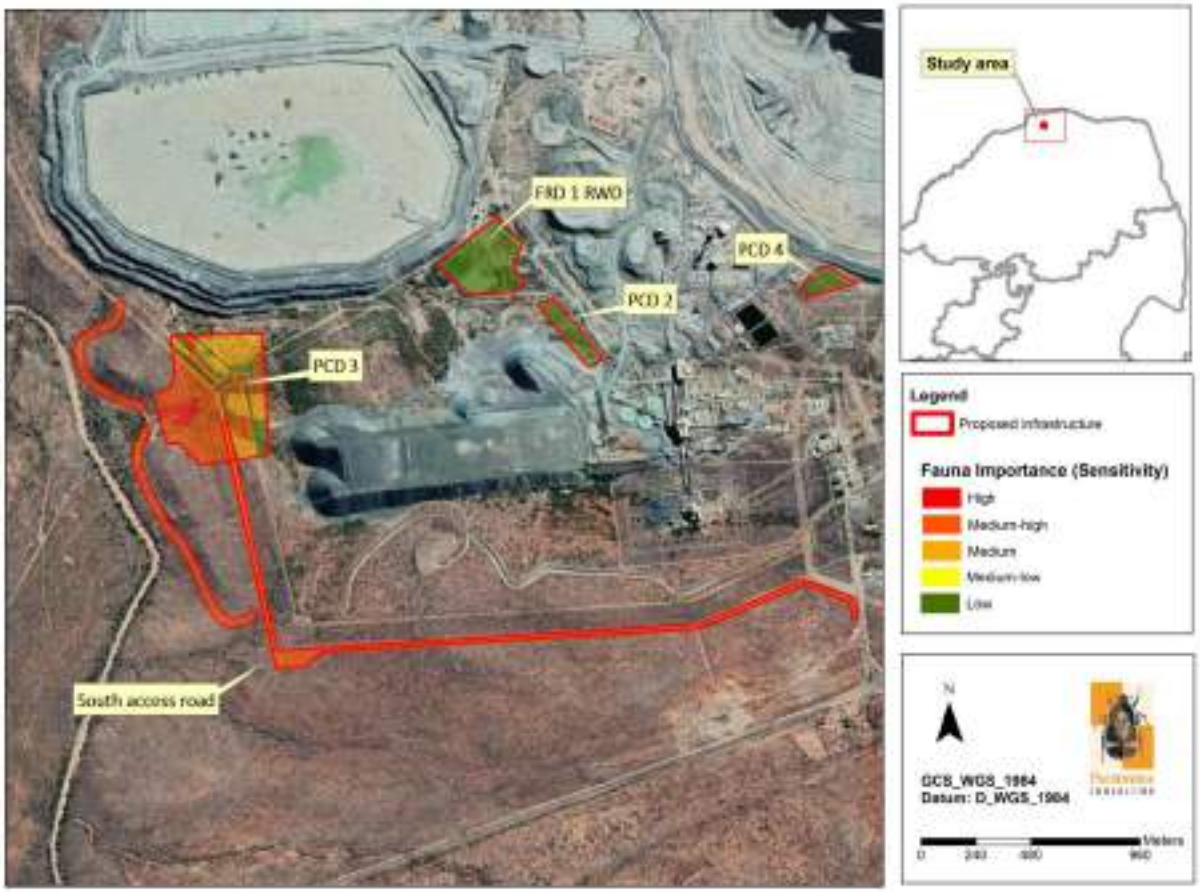


Figure 63: Faunal importance and function (ecological sensitivity) based on the occurrence of terrestrial fauna on PCD3 and the South Access Road

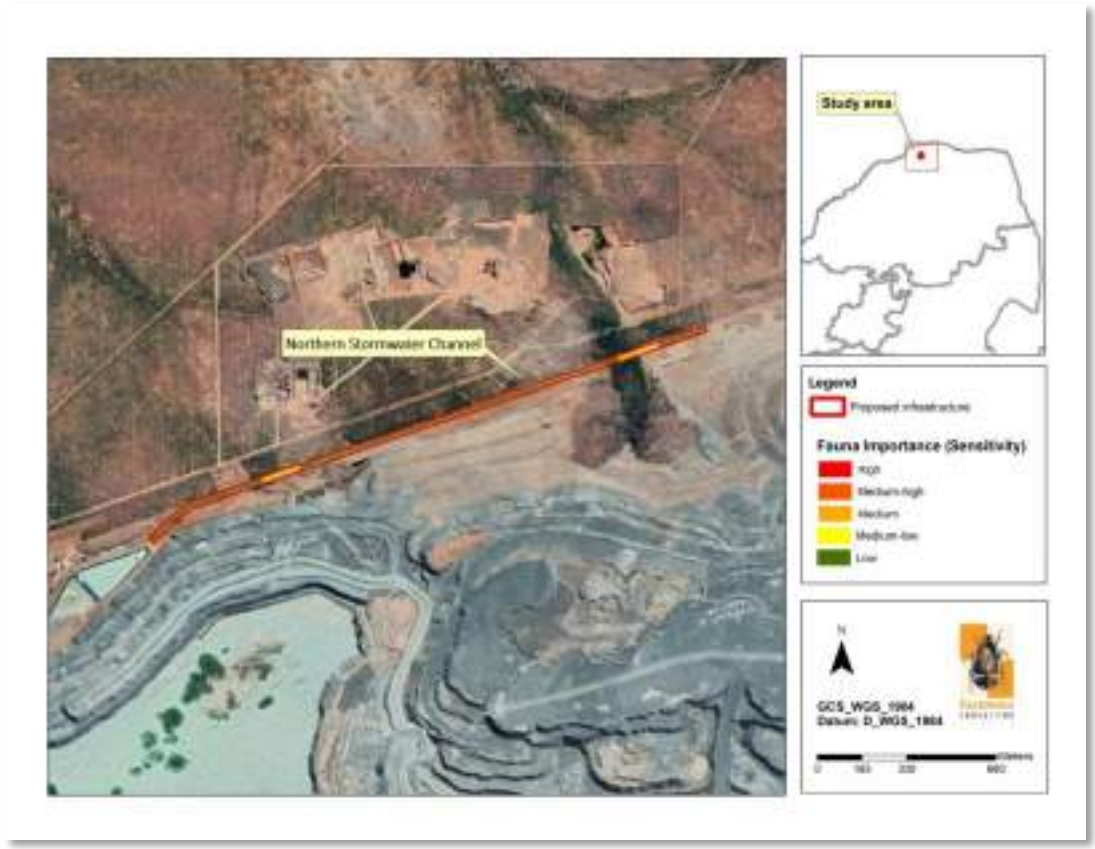


Figure 64: Faunal importance and function (ecological sensitivity) based on the occurrence of terrestrial fauna on the Northern Stormwater and Seepage Attenuation Channel

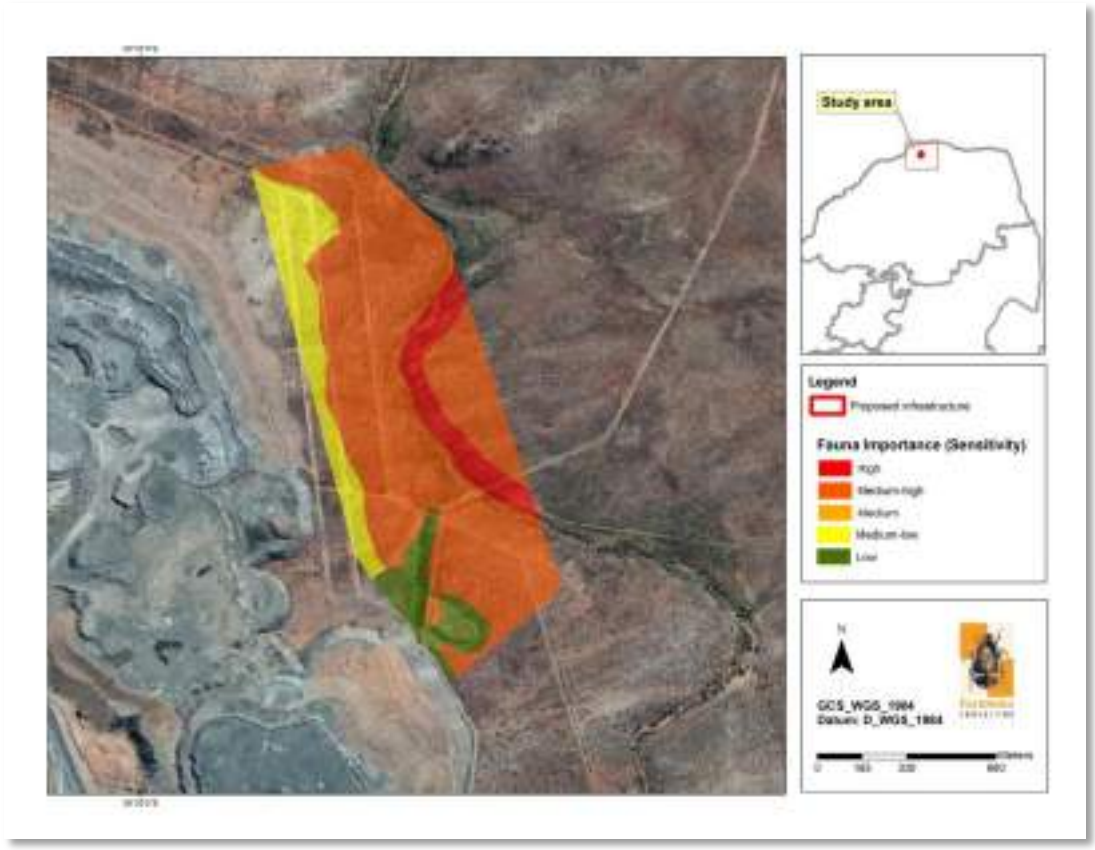


Figure 65: Faunal importance and function (ecological sensitivity) based on the occurrence of terrestrial fauna on the "Eastern Area"

35 ANTICIPATED IMPACTS ON THE FAUNAL ENVIRONMENT

35.1 POTENTIAL ISSUES

⇒ Direct and permanent loss of natural fauna habitat within the development/mining footprints during the construction, operational and also the decommissioning phases. The decommissioning or closure phase will entail rehabilitation of affected/ lost habitat.

⇒ Indirect losses of threatened and near threatened bird and mammal species due to the displacement from the area during the construction and operational phases.

⇒ Decreased habitat quality of surrounding areas due to peripheral impacts such as spillages, litter, increased erosion, contaminants, etc.

⇒ Indirect ecological impacts during all phases pertaining to the loss of the ecological connectivity.

⇒ Subsequent habitat changes and changes to the local fauna community structure and composition (mainly generalists and secondary species) during decommissioning/rehabilitation.

No positive ecological impacts are associated with this project.

35.1.1 DIRECT FAUNAL IMPACTS

The majority of sites comprise of secondary or highly fragmented habitat types, this is especially evident from PCD1, PCD2, PCD4, FRD 1, OMWSD N&S and OMWSD3. These habitat types are invariably colonised by generalist or secondary species with widespread compositions. The subsequent loss of unspecialised and generalist species will be therefore be less severe (low significance impact rating) at PCD1, PCD2, PCD4, FRD 1, OMWSD N&S, the northern stormwater attenuation channel and OMWSD3 when compared to sites that occur at the periphery of the mine area and those site with a high ecological connectivity to the VLNR (e.g. PCD3, southern access road, the "eastern area" and to a certain extent also OMWSD4). Therefore, the intensity of the impact is expected to be greater on areas comprising of habitat types alongside drainage lines or areas with high spatial heterogeneities. In addition, the loss of habitat and consequential loss of faunal compositions are expected to be higher on areas where the loss of wetland-associated habitat occurs (e.g. PCD3). However, the loss of habitat are regarded as local since similar habitat is conserved on the VLNR, while the majority of wetland-associated habitat types are perceived as transient, and some are a by-product of the mine activities.

The study area is likely to host a diversity of venomous snakes (e.g. Puff Adder *Bitis arietans*, Black Mamba *Dendroaspis polylepis* & Mozambique Spitting Cobra *Naja mossambica*), as well as charismatic species (e.g. South African Python *Python natalensis*). Workers and personnel could potentially kill snakes when these are encountered.

35.1.2 INDIRECT FAUNAL IMPACTS

The anticipated loss of wetland habitat and subsequent ephemeral resources at PCD3 and OMWSD4, as well as riparian woodland corresponding to the southern access road and the "eastern area" will result in the potential local displacement of threatened and near threatened mammal and bird species. Similarly, the loss of dead trees will result in the displacement of hole-nesting bird species.

Fragmentation of riparian woodland and drainage lines will also result in the "creation" of dispersal barriers between sub-populations of animals on the proposed sites and those that occur in the adjacent VLNR (mainly applicable to PCD3, southern access road and the "eastern area". It is also expected that the faunal species composition will shift, due to an anticipated loss in habitat and the creation of "new" habitat. In addition, it is predicted that more generalist species (and a loss of functional guilds) will dominate the proposed facilities during rehabilitation.

Construction activities go hand in hand with high ambient noise levels and the eventual loss of habitat (as discussed above). Many of the larger terrestrial mammal and bird species will vacate the study sites during the construction and operational phases. Many of the smaller taxa are sedentary, and their response to disturbances is to seek refuge rather than to flee. Therefore, some invertebrate, frog and reptile taxa, in particular fossorial species are concealed within a refuge habitat and are in immediate threat of being killed (e.g., burrowing amphibians such as *Hemisus*) during the construction phase.

Discharge of water emanating from the pollution control dams and stormwater systems will end up in the nearby drainage systems and ephemeral dams and pools. However, current storm water runoff modelling and water balance assessments indicate that on average a volume of 46 000 m^3 will be discharged annually and during a 1:50-year flood event, with a total volume of 792 000 m^3 to be discharged. It is possible that the spilled water could alter the water chemistry of such closed basins (e.g. ephemeral pools), which could modify the distribution and abundance of the aquatic organisms that reside or make use of these systems (e.g. amphibians and invertebrates). However, if the annual discharges are kept within the modelled specifications, the changes in flood discharges into Kolobe system are predicted to be low (less than 1%). Based on the chemical composition of the discharged water, the impact on water quality is also regarded to be low, although a moderate intensity impact to the water quality is expected. Therefore, the quality of drinking water for fauna and the availability of aquatic food resources for wetland-dependant fauna (e.g. bird species) is only likely to be affected within a small area near the outlet at PCD3 into the Kolobe system. However, if the discharged water should contain abnormal high salt loads, it may elevate the baseline salinity of the natural drainage systems and ephemeral pools in the area, thereby resulting in potential salt toxicosis in animals (especially birds).

35.2 QUANTIFICATION OF IMPACTS

Impacts are collectively quantified for each of the respective areas, as per Table 29.

Table 30: Quantification of Impacts on the Faunal and Avifaunal Environment

Area	Aspect Affected	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
								Probability	Magnitude	Significance		Probability	Magnitude	Significance
PCD 1	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate to exceed mine perimeter	3	2	Medium	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual		2	2	Low		2	1	Low
PCD 2	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate to exceed mine perimeter	3	2	Medium	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual		2	2	Low		2	1	Low
PCD 3 (A)	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat, impacts will exceed local area, significance of impacts anticipated to be severe on local scale	3	3	Medium	Avoid (buffer area) & Control	2	2	Low
			Indirect Impacts on the faunal and avian environment	Low	High	Construction and operational and residual		3	3	Medium		2	2	Low
PCD 3 (B)	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	5	4	High	Avoid (buffer area) & Control	3	3	Medium
			Indirect Impacts on the faunal and avian environment	Low	High	Construction and operational and residual		4	4	High		3	3	Medium
PCD 3 (C) Preferred	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local scale	5	4	High	Avoid (buffer area) & Control	3	3	Medium
			Indirect Impacts on the faunal and avian environment	Low	High	Construction and operational and residual		4	4	High		3	3	Medium
PCD 3 (D)	Vegetation and General Ecology	Construction, operational and post-operational activities, rehabilitation	Direct and Indirect Impacts on the botancial and ecological environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat, impacts will exceed local area, significance of impacts anticipated to be severe on local scale	3	3	Medium	Avoid (buffer area) & Control	2	2	Low
			Cumulative Impacts on the botancial and ecological environment	Low	Medium	Residual and Post-Operational		3	3	Medium		2	2	Low
PCD 4	Fauna and Avifauna	Construction, operational and post-operational	Direct Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate to exceed	2	2	Low	Avoid (buffer area) & Control	2	1	Low

Table 30: Quantification of Impacts on the Faunal and Avifaunal Environment

Area	Aspect	Activity	Potential Impact	Reversibility	Irreplaceable	Phase	Size and scale of	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
		activities	Indirect Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual	mine perimeter	2	1	Low		2	1	Low
FRD 1 RWD	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate to exceed mine perimeter	2	2	Low	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual		2	1	Low		2	1	Low
OMWSD N&S	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual	No loss of natural habitat, existing infrastructure, but impacts might extend to nearby natural habitat, moderate to low significance	2	2	Low	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Low	Construction and operational and residual		2	1	Low		2	1	Low
OMWSD 3	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual	Minor losses of natural habitat, local scale, not anticipate to exceed mine perimeter, impacts anticipated to be of moderate significance, but local	3	2	Medium	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual		2	2	Low		2	1	Low
OMWSD 4	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be moderately severe on local scale	4	3	High	Avoid (buffer area) & Control	3	2	Medium
			Indirect Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual		3	2	Medium		2	1	Low
Northern Attenuation Channel	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be moderately severe on local scale	2	2	Low	Avoid (buffer area) & Control	2	1	Low
			Indirect Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual		2	1	Low		2	1	Low
Southern Access Road	Fauna and Avifauna	Construction, operational and post-operational	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of moderate size natural habitat (from VLNR), impacts will	4	3	High	Avoid (buffer area) & Control	3	2	Medium

Table 30: Quantification of Impacts on the Faunal and Avifaunal Environment

Area	Aspect	Activity	Potential Impact	Reversibility	Irreplaceable	Phase	Size and scale of	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
		activities	Indirect Impacts on the faunal and avian environment	Low	Medium	Construction and operational and residual	exceed local area, significance of impacts anticipated to be moderately severe on local scale	3	2	Medium		2	1	Low
Eastern Area	Fauna and Avifauna	Construction, operational and post-operational activities	Direct Impacts on the faunal and avian environment	Low	High	Construction and operational and residual	Loss of extensive and sensitive areas of natural habitat (from VLNR), impacts will exceed local area, significance of impacts anticipated to be severe on local and larger scale	5	4	High	Avoid (buffer area) & Control	5	4	High
			Indirect Impacts on the faunal and avian environment	Low	High	Construction and operational and residual		5	4	High		5	4	High

Table 31: Measures to rehabilitate the Faunal Environment

No.	*Aspect affected*	*Activity*	*Potential Impact*	*Phase*	*Mitigation type*	*Impact management actions / Mitigation measures*	*Impact management outcome*	*Standard to be Achieved*	*Time period for implementation*
1	Fauna & Avifauna	Construction, operational and post-operational activities (all sites)	Direct Impacts on the faunal and avian environment	Construction and operational and residual	Avoid & Control	1.Minimize area cleared for construction activities and erect a temporary fence to contain construction operations. 2. All development sites (apart from the access road) should be fenced with an impermeable fence structure to prevent game and animal species access to the facilities. 3.Natural corridors (e.g. riparian woodland and drainage lines) must be retained between development sites (PCD3, OMWSD4, Southern Access Road and Eastern Area) and the VLNR to promote the movement of small-bodied fauna. 4. Should any faunal species be identified during the construction phase, these will be relocated in line with the mine's Animal Management Procedures. 5. If any faunal species of conservation concern (as indicated in this report) is exposed during the construction phase, the ECO shall be informed, who shall then issue instructions for its capture, translocation and safe release to the nearby VLNR "screened" prior to, and during the construction phase for reptile species . 6. Harvesting of firewood or any plant material is strictly prohibited. 7. All labour or staff should be advised (induction) by means of	Appoint ECO. Any snake relocations to be undertaken by trained and competent individuals. Demarcation (fencing) and management of development sites including any other open space which is regarded as no-go areas (adjacent areas) Identification of target/protected fauna and relocation/rescue of individuals. Acquisition of relevant permits to relocate protected taxa and/or game species	Avoid impacts to proposed no-go areas or areas that are not part of the development sites. ECO to document number of rescued/relocated animal species and approximate number of affected individuals. Conduct yearly assessments to determine the ecological condition of rehabilitated as well as natural habitat units on development areas and adjacent areas.	Demarcation and fencing of development sites should commence prior to construction activities. Screening of development areas for target species by ECO should be implemented prior to construction. Re-location or rescue of taxa where possible and with guidance from relevant regulatory bodies prior to construction. Veld condition monitoring should be conducted annually (in summer).

Table 31: Measures to rehabilitate the Faunal Environment

No.	Aspect affected	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome	Standard to be Achieved	Time period for implementation
						environmental awareness training on the ecological significance of the area and its conservation importance. 8. Intentional killing of any faunal species (in particular invertebrates and snakes) should be avoided. 9. Indigenous species native to the area should be used during the rehabilitation phase. 10. Large game species occurring or "trapped" within the development sites are to be relocated to the nearby VLNR. 11. Dead game on the sites should promptly be removed and should be disposed at a 'vulture restaurant' located on the nearby VLNR.	Induction of labour and staff on specific environmental issues related to the development sites.		Completion of rehabilitation agreement as part of the mine's greater rehabilitation plan after construction. Produce year report (for at least for consecutive years) on the ecological *status quo* of the development sites and immediate surroundings.
2	Fauna & Avifauna	Construction, operational and post-operational activities (all sites)	Indirect Impacts on the faunal and avian environment	Construction and operational and residual	Avoid & Control	1. Limit construction activities to daytime. 2. Minimize the use of earthmoving equipment that results in noise generation. Generic mitigation measures should include dust suppression and noise reducing technologies to reduce ambient noise and dust levels. Implement monitoring to identify areas where erosion or pollution occur, and remediate when observed. 3. Minimize exterior lighting and implement operational strategies to reduce "spill light" although with the balance to achieve safety and security on the mine. Outside features should be illuminated by using "down-lighting" rather than "up-lighting" as far as possible. Where possible, outside lighting should apply UV filters to high pressure mercury vapour lamps or fluorescent lights to minimise the attraction of nocturnal invertebrates to the light. 4. Introduce speed limits and road calming devices (e.g. speed humps) to the access road to prevent collisions with animals and unnecessary noise pollution by vehicles. 5. Natural corridors (e.g. drainage lines and riparian woodland) must be retained between the sites and the VLNR to promote the movement of fauna when a high rate of natural disruption is expected. 6. Existing access roads must be used (apart from the proposed south and north access road to DMI) and/or road calming devices should be installed to prevent small-bodied or slow-moving animals from being killed, and to facilitate a safe means of dispersal.	Demarcation (fencing) and management of development sites including any other open space which is regarded as no-go areas (adjacent areas Maintenance of natural dispersal corridors and no-go zones. Monthly monitoring of fence structures. Monitoring of water quality and erosion control measures as per the Water Use License requirements. Appropriate remedial action, including the rehabilitation of the eroded areas, where necessary should be undertaken. Implement emergency contingency plan should	Avoid impacts to proposed no-go zones and natural corridors. Conduct yearly assessments to determine the ecological condition of rehabilitated as well as natural habitat units on development areas and adjacent areas. Conduct water quality tests at a frequency approved in the Water Use License at standing water sources adjacent to the developed sites and the Kolope River to determine the salt levels and toxicity of the water for fauna (e.g. ingestion of water by fauna). Compare such to relevant control sites as identified in the Water Use License.	Demarcation and fencing of should commence prior to construction activities (as per Veld condition monitoring should be conducted annually (in summer). Completion of rehabilitation agreement as part of the mine's greater rehabilitation plan after construction. Produce year report (for at least for consecutive years) on the ecological *status quo* of the development sites and immediate surroundings.

Table 31: Measures to rehabilitate the Faunal Environment

No.	Aspect affected	Activity	Potential Impact	Phase	Mitigation type	Impact management actions / Mitigation measures	Impact management outcome	Standard to be Achieved	Time period for implementation
						7. Where possible, ditches/trenches should have slopes of less than 45° rather than vertical sides to allow small animals to escape if they fall into a trench. 8.All domestic waste generated (if present) should be removed from the study site as soon as possible and be disposed at an authorised landfill to reduce the risk of colonization by feral mammals, scavengers or competitively superior bird species (e.g. Pied Crows *Corvus albus*). 9. Disturbed or cleared areas should be rehabilitated where possible, and must be ***maintained***. Rehabilitation should make use of indigenous plant species, preferably of species native to the study area and immediate surroundings. The species selected should strive to represent habitat types typical of the ecological landscape prior to perturbation. Reinstate/rehabilitate as a continual process – this will maximise the viability of the natural seed bank and prevent the unnecessary loss of topsoil during storage. 10. Checks must be carried out at regular intervals to identify areas where erosion is occurring, especially along roads and where slopes occur. 11. The stormwater design should be effective and should not impede with the natural hydrological regime beyond the modelled/predicted discharge volumes. 12. The fence structures should be regularly monitored (at least once a month) during operation, and damaged areas should be immediately repaired. 13. Feeding of animals is strictly prohibited, and signage should be applied at public areas to remind people/staff of the dangers associated with feeding of wild animals. Proper animal-proof dustbins should be used. 14. Electric cables or earth wires associated with transmission (or distribution) lines crossing wetland areas, dams or important roosting and dispersal networks (e.g. drainage lines) used by birds must be marked with appropriate bird deterrent devices (e.g. the Double Loop Bird Flight Diverter; www.preformedsa.co.za).	above predicted/modelled pollution or spillages occur in natural drainage lines (especially the Kolope River, dams and depressions during operation). An ecologist should be consulted to advice on appropriate remedial measures, which may include fencing of polluted area and the relocation of game and animal species.		

35.3 FAUNAL AND AVIAN CONCLUDING STATEMENT AND PROFESSIONAL OPINION

As per Appendix 6 of the Environmental Impact Regulations of 2014 (No. R. 982) of the National Environmental Management Act (Act No. 107 of 1998), the specialist shall provide a reasoned opinion as to whether the proposed activity should be authorised.

This report concludes that the general faunal assemblages on the study area were diverse and also include charismatic and threatened carnivore and scavenger mammal taxa. However, even though these taxa were present on some of the proposed sites (e.g. PCD3 and the southern access roads), these species were also well represented in the nearby VLNR, whereby it is of the opinion that these taxa, when present on the sites, comprised of "over-spill" individuals from the VLNR due to their opportunistic behaviour. However, the occurrence of threatened and near threatened taxa are more prominent at sites with a high ecological connectivity to the VLNR (via drainage lines and riparian woodland) such as PCD3, the "eastern area", the southern access road and to a lesser extent also OMWSD4. Nevertheless, the remaining sites are located and surrounded by mine infrastructure and facilities, which collectively contributed over time to either degraded woodland habitat or habitat that are fragmented, thereby containing mainly unspecialised and generalist taxa.

It is predicted that the impacts on the faunal component of the study area were likely to be low significance at most of the proposed project sites (PCD1, PCD2, PCD4, OMWSD N&S, OMWSD3, FRD 1 RWD and the northern stormwater attenuation channel). However, impacts such as the displacement of fauna was predicted to occur at PCD3, OMWSD4, the southern access road and the "eastern area" due to the clearing of natural habitat, especially riparian woodland, of which the significance was estimated to be moderate-high. The implementation of the suggested mitigation approach is expected to result in the amelioration of the anticipated impacts to an acceptable level. Therefore, no specific objections to the project is raised, but with the understanding that the suggested mitigation protocol is timeous and adequately implemented.

SECTION G: RECOMMENDED MITIGATION APPROACH

36 MITIGATION HIERARCHY BACKGROUND

Mitigation aims to eliminate or reduce negative biodiversity impacts. Mitigation options should generally be considered in the following order of preference:

1. Avoidance of impacts altogether;
2. Reduction of impacts where unavoidable;
3. Restoration of habitats to their original state;
4. Relocation of affected species or habitats; or
5. Compensation for any residual, unavoidable damage.

The mitigation of negative impacts on biodiversity and ecosystem services is a legal requirement for authorisation purposes and must take on different forms, depending on the significance of the impact and the area being affected. Mitigation requires proactive planning that is enabled by following the mitigation hierarchy, illustrated in Figure 66. Its application, is intended to strive to first avoid disturbance of ecosystems and loss of biodiversity, and where this cannot be avoided altogether, to minimise, rehabilitate, and then finally offset any remaining significant residual negative impacts on biodiversity, where:

Avoiding or preventing impacts – refers to considering options in project location, siting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services, and people. This is the best option but is not always possible if development/ construction is to take place. However, there are areas where the environmental and social constraints are too high, and development should not take place. Such areas are best identified early in the development life cycle, so that impacts can be avoided, and authorisations refused. In the case of areas where environmental constraints might be limiting, this includes some ecosystems, habitats, ecological corridors, or areas that provide essential ecosystem services and are of such significant conservation value or importance that their loss cannot be compensated for (i.e. there is no substitute). In such areas, it is unlikely to be possible or appropriate to rely on the latter steps in the mitigation hierarchy (e.g. rehabilitating or offsetting impacts) to provide effective remedy for impacts on biodiversity or ecosystem services. Information about the location of many such areas is available, often making it possible to avoid them.

Reduction of impacts where unavoidable – refers to considering alternatives in the project location, siting, scale, layout, technology, and phasing that would minimise impacts on biodiversity and ecosystem services. Even in areas where the environmental and social constraints are not particularly high for development to proceed/take place every effort should still be made to minimise impacts.

Restoration of habitats to their original state – refers to the rehabilitation of areas where impacts were unavoidable, and measures are taken to return impacted areas to a condition ecologically similar to their 'pre-development natural state' or an agreed land use after closure. Although rehabilitation is important and necessary, unfortunately even with significant resources and effort, rehabilitation is a limited process that usually falls short of replicating the diversity and complexity of a natural system. Instead, rehabilitation helps to restore some resemblance of ecological functioning in an impacted landscape, to avoid on-going negative impacts, and/or to provide some sort of aesthetic fix for a landscape. Rehabilitation should occur concurrently or progressively with the proposed activity, and/or on cessation of the activity.

Relocation of affected species or habitat – refers to the physical translocation of affected individuals within the footprint, or adjacent areas, where unavoidable and devastating effects are likely to occur. The translocation of individuals is generally subject to permitting requirements and should be based on a like-for like habitat, taking cognisance of potential impacts such as genetic populations, geographic isolation, etc. The relocation of habitat

is generally in severely selective events where small, isolated, and biologically significant habitat can be realistically relocated and reproduced outside the affected footprint. This approach can also be augmented by propagation of certain species.

Offset impacts/ Compensation for any residual, unavoidable damage –refers to compensating for remaining and unavoidable negative effects on biodiversity. When every effort has been made to minimise and then rehabilitate remaining impacts to a degree of no net loss of biodiversity against biodiversity targets, biodiversity offsets can provide a mechanism to compensate for significant residual negative impacts on biodiversity.

The mitigation hierarchy is inherently proactive, requiring the on-going and iterative consideration of alternatives of project location, footprint siting, scale, layout, technology and phasing until the proposed development best 'suits' and can be accommodated without significant negative impacts in the receiving environment. In cases where the receiving environment cannot support the development (e.g. there is insufficient water) or where the project will eradicate unique biodiversity, the development may not be feasible; the earlier the developing company knows of these risks, and can plan to avoid them, the better. In cases where biodiversity impacts are likely to be severe, the guiding principle should therefore be to "anticipate and prevent" rather than "assess and repair".

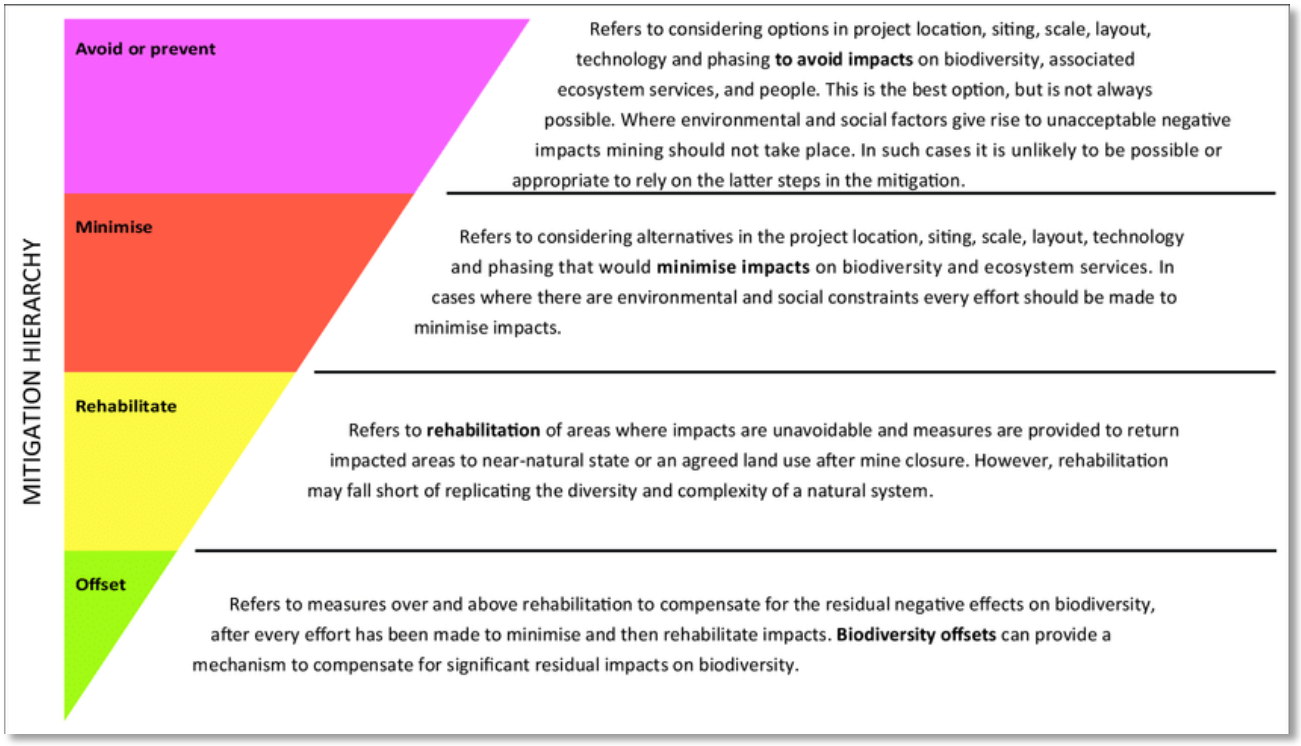


Figure 66: Mitigation hierarchy for dealing with negative impacts on biodiversity

The mitigation approach should be contained and elaborated in the Environmental Management Plan for the activity, notably for the construction phase, and should be regarded as a 'Living Document' that will be amended and updated as new information becomes available. The project should consider minimal disturbance and hazards to the surrounding natural environment. The proposed list of mitigation measures are not considered exhaustive and should be updated where additional or unprecedented impacts are noted during construction and operational phases, i.e. the document should be perceived as a 'living' document that addresses impacts, threats, and issues as it becomes evident.

37 APPLICATION OF THE MITIGATION HIERARCHY

To present the effect of impacts on sensitive areas as well as the need for mitigation strategies, the spatial location of development infrastructure in relation to ecological sensitivity is considered. The proposed sites exhibit a highly variable floristic nature (with moderate to moderate-high floristic sensitivities) and a range of impacts is anticipated, varying between minimal and potentially significant.

37.1 THE "NO-GO' OPTION

The 'No-Go' option is not regarded an appropriate recommendation for this development, based on the following:

1. The proposed development sites comprise comparatively small footprints of natural and transformed woodland habitat types within an existing mining environment.
2. The regional importance of broad-scale habitat types are expressed as Least Threatened, and no habitat of a critical nature is known to persist, or will be affected by the proposed developments.
3. Natural habitat on the site does not exhibit any aspect of uniquely high floristic diversity or sensitivity and was mostly found to be in a moderately deteriorated condition with only selected parts representing woodland habitat of a pristine status.
4. Despite the presence of some protected tree species, the loss of these species is not anticipated to trigger an exacerbation in the conservation status of any of these species, despite some of these species not abundantly encountered in the immediate surrounds. The application of a search and rescue operation for selected species is anticipated to ameliorate this impact acceptably.
5. No plant individual, or population, of a threatened conservation status is anticipated to be affected by the proposed development.
6. The implementation of a dedicated mitigation approach is anticipated to ameliorate expected and likely impacts to an acceptable level.

37.2 OFFSET RECOMMENDATIONS

Considering the small spatial extent of the development footprint, as well as the absence of any habitat, plant species of restricted presence and/ or elevated sensitivity or threatened status, the requirement for an Offset Strategy is not considered appropriate for this project.

37.3 REHABILITATION APPROACH

The near-permanent nature of the proposed development (>20 years), and also considering continued expansion of mining activities and infrastructure within the existing perimeter, implies that it is extremely unlikely that the development will be decommissioned within the immediate future. Addressing unforeseen impacts that result from the development in adjacent natural habitat should be attended immediately and dealt with on a case-by-case basis. The implementation of a generic mitigation approach, which should be based on results and recommendations from a dedicated environmental monitoring programme is expected to be successful in preventing any undue impacts in the surrounding natural environment.

37.4 EXCLUSION AND AVOIDANCE OF HIGH SENSITIVITY AREAS

Habitat from the VLNR is considered sensitive and significant. However the anticipated losses, from a numerical perspective, is marginal and effects are unlikely to trigger the exacerbation of existing conservation levels. However, potential impacts from, specifically, PCD 3 site represents potentially significant peripheral and induced impacts in nearby sensitive habitat (Kolope River) and a rigorous monitoring and management approach is advised. Avoidance of these areas is not considered a requirement, provision of protection measures for the nearby Kolope should be implemented.

37.5 MINIMIZATION OF IMPACTS

The recommended mitigation approach will aim to minimize impacts caused by the development activity within the natural environment. The nature of the development dictates that all natural habitat will be entirely compromised during land clearance activities (construction), and the resultant sterile environment will represent the status quo for the development footprint for a considerable time in future. The minimization approach will therefore have the objective to limit adverse effects of the development on the surrounding ecological receiving environment and address impacts outside the development footprint caused by the development on a case-by-case basis.

37.6 AVOIDANCE OR PREVENTION

The nature of the development and characteristics of natural attributes within the development footprint does not allow for detailed avoidance or prevention strategies. Loss of individual protected plants should be avoided by means of a relocation strategy (for certain species).

Avoidance and prevention strategies will mostly be aimed at limiting the uncontrolled spread of impacts caused by the proposed activity into nearby/ adjacent natural habitat, notably for declared alien and invasive plant species.

37.7 LAYOUT REDESIGN (LOCATION ALTERNATIVES)

A number of capacity and layout alternatives were considered of this project (refer Section 13.2) and were subsequently considered in term of the anticipated impacts on the terrestrial biodiversity environment (refer Sections 30.2 and 35.2).

37.8 PERMITTING REQUIREMENTS & SEARCH AND RESCUE OPERATIONS

⇒ The removal and damage of any protected and conservation important plant species on the site requires compliance in terms of national and provincial legislation. In particular, the National Forest Act (1998) and Limpopo Environmental Management Act (Act No 7 of 2003, including Schedule 11 (Specially protected plants) and Schedule 12 (Protected plants)), require that permits be obtained prior to the removal, damage, or destruction of certain plant species.

⇒ Timelines involving permit applications need to be considered, taking cognisance of the required time of the completion, submission, and approval of permit applications by relevant authorities. It is emphasised that no activity may commence that will adversely affect protected plant species, prior to the approval of all permitting requirements. The permitting process is also dependent on the Environmental Authorisation for the project as a whole and is included as an authorisation condition.

⇒ A suitable Search and Rescue operation needs to be executed prior to commencement of site clearance activities.

Details pertaining the abundance, location, and diversity of plant taxa of conservation concern should be collated through a site-specific walkdown of the respective sites. Results from this particular assessment indicates the presence of protected tree species, as follows:

⇒ *Adansonia digitata* (Baobab, NFA 2014);

⇒ *Boscia albitrunca* (Shepard's Tree, NFA 2014);

⇒ *Combretum imberbe* (Leadwood, NFA 2014);

⇒ *Philenoptera violacea* (Apple Leaf, NFA 2014); and

⇒ *Sclerocarya birrea* (Marula, NFA 2014).

37.9 BOTANICAL MITIGATION RECOMMENDATIONS

Mitigation Measure 1 - Appoint the responsible officer (Environmental Officer, EO) prior to commencement of land clearance activities. Responsibilities should include, but not necessarily be limited to, ensuring adherence to the authorisation conditions, guidance of activities, planning and reporting. The appointment of an Environmental Officer for the project should consider a suitable knowledge of biological and biodiversity aspects of the site, surrounds, and the general region. The Environmental Officer should also establish communication with a suitable ecologist as soon as possible to communicate relevant project details and direct any questions in cases of uncertainties.

Mitigation Measure 2 - EO should delegate and oversee the final walkdown to identify and geolocate protected plant species for permitting purposes.

Mitigation Measure 3 - Apply for and secure all relevant permits from DFFE (and possibly LEDET) for protected plant species that occur on the site prior to any activity being undertaken. No protected plant species may be affected, removed, excavated, relocated, or impacted in any manner, except under a valid permit granted by the relevant authority and under the supervision of the appointed EO.

Mitigation Measure 4 - Develop and execute a Search and Rescue operation for certain plants/ trees as per recommendations from the Final Walkdown Report. These plants should be relocated to a secure, suitable, and appropriate location, taking care to duplicate existing habitat conditions as far as possible. It should be noted that the transportation and relocation process of protected plant species is also subject to permitting requirements; this process should be guided by the EO and executed by a suitable horticultural specialist.

Mitigation Measure 5 - Develop and implement a biodiversity monitoring programme to establish long-term trends of floristic and faunal diversity patterns and the latent and immediate effects of mining on these receiving environments, as per recommendations from Section 14.4.

Mitigation Measure 6 - An Alien and Invasive Plant Management Programme should be developed and implemented with the onset of the construction phase. The aim of this programme should include (*inter alia*) the identification, control, and eradication of invasive plants from the site and immediate surrounds through a responsible, yet effective, management strategy that might involve a combination of physical removal methods and application of chemical treatments. The Environmental Officer shall compile relevant action plans to deal with the presence of alien and invasive species, as per recommendations from Section 14.4.

Mitigation Measure 7 - Provide consideration for the sensitive drainage lines and rivers in spatial proximity to the proposed development footprints. No effluent of a damaging nature should be released, or permitted to enter, natural drainage lines or rivers.

Mitigation Measure 8 - Stormwater management should aim to ameliorate destructive erosion events that will result in further deterioration of the drainage channels.

Mitigation Measure 9 - Erosion control should be prioritized, notably during the planning phase where slopes, runoff from paved and tarmac areas and stormwater control measures need to be highlighted and planned to prevent erosion of surrounding natural areas.

Mitigation Measure 10 - All development areas shall be demarcated, and no personnel or construction vehicle shall be allowed to access neighbouring properties for any purpose whatsoever, with specific reference to the VLNR area.

Mitigation Measure 11 - Under no circumstances shall any natural area on neighbouring properties (outside the development site footprints) be impacted, degraded, cleared, or affected in any manner.

Mitigation Measure 12 - The PCD 3 site portion that is situated in the VLNR shall be demarcated by permanent fencing to prevent any access for animals to these areas.

Mitigation Measure 13 - Due to the type of development, the type and nature of demarcation should not attempt to facilitate free movement of smaller animals as this could lead to unwanted presence (and accidental killing) of animals within the development site. Typical fencing employed for security purposes around the Venetia Mine is considered adequate.

Mitigation Measure 14 - The use of electric fences (particularly on ground level) is discouraged.

Mitigation Measure 15 - Cleared vegetation and debris that has not been utilised must be collected and disposed through an appropriate manner.

Mitigation Measure 16 - No painting or marking of rocks or vegetation (trees) to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. All temporary markings will be removed upon completion of the construction.

Mitigation Measure 17 - Collection of branches, wood (dead or alive), shrubs or any vegetation for fire making purposes is strictly prohibited.

Mitigation Measure 18 - Prevent all open fires on site.

Mitigation Measure 19 - The irresponsible use of welding equipment, oxy-acetylene torches, and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines.

Mitigation Measure 20 - The burning of general waste material is not to be allowed.

Mitigation Measure 21 - Provide demarcated fire-safe zones, facilities, and suitable fire control measures.

Mitigation Measure 22 - Provide temporary and suitable on-site ablution, sanitation, litter and waste management and hazardous materials management facilities until such time that adequate permanent and operational facilities can be provided. Abluting anywhere other than in provided ablutions shall not be permitted. Under no circumstances shall use of the veld for ablution purposes be permitted.

Mitigation Measure 23 - A periodic (at least annual) clean-up of the surrounding natural environment should be undertaken to remove litter and prevent unwanted deterioration of the surrounding natural environment.

Mitigation Measure 24 - Site induction for contractors and workers should include a familiarization with all aspects relating to environmental components of the project.

Mitigation Measure 25 - Ensure the implementation of erosion control measures on the perimeter of the development, aimed at avoiding exacerbation of the existing erosion patterns.

Mitigation Measure 26 - The use of locally indigenous plant species for landscaping purposes is strongly recommended. Under no circumstances shall exotic and invasive plants be used for landscaping purposes.

Mitigation Measure 27 - Rehabilitation of areas where construction activities have been finalised, shall be prioritised.

37.10 FAUNAL & AVIFAUNAL MITIGATION RECOMMENDATIONS

37.10.1 LOSS OF HABITAT AND HABITAT TRANSFORMATION

⇒ Minimize area cleared for construction activities and erect a temporary fence to contain construction operations. This includes the area used by staff and labours during the construction phase and prevent an "overspill" of construction activities into the VLNR.

⇒ All sites (apart from the access road) should be fenced with an impermeable fence structure to prevent game and animal species access to the facilities in order to prevent potential downing or ingestion of contaminated surface water.

⇒ Building material must be located in a secure site.

⇒ Natural corridors (e.g. riparian woodland and drainage lines) must be retained between the sites and the VLNR to promote the movement of small-bodied fauna when a high rate of natural disruption is expected during the construction phase.

⇒ Rehabilitate as a continual process – this will maximise the viability of the natural seed bank and prevent the unnecessary loss of topsoil during storage.

⇒ The study sites should be "screened" prior to, and during the construction phase for reptile species by a qualified herpetologist capable of handling venomous snakes. All species found should be relocated to suitable habitat not more than 50 km from the study site (preferable the VLNR). In addition, the contractor should contact the ECO or herpetologist should any snake (or reptile) species be found on or near the construction/operation site.

⇒ If any faunal species of conservation concern (as indicated in this report) is exposed during the construction phase, the ECO shall be informed, who shall then issue instructions for its capture, translocation and safe release to the nearby VLNR.

37.10.2 DISPLACEMENT AND DISTURBANCE TO FAUNA (ESPECIALLY SPECIES OF CONSERVATION CONCERN)

⇒ Limit construction activities to daytime.

⇒ Minimize the use of earthmoving equipment that results in noise generation.

⇒ The extent of the construction/operational site should be demarcated on site layout plans (preferably on disturbed areas or those identified with low or medium-low conservation importance), and no construction personnel or vehicles may leave the demarcated area except those authorised to do so. Those areas surrounding the mining operations that are not part of the demarcated mining area should be considered as "no-go" areas for employees, machinery or even visitors.

⇒ Provide adequate ablution facilities to avoid the contamination of natural habitat.

⇒ Minimize exterior lighting and implement operational strategies to reduce "spill light" although with the balance to achieve safety and security on the mine. Outside features should be illuminated by using "down-lighting" rather than "up-lighting" as far as possible. Where possible, outside lighting should apply UV filters to high pressure mercury vapour lamps or fluorescent lights to minimise the attraction of nocturnal invertebrates to the lights.

⇒ All domestic waste generated (if present) should be removed from the study site as soon as possible and be disposed at an authorised landfill to reduce the risk of colonization by feral mammals, scavengers or competitively superior bird species (e.g. Pied Crows *Corvus albus*).

⇒ Personnel and staff should be advised (by means of induction) by means of environmental awareness training on the biodiversity importance of the area. The intentional killing of any faunal species (in particular invertebrates, reptiles and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of conservation issues pertaining to the taxa occurring on the study site.

⇒ Generic mitigation measures should include dust suppression and noise reducing technologies to reduce ambient noise and dust levels. Implement monitoring to identify areas where erosion or pollution occur, and remediate when observed.

⇒ Introduce speed limits and road calming devices (e.g. speed humps) to the access road to prevent collisions with animals and unnecessary noise pollution by vehicles.

37.10.3 Increased Fragmentation & Loss of Ecological Connectivity

⇒ Natural corridors (e.g. drainage lines and riparian woodland) must be retained between the sites and the VLNR to promote the movement of fauna when a high rate of natural disruption is expected.

⇒ All linear units (drainage lines) must be clearly demarcated. Construction and operation should be located outside these areas.

⇒ Existing access roads must be used (apart from the proposed south access road) and should preferably be perforated (with underpasses or kerb walls) and/or road calming devices should be installed to prevent small-bodied or slow-moving animals from being killed, and to facilitate a safe means of dispersal.

37.10.4 Poaching, Plundering of Natural Resources & Indiscriminate Killing of Animals

⇒ Harvesting of firewood or any plant material is strictly prohibited. Labour or personnel shall only assist with the removal of important plant species if requested to do so.

⇒ All labour or staff should be advised (induction) by means of environmental awareness training on the ecological significance of the area and its conservation importance.

⇒ Intentional killing of any faunal species (in particular invertebrates and snakes) should be avoided by means of awareness programmes presented to the labour force. The labour force should be made aware of the conservation issues pertaining to the taxa occurring on the study site. Any person found deliberately harassing any animal in any way should face disciplinary measures, following the possible dismissal from the site.

37.10.5 Introduction of Invasive Species

⇒ Indigenous species native to the area should be used during the rehabilitation phase.

⇒ It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species.

37.10.6 Pollution and discharge control

⇒ Make use of effective stormwater control measures to prevent the discharge of water above the modelled/predicted volumes into nearby natural drainage systems, including ephemeral pools and dams.

⇒ The quality of the discharged water should be tested at regular intervals (preferably monthly) to ensure that it is safe for use by wildlife.

⇒ Physical barriers and trenches must be constructed to prevent accidental spillages or discharge of polluted water beyond the modelled predictions and/ or during high rainfall events.

⇒ Implement an emergency contingency plan should excessive pollution above the predicted parameters occur or when excessive discharge occur above the predicted/modelled volumes in natural drainage lines (especially the Kolope River, dams and ephemeral depressions) during operation. An ecologist should be consulted to advise on appropriate remedial measures, which may include fencing of the polluted area (to exclude game/animals from ingesting the water) and the relocation of game and animal species from the affected area. Equipment (bioremediation agents) for the treatment of spillages must be available on site at all times.

⇒ Salt concentrations should be kept at acceptable (e.g. baseline) baseline levels by means of active dilution or by active remediation.

⇒ Monthly monitoring of water quality is recommended at standing water sources adjacent to the developed sites and the Kolope River (when inundated) to determine if discharge of water occurred and to determine the salt levels and toxicity of the water (e.g. potential ingestion of water by fauna).

37.10.7 SPECIFIC MITIGATION MEASURES

⇒ *Venomous snakes & snake handling*: Mine management should acquire the services of a qualified herpetologist capable of handling venomous snakes when encountered during the construction and operational phase. The herpetologist should train specific (and interested) individuals on the mine with the ability to identify and remove venomous snakes when encountered. This person should be working on the mine and should be readily available in the event of a snake posing a risk to the work force.

⇒ *Taxonomic impediment*: There are reptile, amphibian and invertebrate that are known to occur in the wider study area for which their biology is insufficiently known or documented. Many of these species display distribution patterns peripheral or rare in South Africa. Therefore, if any subterranean/fossorial reptile, scorpion or mammal species is recovered during the construction phase, its identity and location must be noted (accompanied with digital photographs) before being relocated to the nearest area or natural open space with suitable habitat for the particular species to continue its life history (e.g. the VLNR). If accidentally killed, then this species should be adequately preserved as a "voucher" specimen (with the assistance and knowledge of the ECO). These specimens may contribute towards a better understanding of biogeography patterns and animal systematics.

⇒ *Game management*: Large game species occurring or "trapped" on the study sites are to be relocated to the nearby VLNR. It is suggested that the services of a professional game capture unit be used. It will entail the temporary opening of the security fence bordering the sites and VLNR.

⇒ *Management of crocodiles*: Vagrant individuals of the Nile Crocodile (*Crocodylus niloticus*) are sometimes encountered in the vicinity of the facilities, and could pose a threat to people working in the area. A qualified herpetologist capable of handling crocodiles should be appointed to capture stray individuals. Captured crocodiles should be relocated to nearby suitable habitat.

⇒ *Game drinking areas*: Many of the proposed facilities are potential sources of drinking water for animals and could pose a risk of drowning due to steep gradients or illness/death due to the ingestion of contaminated surface water. Game should be excluded from these areas by proper game fencing.

⇒ *Dead game management*: Dead game on the sites should promptly be removed and should be disposed at a 'vulture restaurant' located on the nearby VLNR. The spatial position of the restaurant should be selected in consultation with an ornithologist, and due consideration should be given to the position of current transmission and distributions lines to prevent unnecessary 'bird-power line' interactions.

⇒ *Management of nuisance animals (baboons, monkeys, warthogs)*: Feeding of animals is strictly prohibited and signage should be applied at public areas to remind people/staff of the dangers associated with feeding of wild animals. Proper animal-proof dustbins should be used.

⇒ *Electric infrastructure*: Electric cables or earth wires associated with transmission (or distribution) lines crossing wetland areas, dams or important roosting and dispersal networks (e.g. drainage lines) used by birds must be marked with appropriate bird deterrent devices (e.g. the Double Loop Bird Flight Diverter; www.preformedsa.co.za).

⇒ *Removal of large dead trees*: The felling of large (tall) dead trees which could be utilised by the Red-billed Oxpecker (*Buphagus erythrorhynchus*) and other hole-nesting birds for breeding and roosting purposes should be prohibited. Suitable nesting or roosting trees should be identified prior to any construction activities and

should frequently be inspected for breeding/roosting individuals. Confirmed roosting/breeding trees should be marked and conserved in situ.

SECTION H: APPENDICES, BIBLIOGRAPHY AND SPECIALIST CV'S

38 APPENDIX 1: LIST OF PLANT SPECIES RECORDED WITHIN THE STUDY AREAS

Declared AIP species denoted with ***
Species indicated in ***bold*** *denotes species of conservation concern*

Species Name	Family	Growth Form	Common Name	Status/ Uses	Conservation / Invasive Status
Abutilon fruticosum Guill. & Perr.	Malvaceae	Dwarf shrub	Typical on alkaline soils	Least Concern	Shrubby Abutilon (e)
Adansonia digitata **L.**	**Malvaceae**	**Tree**	**Traditional uses, edible parts, traditional medicinal uses**	**Protected Tree (National Forest Act, 1998)**	**Baobab (a), Cream-of-tartar-tree (e), Kremetartboom (a), Muvhuyu (v)**
Alternanthera pungens Humb.	Amaranthaceae	Prostrate herb	Weed, pioneer species	Common weed	Khaki Weed (e), Dubbeltjie (a)
Aptosimum lineare Marloth & Engl.	Scrophulariaceae	Herb	None		--
Aptosimum species	Scrophulariaceae	Dwarf shrub	None		--
Aristida adscensionis L.	Poaceae	Grass	Poor grazing potential, Increaser IIC		Annual Three-awn (e) Eenjarige Steekgras (a)
Aristida congesta subsp. *barbicollis*	Poaceae	Grass	Poor grazing potential, Increaser IIC		Spreading Three-awn (e), Lossteekgras (a)
Aristida congesta subsp. *congesta*	Poaceae	Grass	Poor grazing potential, indicator of poor habitat, Increaser IIC		Tassel Three-awn (e), Katstertsteekgras (a)
Aristida meridionalis Henrard	Poaceae	Grass	Unpalatable, Increaser IIB		Giant three-awn (e), Langbeensteekgras (a)
Aristida rhiniochloa Hochst.	Poaceae	Grass	Poor grazing value, often in disturbed areas, sandy soils	Least Concern	Rough Three-awn (e), Skurwesteekgras (a)
Aristida species	Poaceae	Grass	None		--
Barleria senensis Klotzsch	Acanthaceae	Dwarf shrub	None	Least Concern	Mozambique Barleria (e), Mosambiekse Barleria (a)
Blepharis diversispina (Nees) C.B.Clarke	Acanthaceae	Dwarf shrub	None	Least Concern	Eyelash Flower (e), Rankklits (a)
Boscia albitrunca **(Burch.) Gilg & Gilg-Ben.**	**Capparaceae**	**Tree**	**Important fodder, traditional uses, traditional medicinal uses**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Sheperd's Tree (e), Witgat (a), Matoppie (a), Mohlopi (ns)**
Boscia foetida Schinz subsp. *rehmanniana* (Pestal.) Toelken	Capparaceae	Small tree	Medicinal uses, browsing value		Bushveld Shepherd Tree (e), Stinkwitgat (a), Mopipi (ns)
Calotropis procera (Aiton) R.Br.	Apocynaceae	Shrub	Medicinal uses, indicator of overgrazed land, deterioration. Currently not listed as invasive. Regarded as an encroacher species	Not evaluated	Giant Milkweed (e), Apple of Sodom (e)
Cenchrus ciliaris L.	Poaceae	Grass	Palatable grazing species, Decreaser		Blue Buffalo Grass (e), Bloubuffelgras (a)
Ceratotheca triloba (Bernh.) Hook.f.	Pedaliaceae	Herb	Medicinal properties		Wild Foxglove (e), Vingerhoedblom (a)
Chloris virgata Sw.	Poaceae	Grass	None		Feather-top Chloris (e), Witpluim-chloris (a)
Colophospermum mopane (J.Kirk ex	Caesalpiniaceae	Tree	Traditional medicinal uses, traditional uses,	Least Concern	Mopane (e), Mopane (a), Mopane (tw)

Species Name	Family	Growth Form	Common Name	Status/ Uses	Conservation / Invasive Status
Benth.) J.Kirk ex J.Léonard			pods browsed by game, host plant for moth larvae *Gonimbrasia belina* (Mopane worm). Regarded as an encroacher species		
Combretum apiculatum Sond. subsp. *apiculatum*	Combretaceae	Tree	Traditional medicinal uses, seeds possibly poisonous but consumed by Brown-headed Parrots, , leaves eaten by game, firewood	Least Concern	Red bushwillow (e), Rooibos (a), Mogoeleri (ss)
Combretum imberbe **Wawra**	**Combretaceae**	**Tree**	**Popular firewood, medicinal uses**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Leadwood (e), Hardekool (a), Motswiri (tw), Mudzwiri (v)**
Combretum zeyheri Sond.	Combretaceae	Tree	Edible parts, timber, weaving, medicinal uses		Large-fruited bushwillow (e), Raasblaar (a)
Commiphora glandulosa Schinz	Burseraceae	Tree	Leaves eaten by game	Least Concern	Tall common corkwood (e), Groot gewone kanniedood (a), Iminyela (z)
Commiphora mollis (Oliv.) Engl.	Burseraceae	Small tree	Leaves eaten by game and cattle	Least Concern	Velvet Commiphora (e), Fluweel-kanniedood (a), Mokômoto (tw)
Commiphora viminea Burtt Davy	Burseraceae	Tree	Traditional uses, browsed by game and cattle	Least Concern	Zebra-bark Corkwood (e), Zebrabas-kanniedood (a), Mutonyombidi (v)
Corchorus asplenifolius Burch.	Tiliaceae	Herb	Traditional and medicinal uses, edible parts	Least Concern	Gusha (e), Geel varingblaartjie (a), Ubangalala (z)
Croton gratissimus Burch. var. *gratissimus*	Euphorbiaceae	Tree	Medicinal uses, larval food for *Charaxes candiope candiope*	Least Concern	Lavender fever-berry (e), Laventelkoorsbessie (a)
Cucumis zeyheri Sond.	Cucurbitaceae	Prostrate herb	Edible parts		Wild Cucumber (e), Wildekomkommer (a)
Cynodon dactylon (L.) Pers.	Poaceae	Grass	Indicator of disturbed areas, grazing potential		Common Couch Grass (e), Gewone kweekgras (a)
Cyperus longus L. var. *tenuiflorus* (Rottb.) Boeck.	Cyperaceae	Sedge	None	Least Concern	Sweet cyperus (e), Waterbiesie (a)
Dactyloctenium aegyptium (L.) Willd.	Poaceae	Grass	Increaser IIC. Palatable grazing species		Common Crowfoot (e), Hoenderspoor (a)
Dactyloctenium giganteum Fisher & Schweick.	Poaceae	Grass	Palatable grazing		Giant Crowfoot (e), Reuse Hoenderspoor (a)
Dalbergia melanoxylon Guill. & Perr.	Fabaceae	Small tree	Traditional uses. Roots are used medicinally		Zebrawood (e), Sebrahout (a)
Datura inoxia Mill.**	Solanaceae	Herb	Noxious weed	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2014)	Downy thorn apple (e)
Dicanthium annulatum	Poaceae	Grass	Poor grazing value		Vlei Finger Grass (e), Vleivingergras (a)
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brummitt	Fabaceae	Small tree	Encroacher species, traditional medicinal uses, firewood, pods browsed extensively by game and stock	Least Concern	Small-leaved Sickle Bush (e), Kleinblaar-sekelbos (a), Ugagake (z)
Dicoma capensis	Asteraceae	Dwarf shrub	Medicinal uses		Koorsbossie (a)
Dicoma tomentosa Cass.	Asteraceae	Dwarf shrub	Often on overgrazed and trampled areas	Least Concern	Hairy Dicoma (e), Harige dicoma (a)
Digitaria eriantha Steud.	Poaceae	Grass	Weaving, palatable grazing grass, Decreaser		Finger grass (e), Finger gras (a)
Dombeya rotundifolia (Hochst.) Planch.	Malvaceae	Tree	Wood is used for traditional purposes, bark,	Least Concern	Wild Pear (e), Drolpeer (a)

Species Name	Family	Growth Form	Common Name	Status/ Uses	Conservation / Invasive Status
var. *rotundifolia*			roots and root is used medicinally		
Ehretia rigida (Thunb.) Druce	Ehretiaceae	Small tree	Roots are used medicinally		Puzzle Bush (e), Deurmekaarbos (a)
Enneapogon cenchroides (Roem. & Schult.) C.E.Hubb.	Poaceae	Grass	Useful pioneer grass, moderately palatable		Nine-awned gras (e), Negenaaldgras (a)
Eragrostis capensis (Thunb.) Trin.	Poaceae	Grass	Moderate grazing potential		Heart-seed love grass (e), Hartjiesgras (a)
Eragrostis lehmanniana Nees var. lehmanniana	Poaceae	Grass	Indicator of overgrazing, valuable grazing grass,		Lehman Love Grass (e), Lehmann-eragrostis (a), Knietjiesgras (a)
Eragrostis nindensis Ficalho & Hiern	Poaceae	Grass	Increaser IIC		Wether Love Grass (e), Hamelgras (a)
Eragrostis rotifer Rendle	Poaceae	Grass	Average palatability, important during winter in arid areas		Pearly love grass (e), Vleipluimgras (a)
Eragrostis species	Poaceae	Grass	None		--
Eragrostis tef (Zuccagni) Trotter	Poaceae	Grass	Not Evaluated, often planted in pastures or for rehabilitation		Teff (e), Tef (a)
Evolvulus alsinoides (L.) L.	Convolvulaceae	Herb	None		Blue Haze (e)
Fingerhuthia africana Lehm.	Poaceae	Grass	Moderate grazing potential, Decreaser		Thimble grass (e), Vingerhoedgras (a)
Flaveria bidentis (L.) Kuntze**	Asteraceae	Herb	None	Declared Invader - Category 1B (NEM:BA, 2004. AIP, 2016). Not GBIF listed. Not listed for CARA.	Smelter's bush, Smelterbossie (a)
Gardenia volkensii K.Schum. subsp. *volkensii* var. *volkensii*	Rubiaceae	Tree	Fruit and root are used medicinally, traditional uses	Not evaluated (Least Concern)	Bushveld gardenia (e), Bosveldkatjiepiering (a)
Geigeria acaulis (Sch.Bip.) Benth. & Hook.f. ex Oliv. & Hiern	Asteraceae	Dwarf shrub	In overgrazed areas	Least Concern	Rosulate Geigeria (e), Perdebynessie (a)
Gomphocarpus fruticosus (L.) Aiton f.	Apocynaceae	Shrub	Medicinal uses, common weed		Milkweed (e), Melkbos (a)
Grewia bicolor Juss. var. *bicolor*	Malvaceae	Shrub	Medicinal uses, edible parts, highly variable	Least Concern	White-leaved Raisin (e), Witrosyntjie (a)
Grewia flava DC.	Malvaceae	Shrub	Edible parts, weaving, traditional uses, declared indicator of encroachment	Least Concern	Velvet Raisin (e), Fluweelrosyntjiebos (a)
Grewia flavescens Juss.	Malvaceae	Shrub	Edible parts, beer brewing	Least Concern	Bushman Raisin (e), Kruisbessie (a)
Grewia monticola Sond.	Malvaceae	Shrub	Edible parts, traditional uses, important browsing	Least Concern	Silver raisin (e), Vaal rosyntjiebos (a)
Grewia species	Malvaceae	Shrub	None	Least Concern	--
Gymnosporia undata (Thunb.) Blakelock	Celastraceae	Small tree	None		Common Spike-thron (e), Gewone pendoring (a)
Heliotropium species	Boraginaceae	Perennial herb	Common along roadsides and disturbed areas	Least concern	String of stars (e), Hamelstertjie (a)
Heteropogon contortus (L.) Roem. & Schult.	Poaceae	Grass	Moderate grazing potential, irritant		Spear grass (e), Assegaaigras (a)
Hibiscus micranthus L.f. var. micranthus	Malvaceae	Herb	None		Tiny White Wild Hibiscus (e), Wilde klein Hibuscus (a)
Holubia saccata Oliv.	Pedaliaceae	Herb	None	Least Concern	Sac Flower (e)

Species Name	Family	Growth Form	Common Name	Status/ Uses	Conservation / Invasive Status
Indigofera heterotricha DC.	Fabaceae	Perennial herb	None	Least Concern	Hairy Indigo (e), Harige Indigofera (a)
Indigofera species	Fabaceae	Herb	None		--
Kirkia acuminata Oliv.	Kirkiaceae	Tree	Emergency water source	Least Concern	White Kirkia (e), Witsering (a), Modumêla (tw)
Kyphocarpa angustifolia (Moq.) Lopr.	Amaranthaceae	Herb	None		Silky Burweed (e)
Litogyne gariepina (DC.) Anderb.	Asteraceae	Perennial herb	Unpleasant smell, traditional uses	Least Concern	Dwarf Sage (e), Blougifbossie (a)
Melhania rehmannii Szyszyl.	Malvaceae	Dwarf shrub	None	Least Concern	John Deer Bossies (a)
Melinis nerviglumis (Franch.) Zizka	Poaceae	Grass	Increaser I grass species		Bristle-leaved red top (e)
Melinis repens	Poaceae	Grass	Poor grazing potential, Increaser IIC		Natal Red Top (e), Natal-rooipluim (a)
Panicum maximum Jacq.	Poaceae	Grass	None		Buffalo Grass (e), Gewone Buffelsgras (a)
Pergularia daemia	Apocynaceae	Climber	Medicinal uses		Bobbejaankambro (a), Kgaba
***Philenoptera violacea* (Klotzsch) Schrire**	**Fabaceae**	**Tree**	**Medicinal uses. Host plant for *Charaxes bohemanii* and *Coeliades forestan***	**Least Concern (IUCN), Protected tree (National Forest Act, 1998)**	**Apple leaf (e), Appelblaar (a)**
Phragmites mauritianus	Poaceae	Hydrophilic	None	Least Concern	Lowveld Reed (e), Laveldfluitjiesriet (a)
Pogonarthria squarrosa (Roem. & Schult.) Pilg.	Poaceae	Grass	Unpalatable, indicator of poor habitat conditions		Herringbone Grass (e), Sekelgras (a)
Rhigozum brevispinosum Kuntze	Bignoniaceae	Shrub	None	Least Concern	Short-thorn pomegranate (e), Kortdoringgranaat (a)
Rhynchosia totta	Fabaceae	Herb	Edible parts		Yellow Carpet Bean (e)
Schizachyrium sanguineum (Retz.) Alston	Poaceae	Grass	Palatable grass, thatching, Increaser I		Red Atumn Grass (e), Rooiherfsgras (a)
Schmidtia pappophoroides Steud.	Poaceae	Grass	Palatable grazing grass, Increaser	Least Concern	Sand Quick (e), Sandkweek (a)
***Sclerocarya birrea* (A.Rich.) Hochst. ssp. *caffra* (Sond.) Kokwaro**	**Anacardiaceae**	**Tree**	**Edible parts, traditional uses**	**Least Concern (IUCN), Protected Tree (National Forest Act, 1998)**	**Marula (e), Maroela (a)**
Selaginella dregei (C.Presl) Hieron.	Selaginaceae	Fern	Medicinal uses		Resurrection Plant (e)
Senegalia (Acacia) caffra (Thunb.) P.J.H.Hurter & Mabb.	Fabaceae	Tree	Dyes & tans	Least Concern	Common hook-thorn (e), Gewone haakdoring (a)
Senegalia (Acacia) erubescens (Welw. ex Oliv.) Kyal. & Boatwr.	Fabaceae	Small tree	None, irritant. Often regarded as an encroacher species	Least Concern	Blue Thorn (e), Blouhaak (a), Moloto (tw)
Senegalia (Acacia) mellifera (Vahl) Seigler & Ebinger subsp. *detinens* (Burch.) Kyal. & Boatwr.	Fabaceae	Small tree	Declared indicator of encroachment, medicinal uses, poison source		Black Thorn (e), Swarthaak (a)
Senegalia (Acacia) nigrescens (Oliv.) P.J.H.Hurter	Fabaceae	Tree	Tannin rich bark, important browse for game, Host plant for larvae of *Charaxes phaeus*. Often regarded as an encroacher species	Least Concern	Knob thorn (e), Knoppiesdoring (a), Mokala (tw)
Sesbania bispinosa	Fabaceae	Shrub	Exotic species, often in moist areas, marshes. Originally from India, China, Iran. Edible parts	Currently unlisted	Prickly Sesban
Setaria verticillata (L.) P.Beauv.	Poaceae	Grass	Edible parts, palatable grazing	Least Concern	Bur Britle Grass (e), Klitsgras (a)

Species Name	Family	Growth Form	Common Name	Status/ Uses	Conservation / Invasive Status
Solanum lichtensteinii Willd.	Solanaceae	Dwarf shrub	None		Large Yellow Bitter Apple (e), Groot Geel Gifappel (a)
Solanum panduriforme E.Mey.	Solanaceae	Herb	Traditional medicinal uses, poisonous	Common weed	Poison Apple (e), Gifappel (a)
Sterculia rogersii N.E.Br.	Sterculiaceae	Tree	Traditional uses, edible seeds	Least Concern	Star-chestnut (e), Sterkastaiing (a), Mukakate (v)
Stipagrostis uniplumis	Poaceae	Grass	Edible parts, thatching, weaving		Silky Bushman Grass (e)
Tephrosia species	Fabaceae	Herb	None		--
Terminalia prunioides M.A.Lawson	Combretaceae	Small tree	Traditional uses	Least Concern	Purple-pod Cluster-leaf (e), Sterkbas (a), Nshashantsawu (ts)
Themeda triandra Forssk.	Poaceae	Grass	Palatable grazing, Decreaser		Red grass (e), Rooigras (a)
Tribulus terrestris L.	Zygophyllaceae	Prostrate herb	Medicinal uses		Common Dubbeltjie (e), Gewone Dubbeltjie (a)
Tricholaena monachne (Trin.) Stapf & C.E.Hubb.	Poaceae	Grass	Moderate grazing potential, Increaser IIC		Blue-seed grass (e), Blousaadgras
Urochloa mosambicensis (Hack.) Dandy	Poaceae	Grass	Edible parts, palatable grazing grass		Bushveld signal grass (e), Bosveldbeesgras (a)
Vachellia (Acacia) grandicornuta (Gerstner) Seigler & Ebinger	Fabaceae	Small tree	Regarded as an encroacher species	Least Concern	Horned thorn (e), Horingdoring (a), Masaoka (tw)
Vachellia (Acacia) tortilis (Forssk.) Gallaso & Banfi subsp. *heteracantha* (Burch.) Kyal. & Boatwr.	Fabaceae	Tree	Medicinal uses (bark). Often regarded as an encroacher species		Curly-pod Acacia (e), Haak-en-steek (a), Isishoba (z)
Vachellia (Acacia) xanthophloea (Benth.) P.J.H.Hurter	Fabaceae	Tree	Ornamental	Least Concern	Fever tree (e), Koorsboom (a)
Waltheria indica L.	Sterculiaceae	Herb	None		Meidebossie (a)
Ximenia caffra Sond. var. *caffra*	Olacaceae	Small tree	Edible parts	Least Concern	Large Sourplum (e), Grootsuurpruim (a)
Ziziphus mucronata Willd. subsp. *mucronata*	Rhamnaceae	Small tree	Edible parts, traditional medicinal uses, traditional uses		Buffalo-thorn (e), Blinkblaar-wag-'n-bietjie (a)

39 APPENDIX 2: IMAGE COLLAGE OF SELECTED PLANT SPECIES RECORDED FROM THE STUDY AREA AND IMMEDIATE SURROUNDS

Adenia multiflorum (Impala lily, not within sites)

*Abutilon fruticosum (*Shrubby Abutilon)

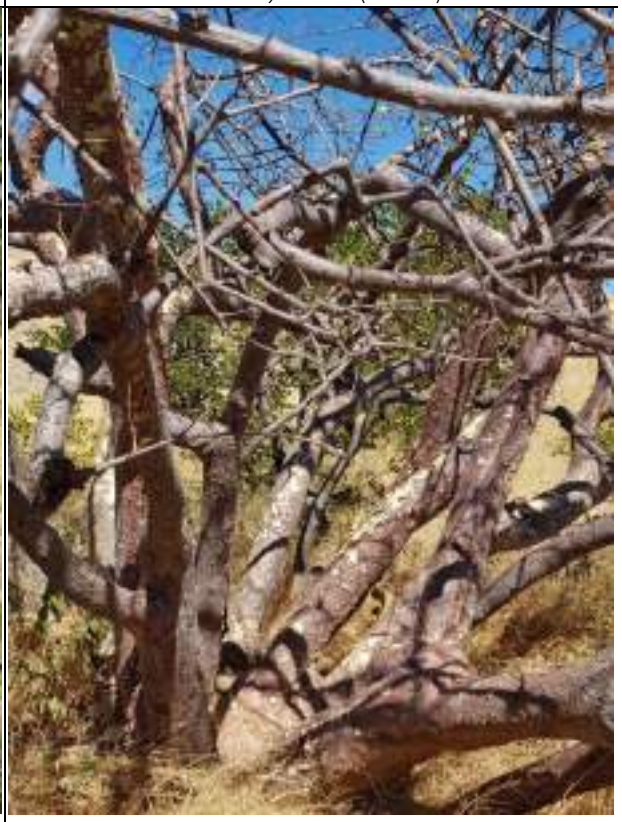
Sterculia rogersii (Star-chestnut)

Adansonia digitata (Baobab)

Boscia albitrunca (Shepard's Tree)

Boscia foetida (Bushveld Shepherd Tree)

		
Aptosimum lineare	*Blepharis diversispina* (Eyelash Flower)	*Dichrostachys cinerea* (Sickle Bush)
		
Calotropis procera (Giant Milkweed)	*Commiphora glandulosa* (Tall common corkwood)	*Datura inoxia* (Downy thorn apple)

		
Terminalia prunelloides (Purple-pod Cluster-leaf)	*Ximenia caffra* (Large Sourplum)	*Sclerocarya birrea* (Marula)
		
Combretum imberbe (Leadwood)	*Holubia saccata* (Sac Flower)	*Sterculia* (Star-chestnut)

Melhania rehmannii (John Deer Bossie)

Philenoptera violacea (Violet Tree)

Solanum lichtensteinii (Large Yellow Bitter Apple)

Dicoma tomentosa (Hairy Dicoma)

Waltheria indica (Meidebossie)

Pergularia daemia (Bobbejaankambro)

40 APPENDIX 3: LIST OF PROTECTED TREE SPECIES UNDER THE NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998)

Binomial name	*Common Name (English)*	*National Tree Number*
Adansonia digitata	**Baobab**	**467**
Afzelia quanzensis	Pod mahogany	207
Balanites maughamii subsp. *maughamii*	Torchwood	251
Barringtonia racemosa	Powder-puff tree	524
Boscia albitrunca	**Shepherd's tree**	**122**
Brachystegia spiciformis	Msasa	198.1
Breonadia salicina	Matumi	684
Bruguiera gymnorrhiza	Black mangrove	527
Cassipourea swaziensis	Swazi onionwood	531.1
Catha edulis	Bushman's tea	404
Ceriops tagal	Indian mangrove	525
Cleistanthus schlechteri var. *schlechteri*	False tamboti	320
Colubrina nicholsonii	Pondo weeping thorn	453.8
Combretum imberbe	**Leadwood**	**539**
Curtisia dentata	Assegai	570
Elaeodendron transvaalensis	Bushveld saffron	416
Erythrophysa transvaalensis	Bushveld red balloon	436.2
Euclea pseudebenus	Ebony guarri	598
Ficus trichopoda	Swamp fig	54
Leucadendron argenteum	Silver tree	77
Lumnitzera racemosa var. *racemosa*	Tonga mangrove	552
Lydenburgia abotti	Pondo bushman'sTea	407
Lydenburgia cassinoides	Sekhukhunibushman's tea	406
Mimusops caffra	Coastal red milkwood	583
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo wattle	191
Ocotea bullata	Stinkwood	118
Ozoroa namaquensis	Gariep resin tree	373.2
Philenoptera violacea	**Apple-leaf**	**238**
Pittosporum viridiflorum	Cheesewood	139
Podocarpus elongates	Breede River yellowwood	15
Podocarpus falcatus	Outeniqua yellowwood	16
Podocarpus henkelii	Henkel's yellowwood	17
Podocarpus latifolius	Real yellowwood	18
Protea comptonii	Saddleback sugarbush	88
Protea curvata	Serpentine sugarbush	88.1
Prunus africana	Red stinkwood	147
Pterocarpus angolensis	Wild teak	236
Rhizophora mucronata	Red mangrove	526
Sclerocarya birrea subsp. ***caffra***	**Marula**	**360**
Securidaca longepedunculata	Violet tree	303
Sideroxylon inerme subsp. *inerme*	White milkwood	579
Tephrosia pondoensis	Pondo poison pea	226.1
Vachellia (Acacia) erioloba	Camel thorn	168
Vachellia (Acacia) haematoxylon	Grey camel thorn	169
Warburgia salutaris	Pepper-bark tree	488
Widdringtonia cedarbergensis	Clanwilliam cedar	19
Widdringtonia schwarzii	Willowmore cedar	21

*Species indicated in **bold** were recorded from the development footprints during the site inspection period*

41 APPENDIX 4: LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (ACT NO 7 OF 2003) CONSERVATION SCHEDULES FOR PLANT SPECIES

*Species indicated in **bold** were recorded from the development footprint during the site inspection period, or are regarded highly likely to persist on the site (apart from opportunistic or migratory purposes).*

Schedule 2	
Prohibited Aquatic Growth	
Common Name	*Scientific Name*
Azolla	*Azolla* spp
Kariba Weed	*Salvinia molesta*
Parrot's Feather	*Myriophyllum aquaticum*
Pond Weed	*Egeria densa*
Water Hyacinth	*Eichhornia crassipes*
Water Lettuce	*Pistia stratiotes*
Schedule 11	
Specially Protected Plants	
Common Name	*Scientific Name*
All cultivated seedlings of indigenous cycads	*Encephalartos* spp
Schedule 12 Trees and Shrubs	
Common Name	*Scientific Name*
The following *Adenia* species	*Adenia fruticosa simpliciflora*
Baobab	*Adansonia digitata*
Beech	*Faurea macnaughtonii*
Bitter False Thorn	*Albizia amara sericocephala*
The following *Boscia* species	*Boscia angustifolia* var. *corymbosa*
	Boscia foetida minima
Borassus Palm	*Borassus aethiopicum*
Brackenridgea	*Brackenridgea zanguebarica*
Capper Bush	*Capparis sepiaria* var. *subglabra*
The following Combretum species:	*Combretum collinum taborense*
	Combretum padoides
	Combretum petrophilum
	Combretum vendae
Forest Bastard Currant	*Allophylus ainifolius*
The following *Elephantorrhiza* species:	*Elephantorrhiza praetermissa*
The following *Grewia* species:	*Grewia rogersii*
The following *Hibiscus* species	*Hibiscus articulates*
	Hibiscus barnardii
	Hibiscus sabiensis
Large Cape Myrtle	*Myrsine pillansii*
Largeleaved Dragon Tree	*Dracaena hookerana*
Large-leaved Saucerberry	*Cordia africana*
The following *Maytenus* species:	*Maytenus oxycarpa*
	Maytenus pubescens
The following *Ochna* species	*Ochna glauca*
Pepperbark Tree	*Warburgia salutaris*
Pincushion	*Leucospermum saxosum*
The following *Rhus* species	*Rhus batophylla*
Sand ironplum	*Drypetes mossambicensis*
Salati Palm	*Borassus aethiopicum*
Stinkwood, Black	*Ocotea bullata*
Stinkwood, Transvaal	*Ocotea kenyensis*
Tamboti	*Spirostachys africana*
The following *Tarenna* species	*Tarenna zygoon*
Transvaal Red Balloon	*Erythrophysa transvaalensis*
Venda Beadstring	*Alchornea laxiflora*
Wild Banana	*Ensete ventricosum*
Wild Teak	*Pterocarpus angolensis*
Yellowwood, Outeniqua	*Podocarpus latifolius*

Yellowwood, Real	*Podocarpus falcatus*
Succulents	
All species of Aloes indigenous to the Province, **excluding** the following species:	
Common Name	***Scientific Name***
Aculeata	*Aloe aculeata*
Aloe, Catstail	*A. castanea*
Aloe, Krans	*A. arborescens*
Aloe, Mountain	*A. marlothii*
Ammophilla	*A. ammophilla*
Davyana	*A. davyana*
Fosteri	*A. fosteri*
Globuligemma	*A. globuligemma*
Grandidentata	*A. grandidentata*
Greatheadii	*A. greatheadii*
Lutescens	*A lutescens*
Mutans	*A. mutans*
Parvibracteata	*A. parvibracteata*
Transvaalensis	*A. transvaalensis*
Wickensii	*A. wickensii*
All species of *Brachystelma*	*Brachystelma* spp
All species of *Ceropegia*	*Ceropegia* spp
All species of *Duvalia*	*Duvalia* spp
The following *Euphorbia* species:	*Euphorbia barnardii*,
	E. divicola,
	E. grandialata,
	E. groenewaldii,
	E. louwii,
	E. restricta,
	E. rowlandii,
	E. tortirama
	E. waterbergensis
Ghaap	*Hoodia lugardii*
All species of Ghaap	*Tavaresia* spp
All species of *Huernia*	*Huernia* spp
All species of *Huerniopsis*	*Huerniopsis* spp
The following Impala Lilies	*Adenium multiflorum*
	A. olefolium
Kudu Lily	*Pachypodium saundersii*
All species of *Orbeanthus*	*Orbeanthus* spp
All species of *Orbeas*	*Orbea* spp
All species of *Orbeopsis*	*Orbeopsis* spp
All species of *Pachycymbiums*	*Pachycymbium* spp
All species of *Riocreuxias*	*Riocreuxia* spp
All species of *Stapeliads*	*Stapelia* spp
Stone Plant	*Lithops* leslieii
Other Plants	
Common Name	***Scientific Name***
The following *Agapanthus* species	*Agapanthus coddii, A. dyeri*
The following *Anacampseros* species	*Anacampseros bemenkampii* (now *A. rhodesica*)
All species of *Anomatheca*	*Anomatheca* spp
The following *Anthericum* species	*Anthericum cyperaceum*
The following Arum Lilies:	*Zantedeschia jucunda, Z.pentlandii, Z. rehmannii*
The following *Babiana* Species	*Babiana hypogea* var. *longituba*
Batesiana Gasteria	*Gasteria batesiana*
Blue Squill	*Scilla natalensis (Merwillea plumbea)*
Clivia	*Clivia caulescens*
The following *Cyathula* species	*Cyathula natalensis*
The following *Eragrostis* species	*Eragrostis arenicola*
The following *Eriosema* species	*Eriosema transvaalense*
The following *Eulophia* species	*Eulophia coddii*

	E. leachii
The following *Felicia* species	*Felicia fruticosa brevipendunculata*
The following *Festuca* species	*Festuca dracomontana*
All species of Fire Lily	*Cyrtanthus* spp
The following *Freylinia* species	*Freylinia tropica*
The following *Gladiolus* species	*Gladiolus macneilii*
The following *Habernaria* species	*Habernaria kraenzliniana*
The following *Heinsia* species	*Heinsia crinita*
The following *Hermstaedtia* species	*Hermstaedtia capitata*
The following *Hippocratea* species	*Hippocratea parvifolia*
The following *Hymenodictyon* species	*Hymenodictyon parvifolium parvifolium*
The following *Hyptis* species	*Hyptis spicigera*
The following *Inula* species	*Inula paniculata*
The following *Jasminum* species	*Jasminum abyssinbicum*
The following *Kalanchoe* species	*Kalanchoe crundallii*
	K. rogersii
The following *Kniphofia* species	*Kniphofia coralligemma*
	K. crassifolia
	K. rigidifolia
The following *Kotschya* species	*Kotschya thymodora*
The following *Melinus* species	*Melinus tenuissima*
The following *Mondia* species	*Mondia whitei*
The following *Monsonia* species	*Monsonia lanuginosa*
The following *Neobulosia* species	*Neobulosia tysonii*
The following *Nervillia* species	*Nervillia umbroza*
The following *Nymphaea* species	*Nymphaea lotus*
The following *Oberonia* species	*Oberonia distichia*
The following *Oreosyce* species	*Oreosyce africana*
Paint Brush	*Haemanthus montanus*
The following *Peristrophe* species	*Peristrophe cliffordii*
	P. gililandorum
	P. transvaalensis
The following *Phyllanthus* species	*Phyllanthus pinnatus*
The following *Pilea* species	*Pilea rivularis*
The following *Plinthus* species	*Plinthus rehmannii*
The following *Polycarpea* species	*Polycarpia eriantha* var. *effusa*
The following *Polystachya* species	*Polystachia albescens imbricata*
The following *Portulaca* species	*Portulaca foliosa*
	P. trianthemoides
The following *Rhyncosia* species	*Rhyncosia vendae*
Royal Paint Brush (Blood lily)	*Scadoxis puniceus*
The following *Sartidia* species	*Sartidia jucunda*
The following *Schizagyrium* species	*Schizagyrium brevifolium*
All species of South African Orchid	Family *Orchidaceae*
The following *Stadmania* species	*Stadmania oppositifolia*
The following *Streptocarpus* species	*Streptocarpus decipiens*
The following *Strophanthus* species	*Strophanthus luteolus*
The following *Sutera* species	*Sutera maerantha*
The following *Thorncroftia* species	*Thorncroftia media*
All species of Tree Ferns *Cyathea* species	*Cyathea* spp
All species of Tree Moss	*Porothamnium, Pilotrichella* and *Papillaria* spp
The following *Trilepisium* species	*Trilepisium madagascariensis*
The following *Tristachya* species	*Tristachya trifaria*
The following *Turbina* species	*Turbina shirensis*
The following *Watsonia* species	*Watsonia densiflora*
	W. transvaalensis
	W. wilmsii
Wild Ginger	*Burmannia madagascariensis*
Wild Ginger	*Siphonochilus aethiopicus*
The following *Xylopia* species	*Xylopia parviflora*

42 APPENDIX 5: LEGISLATIVE BACKGROUND

This report has been prepared in terms of the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 385 Section 33 – Specialist reports and reports on specialised processes under the Act. Relevant clauses of the above regulation include:

Regulation 33.(1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialised process.

Regulation 33.(2): A specialist report or a report on a specialised process prepared in terms of these Regulations must contain:

(a) Details of:
  (i) The person who prepared the report, and
  (ii) The expertise of that person to carry out the specialist study or specialised process;
(b) A declaration that the person is independent in a form as may be specified by the competent authority;
(c) An indication of the scope of, and the purpose for which, the report was prepared;
(d) A description of the methodology adopted in preparing the report of carrying out the specialised process;
(e) A description of any assumptions made and any uncertainties or gaps in knowledge;
(f) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
(g) Recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
(h) A summary and copies of any comments that were received during any consultation process;
(i) Any other information requested by the competent authority.

Compliance with provincial, national, and international legislative aspects is strongly advised during the planning, assessment, authorisation, and execution of this particular project. Legislative aspects of which cognisance were taken during the compilation of this report are summarised in, but not necessarily limited to the following:

Legislation	Relevance
Biodiversity Act (No. 10 of 2004)	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act 1998; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith.
Conservation of Agricultural Resources Act 43 of 1983	The conservation of soil, water resources and vegetation are promoted. Management plans to eradicate weeds and invader plants must be established to benefit the integrity of indigenous life.
Constitution of the Republic of South Africa (Act 108 of 1996)	The Bill of Rights, in the Constitution of South Africa (No. 108 of 1996), states that everyone has a right to a non-threatening environment and requires that reasonable measures are applied to protect the environment. This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development. These principles are embraced in NEMA and given further expression.
Convention on Biological Diversity, 1995	International legally binding treaty with three main goals; conserve biological diversity (or biodiversity); ensure sustainable use of its components and the fair and equitable sharing of benefits arising from genetic resources.
Environmental Conservation Act (No. 73 of 1989)	To provide for the effective protection and controlled utilization of the environment and for matters incidental thereto.
National Environmental Management Act (No. 107 of 1998)	Requires adherence to the principles of Integrated Environmental Management (IEA) to ensure sustainable development, which, in turn, aims to ensure that environmental consequences of development proposals be understood and adequately considered during all stages of the project cycle and that negative aspects be resolved or mitigated, and positive aspects enhanced.
National Environmental Management Act (No 10 of 2004)	Restriction of activities involving alien species, restricted activities involving certain alien species totally prohibited and duty care relating to listed invasive species.
Protected Areas Act (No. 57 of 2003)	To provide for 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 all national, provincial, and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; and for matters in connection therewith.
National Forest Act of	Provides for the protection of certain tree species, groups of trees, woodland or forests as declared by

Legislation	Relevance
1998	the minister and prohibits the destruction of indigenous trees in any natural forest without a licence
Limpopo Environmental Management Act (Act No.7 of 2003)	To consolidate and amend the environmental management legislation of or assigned to the Province, and to provide for matters incidental thereto.

43 APPENDIX 6: IMPACT ASSESSMENT METHOD

Methodology used in determining and ranking potential environmental impacts and risks

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk. Impact assessments should be conducted based on a methodology that includes the following:

⇒ Clear processes for impact identification, predication and evaluation;
⇒ Specification of the impact identification techniques;
⇒ Criteria to evaluate the significance of impacts;
⇒ Design of mitigation measures to lessen impacts;
⇒ Definition of the different types of impacts (indirect, direct or cumulative); and
⇒ Specification of uncertainties.

After all impacts have been identified, the nature and scale of each impact can be predicted. The impact prediction will consider physical, biological, socio-economic and cultural information and will then estimate the likely parameters and characteristics of the impacts. The impact prediction will aim to provide a basis where the significance of each impact can be determined, and appropriate mitigation measures can be developed.

The risk assessment methodology is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor). Figure 67 represents the above principle (as contained in the DWA's Best Practice Guideline: G4 – Impact Prediction).

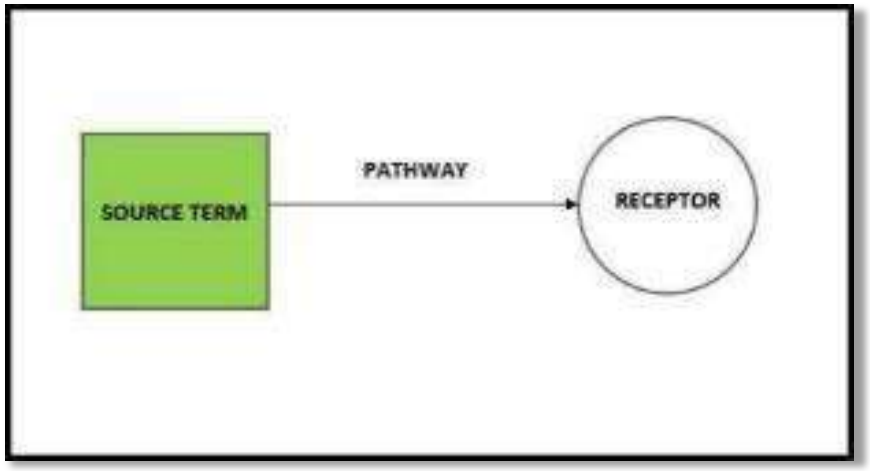


Figure 67: Impact prediction model

Tables 32 and 33 below indicate the methodology to be used in order to assess the Probability and Magnitude of the impact, respectively, and Table 40 provides the Risk Matrix that will be used to plot the Probability against the Magnitude in order to determine the Severity of the impact.

Table 32: Determination of Probability of Impact

Score	*Frequency of aspect / unwanted event*	*Availability of pathway from the source to the receptor*	*Availability of receptor*
1	Never known to have happened, but may happen	A pathway to allow for the impact to occur is never available	The receptor is never available
2	Known to happen in industry	A pathway to allow for the impact to occur is almost never available	The receptor is almost never available
3	< once a year	A pathway to allow for the impact to occur is sometimes available	The receptor is sometimes available
4	Once per year to up to once per month	A pathway to allow for the impact to occur is almost always available	The receptor is almost always available
5	Once a month - Continuous	A pathway to allow for the impact to occur is always available	The receptor is always available

Step 1: Determine the PROBABILITY of the impact by calculating the average between the Frequency of the Aspect, the Availability of a pathway to the receptor and the availability of the receptor.

Table 33: Determination of Magnitude of Impact

Source			Receptor			
Score	Duration of impact	Extent	Volume / Quantity / Intensity	Toxicity / Destruction Effect	Reversibility	Sensitivity of environmental component
1	Lasting days to a month	Effect limited to the site. (meters);	Very small quantities / volumes / intensity (e.g. < 50L or < 1 ha)	Non-toxic (e.g. water) / Very low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes will remain unaltered.	Current environmental component(s) are largely disturbed from the natural state. Receptor of low significance / sensitivity
2	Lasting 1 month to 1 year	Effect limited to the activity and its immediate surroundings (tens of meters)	Small quantities / volumes / intensity (e.g. 50 L to 210 L or 1 ha to 5 ha)	Slightly toxic / Harmful (e.g. diluted brine) / Low potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be negligibly altered or enhanced / Still reversible.	Current environmental component(s) are moderately disturbed from the natural state. No environmentally sensitive components.
3	Lasting 1 – 5 years	Impacts on extended area beyond site boundary (hundreds of meters)	Moderate quantities / volumes / intensity (e.g. > 210 L < 5 000 L or 5 – 8 ha)	Moderately toxic (e.g. slimes) Potential to create damage or destruction to the environment	Bio-physical and/or social functions and/or processes might be notably altered or enhanced / Partially reversible	Current environmental component(s) are a mix of disturbed and undisturbed areas. Area with some environmental sensitivity (scarce / valuable environment etc.).
4	Lasting 5 years to Life of Organization	Impact on local scale / adjacent sites (km's)	Very large quantities / volumes / intensity (e.g. 5 000 L – 10 000 L or 8 ha– 12 ha)	Toxic (e.g. diesel & Sodium Hydroxide)	Bio-physical and/or social functions and/or processes might be considerably altered or enhanced / potentially irreversible	Current environmental component(s) are in a natural state. Environmentally sensitive environment / receptor (endangered species / habitats etc.).
5	Beyond life of Organization / Permanent impacts	Extends widely (nationally or globally)	Very large quantities / volumes / intensity (e.g. > 10 000 L or > 12 ha)	Highly toxic (e.g. arsenic or TCE)	Bio-physical and/or social functions and/or processes might be severely/substantially altered or enhanced / Irreversible	Current environmental component(s) are in a pristine natural state. Highly Sensitive area (endangered species, protected habitats etc.)

*Step 2: Determine the **MAGNITUDE** of the impact by calculating the average of the factors above*

Table 34: Determine Environmental Impact Severity Rating / Priority					
Probability	Magnitude				
	1 (Minor)	2 (Low)	3 (Medium)	4 (High)	5 (Major)
5 Almost Certain	Low	Medium	High	High	High
4 Likely	Low	Medium	High	High	High
3 Possible	Low	Medium	Medium	High	High
2 Unlikely	Low	Low	Medium	Medium	High
1 Rare	Low	Low	Low	Medium	Medium

*Step 3: Determine the **SEVERITY** of the impact by plotting the averages that were obtained above for Probability and Magnitude*

For example:

Table 35: Environmental Severity of the Impact														
No	Aspect Affected	Activity	Potential Impact	Reversibility	Irreplaceable loss	Phase	Size and scale of disturbance	Significance pre-mitigation			Mitigation Type	Significance post-mitigation		
								Probability	Magnitude	Significance		Probability	Magnitude	Significance
1	Biodiversity	Residential development (high density)	Clearing of secondary grassland and *Vachellia* bushveld	Low reversibility	Moderate	Construction and operational	Within 22.05 ha (excluding the buffer area)	5	3	High	Avoid (buffer area) & Control	5	2	Medium

44 APPENDIX 7: SHORTLIST OF ANTICIPATED AND RECORDED BIRD DIVERSITY

A shortlist of bird species **expected** and **observed** on the study area.
Scientific names and colloquial names were used according to Gill et al. (2021).
Also provided is the global and regional conservation status of each species (IUCN, 2021; Taylor et al., 2015). (CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near threatened). N = number of submitted cards to SABAP2.

Common Name	*Scientific Name*	*Global Conservation Status*	*Regional Conservation Status*	*Observed (April 2021)*	*SABAP2 Reporting Rates*			
					Full Protocol		*Ad hoc*	
					%	*N*	*%*	*N*
Shikra	*Accipiter badius*			X	11.11	2	3.28	2
Common Myna	*Acridotheres tristis*			X	11.11	2	4.92	3
African Jacana	*Actophilornis africanus*				5.56	1	0.00	0
Egyptian Goose	*Alopochen aegyptiaca*			X	5.56	1	1.64	1
Red-headed Finch	*Amadina erythrocephala*				11.11	2	0.00	0
Cut-throat Finch	*Amadina fasciata*				22.22	4	0.00	0
Red-headed Weaver	*Anaplectes rubriceps*				44.44	8	1.64	1
Red-billed Teal	*Anas erythrorhyncha*				5.56	1	1.64	1
African Darter	*Anhinga rufa*				5.56	1	0.00	0
African Pipit	*Anthus cinnamomeus*			X				
Little Swift	*Apus affinis*			X	27.78	5	3.28	2
White-rumped Swift	*Apus caffer*			X	16.67	3	0.00	0
Tawny Eagle	*Aquila rapax*	VU	EN		22.22	4	11.48	7
African Hawk-eagle	*Aquila spilogaster*				16.67	3	8.20	5
Great Egret	*Ardea alba*				5.56	1	0.00	0
Grey Heron	*Ardea cinerea*			X	11.11	2	1.64	1
Goliath Heron	*Ardea goliath*				5.56	1	0.00	0
Intermediate Egret	*Ardea intermedia*				5.56	1	0.00	0
Black-headed Heron	*Ardea melanocephala*			X	5.56	1	0.00	0
Purple Heron	*Ardea purpurea*				5.56	1	0.00	0
Squacco Heron	*Ardeola ralloides*				11.11	2	0.00	0
Kori Bustard	*Ardeotis kori*	NT	NT		11.11	2	0.00	0
Chinspot Batis	*Batis molitor*			X	100.00	18	4.92	3
Hadada Ibis	*Bostrychia hagedash*				16.67	3	3.28	2
Black-faced Waxbill	*Brunhilda erythronotos*			X	11.11	2	3.28	2
Red-billed Buffalo Weaver	*Bubalornis niger*			X	22.22	4	1.64	1
Verreaux's Eagle-Owl	*Bubo lacteus*				5.56	1	0.00	0
Western Cattle Egret	*Bubulcus ibis*			X	5.56	1	1.64	1
Red-billed Oxpecker	*Buphagus erythrorynchus*			X	33.33	6	1.64	1

Common Name	Scientific Name	Global Conservation Status	Regional Conservation Status	Observed (April 2021)	SABAP2 Reporting Rates			
					Full Protocol		Ad hoc	
					%	N	%	N
Water Thick-knee	*Burhinus vermiculatus*			X	5.56	1	0.00	0
Common (Steppe) Buzzard	*Buteo buteov ulpinus*				5.56	1	4.92	3
Striated Heron	*Butorides striata*			X	11.11	2	0.00	0
Barred Wren-Warbler	*Calamonastes fasciolatus*				16.67	3	1.64	1
Sabota Lark	*Calendulauda sabota*			X	66.67	12	3.28	2
Little Stint	*Calidris minuta*				5.56	1	0.00	0
Ruff	*Calidris pugnax*				5.56	1	0.00	0
Grey-backed Camaroptera	*Camaroptera brevicaudata*			X	38.89	7	1.64	1
Golden-tailed Woodpecker	*Campethera abingoni*			X	11.11	2	0.00	0
Square-tailed Nightjar	*Caprimulgus fossii*				5.56	1	0.00	0
Fiery-necked Nightjar	*Caprimulgus pectoralis*				11.11	2	1.64	1
Rufous-cheeked Nightjar	*Caprimulgus rufigena*				11.11	2	1.64	1
Lesser Striped Swallow	*Cecropis abyssinica*			X	33.33	6	1.64	1
Red-breasted Swallow	*Cecropis semirufa*				5.56	1	1.64	1
Burchell's Coucal	*Centropus burchellii*			X	11.11	2	0.00	0
Senegal Coucal	*Centropus senegalensis*				5.56	1	0.00	0
White-browed Scrub Robin	*Cercotrichas leucophrys*			X	77.78	14	3.28	2
Kalahari Scrub Robin	*Cercotrichas paena*				11.11	2	0.00	0
Three-banded Plover	*Charadrius tricollaris*			X	16.67	3	3.28	2
Orange-breasted Bushshrike	*Chlorophoneus sulfureopectus*				16.67	3	0.00	0
Bearded Woodpecker	*Chloropicus namaquus*			X				
Diederik Cuckoo	*Chrysococcyx caprius*				11.11	2	4.92	3
Klaas's Cuckoo	*Chrysococcyx klaas*				0.00	0	1.64	1
White Stork	*Ciconia ciconia*				5.56	1	0.00	0
Violet-backed Starling	*Cinnyricinclus leucogaster*				5.56	1	0.00	0
Marico Sunbird	*Cinnyris mariquensis*			X	61.11	11	0.00	0
White-bellied Sunbird	*Cinnyris talatala*			X	83.33	15	1.64	1
Brown Snake Eagle	*Circaetus cinereus*				16.67	3	6.56	4
Black-chested Snake Eagle	*Circaetus pectoralis*				5.56	1	3.28	2
Rattling Cisticola	*Cisticola chiniana*			X	50.00	9	1.64	1
Neddicky	*Cisticola fulvicapilla*				5.56	1	0.00	0
Zitting Cisticola	*Cisticola juncidis*				0.00	0	1.64	1
Jacobin Cuckoo	*Clamator jacobinus*			X	5.56	1	0.00	0
Levaillant's Cuckoo	*Clamator levaillantii*				5.56	1	0.00	0
Speckled Mousebird	*Colius striatus*				5.56	1	0.00	0
Speckled Pigeon	*Columba guinea*			X				

Common Name	Scientific Name	Global Conservation Status	Regional Conservation Status	Observed (April 2021)	SABAP2 Reporting Rates			
					Full Protocol		Ad hoc	
					%	N	%	N
Rock Dove	*Columba livia*				5.56	1	0.00	0
Lilac-breasted Roller	*Coracias caudatus*			X	44.44	8	22.95	14
European Roller	*Coracias garrulus*			X	5.56	1	22.95	14
Purple Roller	*Coracias naevius*				38.89	7	13.11	8
Pied Crow	*Corvus albus*			X	27.78	5	3.28	2
Grey Go-away-bird	*Corythaixoides concolor*			X				
Malachite Kingfisher	*Corythornis cristatus*			X				
White-throated Robin-Chat	*Cossypha humeralis*			X	11.11	2	0.00	0
Wattled Starling	*Creatophora cinerea*			X	16.67	3	3.28	2
Grey Go-away-bird	*Crinifer concolor*				72.22	13	16.39	10
Black-throated Canary	*Crithagra atrogularis*				5.56	1	0.00	0
Yellow-fronted Canary	*Crithagra mozambica*			X	61.11	11	4.92	3
Common Cuckoo	*Cuculus canorus*				5.56	1	0.00	0
Black Cuckoo	*Cuculus clamosus*			X	16.67	3	1.64	1
Red-chested Cuckoo	*Cuculus solitarius*			X	5.56	1	0.00	0
Chestnut-vented Warbler	*Curruca subcoerulea*				11.11	2	0.00	0
African Palm Swift	*Cypsiurus parvus*			X	22.22	4	3.28	2
Common House Martin	*Delichon urbicum*				0.00	0	3.28	2
White-faced Whistling Duck	*Dendrocygna viduata*			X				
Crested Francolin	*Dendroperdix sephaena*			X	50.00	9	1.64	1
Cardinal Woodpecker	*Dendropicos fuscescens*				22.22	4	1.64	1
Fork-tailed Drongo	*Dicrurus adsimilis*			X	88.89	16	19.67	12
Black-backed Puffback	*Dryoscopus cubla*			X	55.56	10	3.28	2
Black Heron	*Egretta ardesiaca*				5.56	1	0.00	0
Black-winged Kite	*Elanus caeruleus*				0.00	0	3.28	2
Golden-breasted Bunting	*Emberiza flaviventris*			X	72.22	13	6.56	4
Lark-like Bunting	*Emberiza impetuani*				27.78	5	3.28	2
Cinnamon-breasted Bunting	*Emberiza tahapisi*			X	38.89	7	4.92	3
Yellow-bellied Eremomela	*Eremomela icteropygialis*			X	22.22	4	0.00	0
Burnt-necked Eremomela	*Eremomela usticollis*				22.22	4	0.00	0
Chestnut-backed Sparrow-Lark	*Eremopterix leucotis*			X	5.56	1	0.00	0
Common Waxbill	*Estrilda astrild*			X				
Southern White-crowned Shrike	*Eurocephalus anguitimens*			X	55.56	10	18.03	11
Amur Falcon	*Falco amurensis*				5.56	1	1.64	1
Lesser Kestrel	*Falco naumanni*				0.00	0	1.64	1
Peregrine Falcon	*Falco peregrinus*			X				

Common Name	Scientific Name	Global Conservation Status	Regional Conservation Status	Observed (April 2021)	SABAP2 Reporting Rates			
					Full Protocol		Ad hoc	
					%	N	%	N
Greater Kestrel	*Falco rupicoloides*				5.56	1	0.00	0
Common Moorhen	*Gallinula chloropus*			X	5.56	1	0.00	0
Pearl-spotted Owlet	*Glaucidium perlatum*			X	16.67	3	0.00	0
Violet-eared Waxbill	*Granatina granatina*				16.67	3	1.64	1
Yellow-throated Bush Sparrow	*Gymnoris superciliaris*				5.56	1	3.28	2
White-backed Vulture	*Gyps africanus*	CR	CR		27.78	5	0.00	0
Brown-hooded Kingfisher	*Halcyon albiventris*			X	22.22	4	1.64	1
Striped Kingfisher	*Halcyon chelicuti*				16.67	3	3.28	2
Grey-headed Kingfisher	*Halcyon leucocephala*				5.56	1	0.00	0
Woodland Kingfisher	*Halcyon senegalensis*				5.56	1	0.00	0
African Fish Eagle	*Haliaeetus vocifer*				5.56	1	0.00	0
Wahlberg's Eagle	*Hieraaetus wahlbergi*			X	0.00	0	1.64	1
Black-winged Stilt	*Himantopus himantopus*			X	11.11	2	0.00	0
Icterine Warbler	*Hippolais icterina*				5.56	1	0.00	0
Pearl-breasted Swallow	*Hirundo dimidiata*			X				
Barn Swallow	*Hirundo rustica*				27.78	5	4.92	3
Wire-tailed Swallow	*Hirundo smithii*				0.00	0	1.64	1
Jameson's Firefinch	*Lagonosticta rhodopareia*				11.11	2	0.00	0
Red-billed Firefinch	*Lagonosticta senegala*				11.11	2	0.00	0
Greater Blue-eared Starling	*Lamprotornis chalybaeus*			X	5.56	1	0.00	0
Cape Starling	*Lamprotornis nitens*			X	50.00	9	24.59	15
Crimson-breasted Shrike	*Laniarius atrococcineus*			X	27.78	5	3.28	2
Red-backed Shrike	*Lanius collurio*				11.11	2	4.92	3
Lesser Grey Shrike	*Lanius minor*				0.00	0	3.28	2
African Grey Hornbill	*Lophoceros nasutus*			X	55.56	10	4.92	3
Red-crested Korhaan	*Lophotis ruficrista*			X	61.11	11	4.92	3
Grey-headed Bushshrike	*Malaconotus blanchoti*				33.33	6	0.00	0
Marico Flycatcher	*Melaenornis mariquensis*			X	50.00	9	0.00	0
Southern Black Tit	*Melaniparus niger*			X	55.56	10	3.28	2
Pale Chanting Goshawk	*Melierax canorus*			X	22.22	4	9.84	6
Dark Chanting Goshawk	*Melierax metabates*				16.67	3	14.75	9
European Bee-eater	*Merops apiaster*				27.78	5	3.28	2
Southern Carmine Bee-eater	*Merops nubicoides*				5.56	1	3.28	2
Little Bee-eater	*Merops pusillus*			X	11.11	2	1.64	1
Reed Cormorant	*Microcarbo africanus*			X	5.56	1	0.00	0
Gabar Goshawk	*Micronisus gabar*			X	16.67	3	0.00	0

Common Name	Scientific Name	Global Conservation Status	Regional Conservation Status	Observed (April 2021)	SABAP2 Reporting Rates			
					Full Protocol		Ad hoc	
					%	N	%	N
Yellow-billed Kite	*Milvus aegyptius*				0.00	0	3.28	2
Monotonous Lark	*Mirafra passerina*				5.56	1	0.00	0
Spotted Flycatcher	*Muscicapa striata*				5.56	1	0.00	0
Brubru	*Nilaus afer*			X	61.11	11	1.64	1
Helmeted Guineafowl	*Numida meleagris*			X	88.89	16	11.48	7
Black-crowned Night Heron	*Nycticorax nycticorax*			X	5.56	1	0.00	0
Namaqua Dove	*Oena capensis*			X	61.11	11	6.56	4
Familiar Chat	*Oenanthe familiaris*			X	16.67	3	3.28	2
Red-winged Starling	*Onychognathus morio*			X	0.00	0	1.64	1
Black-headed Oriole	*Oriolus larvatus*				72.22	13	4.92	3
Eurasian Golden Oriole	*Oriolus oriolus*				5.56	1	0.00	0
Southern Grey-headed Sparrow	*Passer diffusus*			X	88.89	16	4.92	3
Cape Sparrow	*Passer melanurus*			X	5.56	1	1.64	1
Great Sparrow	*Passer motitensis*				16.67	3	0.00	0
Green Wood Hoopoe	*Phoeniculus purpureus*				11.11	2	0.00	0
Willow Warbler	*Phylloscopus trochilus*			X	11.11	2	0.00	0
Dusky Lark	*Pinarocorys nigricans*				5.56	1	0.00	0
African Spoonbill	*Platalea alba*			X	5.56	1	0.00	0
White-browed Sparrow-Weaver	*Plocepasser mahali*			X	77.78	14	13.11	8
Lesser Masked-weaver	*Ploceus intermedius*			X	5.56	1	1.64	1
Southern Masked Weaver	*Ploceus velatus*			X	83.33	15	3.28	2
Meyer's Parrot	*Poicephalus meyeri*				5.56	1	0.00	0
Martial Eagle	*Polemaetus bellicosus*	EN	EN	X	0.00	0	1.64	1
African Harrier-hawk	*Polyboroides typus*			X				
Black-chested Prinia	*Prinia flavicans*				22.22	4	0.00	0
Tawny-flanked Prinia	*Prinia subflava*			X	38.89	7	1.64	1
White-crested Helmetshrike	*Prionops plumatus*			X	44.44	8	6.56	4
Natal Spurfowl	*Pternistis natalensis*				38.89	7	0.00	0
Swainson's Spurfowl	*Pternistis swainsonii*			X	11.11	2	0.00	0
Double-banded Sandgrouse	*Pterocles bicinctus*				16.67	3	1.64	1
Burchell's Sandgrouse	*Pterocles burchelli*			X	5.56	1	1.64	1
Southern White-faced Scops Owl	*Ptilopsis granti*				5.56	1	0.00	0
Dark-capped Bulbul	*Pycnonotus tricolor*			X	55.56	10	4.92	3
Green-winged Pytilia	*Pytilia melba*			X	61.11	11	1.64	1
Red-billed Quelea	*Quelea quelea*			X	55.56	10	11.48	7
Common Scimitarbill	*Rhinopomastus cyanomelas*			X	44.44	8	3.28	2

Common Name	Scientific Name	Global Conservation Status	Regional Conservation Status	Observed (April 2021)	SABAP2 Reporting Rates			
					Full Protocol		Ad hoc	
					%	N	%	N
Bronze-winged Courser	*Rhinoptilus chalcopterus*				5.56	1	0.00	0
Three-banded Courser	*Rhinoptilus cinctus*				5.56	1	0.00	0
Brown-throated Martin	*Riparia paludicola*			X	0.00	0	1.64	1
Greater Painted-snipe	*Rostratula benghalensis*		NT		5.56	1	0.00	0
Secretarybird	*Sagittarius serpentarius*	EN	VU		5.56	1	0.00	0
Hamerkop	*Scopus umbretta*			X	5.56	1	0.00	0
Laughing Dove	*Spilopelia senegalensis*			X	77.78	14	24.59	15
Scaly-feathered Weaver	*Sporopipes squamifrons*			X	27.78	5	0.00	0
Cape Turtle Dove	*Streptopelia capicola*			X	94.44	17	16.39	10
Red-eyed Dove	*Streptopelia semitorquata*				27.78	5	3.28	2
Chestnut-vented Warbler	*Sylvia subcoerulea*			X				
Long-billed Crombec	*Sylvietta rufescens*			X	77.78	14	4.92	3
Little Grebe	*Tachybaptus ruficollis*			X	5.56	1	1.64	1
Brown-crowned Tchagra	*Tchagra australis*			X	38.89	7	1.64	1
Black-crowned Tchagra	*Tchagra senegalus*				11.11	2	0.00	0
Bateleur	*Terathopius ecaudatus*	EN	EN		11.11	2	0.00	0
African Paradise Flycatcher	*Terpsiphone viridis*				5.56	1	0.00	0
African Sacred Ibis	*Threskiornis aethiopicus*				5.56	1	0.00	0
Southern Yellow-billed Hornbill	*Tockus leucomelas*			X	94.44	17	19.67	12
Southern Red-billed Hornbill	*Tockus rufirostris*				50.00	9	1.64	1
Crested Barbet	*Trachyphonus vaillantii*				50.00	9	1.64	1
Acacia Pied Barbet	*Tricholaema leucomelas*			X	61.11	11	4.92	3
Wood Sandpiper	*Tringa glareola*			X				
Common Greenshank	*Tringa nebularia*				11.11	2	1.64	1
Southern Pied Babbler	*Turdoides bicolor*			X	5.56	1	1.64	1
Arrow-marked Babbler	*Turdoides jardineii*			X	33.33	6	1.64	1
Kurrichane Thrush	*Turdus libonyana*				22.22	4	1.64	1
Groundscraper Thrush	*Turdus litsitsirupa*			X	11.11	2	4.92	3
Common Buttonquail	*Turnix sylvaticus*				5.56	1	0.00	0
Emerald-spotted Wood Dove	*Turtur chalcospilos*			X	50.00	9	6.56	4
Western Barn Owl	*Tyto alba*				5.56	1	0.00	0
African Hoopoe	*Upupa africana*			X	38.89	7	3.28	2
Blue Waxbill	*Uraeginthus angolensis*			X	83.33	15	9.84	6
Red-faced Mousebird	*Urocolius indicus*			X	50.00	9	4.92	3
Magpie Shrike	*Urolestes melanoleucus*				5.56	1	0.00	0
Blacksmith Lapwing	*Vanellus armatus*			X	11.11	2	4.92	3

Common Name	*Scientific Name*	*Global Conservation Status*	*Regional Conservation Status*	*Observed (April 2021)*	*SABAP2 Reporting Rates*			
					Full Protocol		*Ad hoc*	
					%	*N*	*%*	*N*
Crowned Lapwing	*Vanellus coronatus*				*33.33*	*6*	*1.64*	*1*
Village Indigobird	*Vidua chalybeata*			*X*				
Long-tailed Paradise Whydah	*Vidua paradisaea*			*X*	*11.11*	*2*	*8.20*	*5*
Black Crake	*Zapornia flavirostra*				*5.56*	*1*	*0.00*	*0*

45 CURRICULUM VITAE OF LUKAS J, NIEMAND (PR.SCI.NAT.)

Name:	LUKAS JURIE NIEMAND
Company:	Pachnoda Consulting cc (Director)
Date of Birth:	1974-03-12
Nationality:	South African
Languages:	English and Afrikaans

EDUCATIONAL QUALIFICATIONS

1992	Hoërskool Hartbeespoort, Hartbeespoort - Senior Certificate.
1996	University of Pretoria, Pretoria - B.Sc. (Zoology and Entomology).
1997	University of Pretoria, Pretoria - B.Sc. (Hons) (Entomology).
2001	University of Pretoria, Pretoria - M.Sc. (Restoration Ecology/Zoology).

MEMBERSHIP IN PROFESSIONAL SOCIETY

⇒ Professional Natural Scientist (Pr. Sci. Nat.) (Reg. no. 400095/06 - Ecology & Zoology)
⇒ BirdLife South Africa (1039913)
⇒ Hartbeespoort Natural Heritage Society

COMPANY EXPERIENCE

Pachnoda Consulting CC is a small enterprise based in Pretoria, South Africa providing specialised consulting services and products in the terrestrial ecological milieu for mining companies, environmental consultants, developers, and other industry related institutions throughout Africa and abroad.

Pachnoda Consulting envisions a holistic approach to ensure the sustainable development and preservation of natural resources based on accepted scientific methods. Since its establishment in 2007, it has produced several ecological assessments, including botanical and faunal surveys spanning all nine provinces in South Africa and a number of African countries. It provides a broad range of quality services that specialises in ornithology (avifauna), entomology (invertebrates) and general zoology. In addition, it values a long-standing relationship with various non-governmental and tertiary institutions notably the University of Pretoria, Endangered Wildlife Trust, the Agricultural Research Council and the South African Biodiversity Institute.

CORE SERVICES

⇒ Objective and quantified ecological assessments (a holistic eco-system approach based on approved scientific methods) in accordance with International Best Practice (e.g. International Finance Corporation's Performance Standards & Millennium Challenge Corporation's Guidelines)
⇒ Ecological due diligence and risk assessments;
⇒ Taxon-specific surveys in the botanical, mammalian, avifaunal and invertebrate fields;
⇒ Bird impact studies for power lines and renewable energy plants;
⇒ Biodiversity action plans; and
⇒ Mapping and modelling of species distributions and ecological sensitivities.

MEMBER

Lukas Niemand is director and founding member of Pachnoda Consulting. He has been involved in the discipline of consultant ecologist since 2000, and his core services include ecological studies with emphasis on ornithological (the study of birds), faunal and entomological (the study of invertebrates) assessments.

He has travelled extensively to many remote places as far afield as Marion Island, and has worked on numerous international projects pertaining to the African continent (South Africa, Lesotho, Mozambique, Burundi, Congo-Brazzaville, Liberia, Zambia, Tanzania, Guinea and Ethiopia). He worked on projects earmarked for the urban and mining sector and has been involved in linear projects, monitoring programmes, biodiversity action plans as well as specific investigations regarding species with rare/elusive life-history traits (e.g. threatened species).

He is also registered with the panel of the Birds and Renewable Energy division of BirdLife South Africa.

PROJECTS

A Work conducted in South Africa

1 General Ecological Assessments (Fauna, Flora and Red Data Scans, including both functional and compositional aspects) for urban, residential, recreational and light industrial developments:

⇒ Belvedere Trust, Proposed retirement village on Amorosa Agricultural Holdings, Roodepoort, Gauteng (2004);
⇒ City of Joburg Property Development Company, Proposed upgrade and development of the Orlando Dam Intersection, Soweto, Gauteng (2004);
⇒ PDNA, Proposed NASREC development, Johannesburg, Gauteng (2004);
⇒ 17 Shaft Conference and Education Centre, Proposed establishment of the Veteran's Heritage Education Centre, Crown Mines, Gauteng (2004);
⇒ GAUTRANS, Proposed re-alignment of Road D781 and construction of a road bridge over the Rietvleispruit, Kempton Park, Gauteng (2004);
⇒ Mr. N. Lang, Ecological Opinion on the proposed establishment of a township, Muldersdrift, Gauteng (2004);
⇒ AGES, Proposed Equestrian Centre, Leeufontein 299 IR, Gauteng (2004);
⇒ PDNA, Proposed new bridge and re-alignment of a portion of provincial road P101-2 (R51), Laversburg, Gauteng (2004);
⇒ Blenneerville Investment (Pty) Ltd, Proposed construction of a residential and commercial development on of Paradiso Estate, Tweefontein 372 JR, Gauteng (2004);
⇒ Les Roches (Pty) Ltd, Proposed zoning of holdings 1, 2 & 3 of Hyde Park Agricultural Holdings, Gauteng (2004);
⇒ Celebration North Riding (Pty) Ltd, Proposed mixed land-use development, North Riding, Gauteng (2005);
⇒ Wilderness Safaris, Proposed upgrade of the Manzengwenya Dive Camp, Greater St. Lucia Wetlands Park, KwaZulu-Natal (2005);
⇒ Wilderness Safaris, Proposed upgrade of the Rocktail Bay Camp, Greater St. Lucia Wetlands Park, KwaZulu-Natal (2005);
⇒ GAEA Projects, Corridor Assessment for the proposed Sibaya Precinct, KwaZulu-Natal (2005);
⇒ Computer Domain Holdings (Pty) Ltd, Red Data Floral Scan on portion 3 of the farm Elandshoek, portions 12 & 27 of the farm Groot Suikerboschkop, and portions 5 & 10 of the farm Palmietfontein, Dullstroom (2005);
⇒ Zong's Property Investments, Proposed establishment of a residential development on a portion of Pomona Estates Agricultural Holdings, Pomona, Gauteng (2005);
⇒ GJ van Zyl Trust, Proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2005);
⇒ Mr. Howard Walker, Proposed subdivision of the Farm Lunsklip 105 JT, and the Farm Morgenzon 122 JT, for the establishment of a private resort, Dullstroom, Mpumalanga (2005);
⇒ Lavender Manor cc, Proposed establishment of a retail, commercial and Lavender Manor Township on part of farm Rietfontein 189 IQ, Muldersdrift, Gauteng (2005);
⇒ Geo Pollution Technologies, Proposed establishment of a residential development: Noordwyk Ext 65 & 80 on Erand Agricultural Holdings, Midrand, Gauteng (2005);
⇒ Mr. A. Le Roux, Proposed Cradle View Country Estate, Muldersdrift, Gauteng (2006);
⇒ Viking Bay Development Company (Pty) Ltd, Proposed Viking Bay freshwater marina and hotel development, Vaal Dam, Gauteng (2006);
⇒ Land for Africa (Pty) Ltd, Ecological Opinion for the proposed establishment of a residential township on holding 122 Erand Agricultural Holding Extension 1, Halfway House, Midrand, Gauteng (2006);
⇒ Brickot Developments cc, Ecological opinion for the proposed Bethal Retirement Village on the remainder of portion 3 of the farm Mooifontein 108 IS, Bethal, Mpumalanga (2006);
⇒ Brawild (Pty) Ltd, Red Data Scan for the proposed Annlin Ex 117, Pretoria, Gauteng (2006);
⇒ Mbombela Local Municipality, Ecological Opinion for the proposed extension of the Lowveld Botanical Gardens, Nelspruit, Mpumalanga (2006);
⇒ Aurecon, Desktop biodiversity assessment and wetland scan: upgrade of the River View waste water treatment works, eMalahleni, Mpumalanga province. Report compiled in association with Imperata Consulting (2009);
⇒ Teurlings Environmental, Ecological evaluation for rectification as per Section 24G of NEMA on Portion 437 of the Farm Zwavelpoort 373 JR, Bronberg area, Gauteng (2017);
⇒ Kyllinga Consulting/ AdiEnvironmental - Ecological Assessment (with emphasis on terrestrial fauna) for the proposed Rockdale development, Middelburg, Mpumalanga (2017);
⇒ Envirolution Consulting, Ecological evaluation for the proposed V& S Asphalt Plant at Putfontein, Gauteng (2018);
⇒ Batho Earth - An ecological evaluation (fauna & flora) on Portion 24 of Erf 2440 in Newcastle, KwaZulu-Natal (2018);
⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Matopie Ecological Assessment as part of the Section 24G rectification process for unauthorised construction activities on Portion 27 of the Farm Kloppersbos 128 JR, Dinokeng, Gauteng Province (2018);
⇒ Knight Piésold/ Afri-Active Mechanical & Electrical - Ecological and Avifaunal assessment for the Lanark PV Solar Facility near Dendron (Mogwadi), Limpopo Province (2018);
⇒ Teurlings Environmental, Ecological Evaluation for Plot 82 on the Farm Klipkop (Del la Mas), Bronberg Area, Gauteng (2018);
⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Terrestrial Ecological Assessment for the expansion of the Hesters Rust Quarry near Welkom, Free State Province (2019);
⇒ Exigent Environmental - Ecological Evaluation (with emphasis on vegetation) on Portions 77, 169 and RE 76 of the Farm Zandfontein 317 JR, Andeon, Gauteng (2018);

- ⇒ SRK Consulting, Terrestrial ecological assessment for the proposed development of the Sandton field and Study Centre, Sandton, Gauteng (2018);
- ⇒ Teurlings Environmental, Ecological Management and Rehabilitation (including alien plant management plan) for rectification as per Section 24G of NEMA on Portion 437 of the Farm Zwavelpoort 373 JR, Bronberg area, Gauteng (2019);
- ⇒ Batho Earth, Ecological evaluation for the Mahlakwane Trick Stop at Steelpoort, Limpopo Province (2019);
- ⇒ EkoInfo/NGT Holdings, Vertebrate faunal assessment for the proposed Madimatle Cave recreation plan near Thabazimbi, Limpopo Province (2019);
- ⇒ De Castro & Brits Ecological Consultants/ Bucandi Environmental - Ecological Assessment for the Hubner Hog development on Portion 224 of the Farm Honingnestkrans 269 JR, Dinokeng, Gauteng Province (2019);
- ⇒ NuLeaf Planning & Environmental, Ecological evaluation for the Tuna park open space project, Nigel, Gauteng (2019);
- ⇒ Kyllinga Consulting, Fauna assessment for the proposed residential development on Portion 58 of the Farm Zwavelpoort 373 JR , Bronberg area, Gauteng (2019);
- ⇒ Envirolution Consulting, Ecological evaluation for a Tyre recycling plant on Portion 156 of Farm Zandspruit 191 IQ, Gauteng (2020);
- ⇒ Adienvironmental/Kyllinga consulting, Ecological assessment for the proposed light industrial development on Portion 58 of the Farm Vaalbank 289 JS, Middelburg, Mpumalanga (2020).

2 Mining and Industrial related projects (ecological assessments):

- ⇒ Lonmin Platinum (Western Platinum Limited), Ecological Assessment for the proposed MK3 Shaft Complex on the farm Wonderkop 400 JQ, Rustenburg, North West Province (2004);
- ⇒ Impala Platinum Limited, Ecological Assessment for prospecting SEMPs on the farms Buffelshoek 386 KT, Kalkfontein 367 KT, Spitskop 333 KT, Steelpoortpark 366 Kt and Tweefontein 360 KT and Hackney 116 KT (all Sekhukhuneland), Mpumalanga and Limpopo Province (2004);
- ⇒ Transnet Limited, Terrestrial Faunal Ecological Opinion: Phase 1B expansion of the Sishen-Saldanha Iron ore export corridor, Saldanha Bay, Western Cape (2005);
- ⇒ Trans-Caledon Tunnel Authority (TCTA), Ecological Assessment for borrow pit SEMPs on the TCTA pipeline, Vaal Marina to Secunda (2005);
- ⇒ Boynton Platinum (Pty) Ltd, Ecological Assessment for the proposed establishment of platinum mines on the farms Tuschenkomst 135 JP, Witkleifontein 136 JP and Ruighoek 169 JP, North West Province (2005);
- ⇒ Impala Platinum Holdings, Ecological Assessment for prospecting SEMPs on the Impala Platinum Bafokeng Mining Complex, North West Province (2005);
- ⇒ Ceramic Industries Limited, Ecological Assessment of the Rietspruit Clay Quarries, Vanderbijlpark, Gauteng (2005);
- ⇒ Ekurhuleni Metropolitan Municipality, Ecological Assessment Report for the proposed GLB Landfill Site on the farm Zesfontein 27 IR, Benoni, Gauteng (peer reviewed, 2006);
- ⇒ Ceramic Industries Limited, Ecological Assessment of the Leeukuil Clay Quarries, Vanderbijlpark, Gauteng (2006);
- ⇒ Council for Geoscience, Habitat sensitivity assessment scoping report for Bon Accord quarry on a portion of the farm de Onderstepoort 300-JR, Tshwane, Gauteng (2007);
- ⇒ Natural Scientific Services cc, Botanical survey for the SASOL Mafutha coal project near Lephalale, Limpopo Province, RSA (2008);
- ⇒ SRK Consulting, Ecological assessment on Vlakfontein area, NW of Ogies, Mpumalanga. Report compiled in association with EkoInfo (2009);
- ⇒ Fraser Alexander, Biodiversity action plan for Lonmin Limpopo & Platinum, North West & Limpopo Province, RSA (2008-2009);
- ⇒ Envirolution Consulting (Pty) Ltd., Ecological screening report and site selection process for an Eskom general landfill and hazardous waste storage facility near Lephalale, Limpopo Province, RSA (2009);
- ⇒ Envirolution Consulting (Pty) Ltd., Ecological assessment for the proposed construction of an Eskom general landfill and hazardous waste storage facility at the Matimba Power Station, Limpopo Province, RSA (2009);
- ⇒ Shangoni/Vergenoeg Mining Company, Ecological assessment for the proposed construction of a slurry pipeline and waste rock dump at the Vergenoeg Mine, Gauteng (2011);
- ⇒ ENVASS, An ecological evaluation (vertebrate & avifaunal component) for the proposed alternative energy plant on Portion 3, 4 & 5 of the Farm Groenwater 453, Northern cape (2012); and
- ⇒ ENVASS, Ecological evaluation (vertebrate & avifaunal component) for the proposed alternative energy plant on !xun & khwe, Northern cape (2012).
- ⇒ Mulilo & CSIR, Ecological evaluation (vertebrate & avifaunal component) for seven proposed PV plants near Kenhardt, Northern Cape (2016);
- ⇒ Shangoni & Aquila Resources (Vegetation, vertebrate & avifaunal component) for the mining of Iron Ore at Meletse Mountain near Thabazimbi, including the compilation of a habitat occurrence model for a threatened fern species (*Cheilanthes deltoidea silicicola*) and an offset strategy (2016);
- ⇒ De Castro and Brits/Clearstream Environmental, Terrestrial ecological assessment for the Impumelelo Mine (SASOL) expansion areas between Secunda and Greylingstad, Mpumalanga (2016);
- ⇒ EkoInfo/AngloCoal - Biodiversity assessment (vertebrates and invertebrates) for Kriel Coal Mine Lease Area (18 000ha), Kriel, Mpumalanga (2017);
- ⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental, Bio-monitoring survey for Exxaro Glisa coal mine: Vertebrate Wetland Fauna Assessment, Belfast, Mpumalanga (2018).
- ⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental - Ecological follow-up survey of the Stuart Colliery with emphasis on surface infrastructure, Delmas, Mpumalanga (2018);

- ⇒ EkoInfo/Ethical Exchange - Biodiversity assessment (with inputs related to fauna) for the application of a prospecting permit at the Boschpoort Granite Mine, North-West Province (2019);
- ⇒ EkoInfo/Seriti - Biodiversity baseline assessment (vertebrates and invertebrates) for the Kriel Colliery's post mined and rehabilitated areas, Kriel, Mpumalanga (2019);
- ⇒ De Castro & Brits Ecological Consultants, Vertebrate Fauna Assessment for Glencore's Wonderfontein Mine complex Mineral Rights Area, Wonderfontein, Mpumalanga (2019);
- ⇒ Bathusi Environmental/ENVASS, Terrestrial fauna and avifaunal survey and impact assessment for the mining of heavy mineral sands at areas known as Die Kom and Grouwduin se Kop, near Koekenaap, Western Cape (2019);
- ⇒ De Castro & Brits Ecological Consultants/ Cleanstream Environmental, Bio-monitoring survey for Exxaro Glisa coal mine: Vertebrate Wetland Fauna Assessment, Belfast, Mpumalanga (2020);
- ⇒ De Castro & Brits Ecological Consultants/Cleanstream Environmental, Vertebrate Fauna Assessment on 376.5ha of Kriel Colliery Pit F, Kriel, Mpumalanga (2020).

3 Avifaunal and Invertebrate Assessments:

- ⇒ Lavender Manor cc, Red Data Bird Assessment for the proposed establishment of a retail, commercial and Lavender Manor Township on part of the farm Rietfontein 189 IQ, Muldersdrift, Gauteng (2004);
- ⇒ Helga Schneider & Associates, Avifaunal & Invertebrate Red Data Assessment for the proposed rezoning & subdivision on Erf 6486 Orange Farm Ext 2, Johannesburg, Gauteng (2005);
- ⇒ TOWNDEV, Avifaunal and Arachnid Assessment for the proposed subdivision of Grootfontein 349 JR, Rievlei Dam, Gauteng (2006);
- ⇒ Prof. Van Rensburg, Red Data Invertebrate Scan for the proposed Rietvalleirand Extension 59, Gauteng (2006);
- ⇒ Group Five Property Development, Invertebrate Assessment for the proposed Buccleuch Ex 1, Gauteng (2006);
- ⇒ Zong's Property Investments, Avifaunal and Metisella meninx assessment for the establishment of a residential development on a portion of Pomona Estates Agricultural Holdings, Pomona, Gauteng (2006);
- ⇒ Waterval Islamic Institute, Avifaunal and Invertebrate Assessment for the proposed Northern Golf Course Development, Midrand, Gauteng (2006);
- ⇒ Ekurhuleni Metropolitan Municipality, Avifaunal & Invertebrate Red Data Assessment for the proposed low-cost housing development on Olifantsfontein 410 JR, Gauteng (2006);
- ⇒ City of Tshwane Metropolitan Municipality, Invertebrate Red Data Scan for the proposed flood remediation and river upgrade at Soshanguve, Gauteng (2006);
- ⇒ AGES, Invertebrate assessment for the proposed mining activities on the farm Thorncliffe 374 KT, 1strata Eastern Mines, Mpumalanga (2007)
- ⇒ AGES, Mammal and invertebrate assessment for the proposed Kalplats project, Stella, North West Province (2007)
- ⇒ Exigent Engineering Consultants, Invertebrate assessment for the proposed Derdepoort 1 11, Derdepoort, Gauteng (2007);
- ⇒ Exigent Engineering Consultants, Invertebrate and Avifaunal scan for the proposed Cutty Sark hotel extension, Scottburgh, Kwazulu-Natal (2007);
- ⇒ Strategic Environmental Focus, African Grass Owl assessment on the proposed Cradle View country estate on portion 60 of the farm Driefontein 179 IQ, Muldersdrift, Gauteng (2007);
- ⇒ GEOLAB, Ecological assessment for the West Rand Gold Operations (WERGO) Witfontein tailings disposal facility, Mintails, Gauteng, RSA (2008);
- ⇒ Coastal Environmental Services, Avifaunal Assessment for the proposed mining of heavy minerals at Port Durnford (Exxaro KZN-Sands), KwaZulu-Natal (2008);
- ⇒ SRK & Natural Scientific Services cc, A feasibility study for the mining of coal north of the Limpopo Province. Avifaunal & invertebrate assessment, Rio Tinto Exploration, Limpopo Province, RSA (2009);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal & faunal component) for the proposed Dinaledi - Spitskop 400 kV transmission line, North West Province (2010);
- ⇒ Eskom/Baagi Environmental, An avifaunal impact report for the proposed 400 kV Ariadne-Venus transmission line between Estcourt and Pietermaritzburg, KwaZulu-Natal (2010);
- ⇒ Eskom/Baagi Environmental, An avifaunal impact assessment report for a 275 kV power line between the substations of Glockner and Kookfontein, Vanderbijlpark, Gauteng (2010);
- ⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed expansion of Exxaro's Glisa coal mine, Belfast, Mpumalanga (2010);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifauna component) for the proposed 400 kV Medupi-Massa transmission lines, Limpopo Province (2011);
- ⇒ Eskom/Baagi Environmental, An avifaunal and fauna impact assessment report for the proposed 400 kV Arnott-Gumeni transmission line, Mpumalanga Province (2012);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed 400 kV Ngwedi transmission line and substation, North West Province (2012);
- ⇒ Exxaro/EkoInfo, An avifaunal and invertebrate assessment (as part of a Biodiversity Assessment and action plan) for the Gravelotte MagVanTi Mining Area, Limpopo Province (2012);
- ⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed Paardeplaats coal mine area, Belfast, Mpumalanga (2012);
- ⇒ Groundwater Consulting Services (Pty) Ltd/EkoInfo, An invertebrate and avifaunal specialist report for the proposed Leeuwpan coal mine area, Belfast, Mpumalanga (2013);

- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Medupi - Borutho 400 kV transmission line, Limpopo Province (2012);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Gromis - Oranjemund 400 kV transmission line, Northern Cape (2013);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Ariadne - Eros 400 kV transmission line, KwaZulu-Natal (2014);
- ⇒ Eskom/Baagi Environmental, An avifaunal and fauna impact assessment report for the proposed 400 kV Nzhelele - Triangle Project, Musina, Limpopo Province (2014);
- ⇒ Exxaro/EkoInfo, An avifauna and invertebrate investigation for the proposed Zonderwater Coal Project, Lephalale, Limpopo Province (2014);
- ⇒ Eskom/Baagi Environmental, An environmental management plan (avifaunal component) for the proposed Everest - Merapi 400 kV transmission line, Free State Province (2015);
- ⇒ Malelane Safari Resort Investments, An avifaunal investigation for the proposed safari lodge near Malelane Gate, Kruger National Park (2015);
- ⇒ Exigent, An avifaunal investigation for the proposed Zamokuhle Development within the Pongola Game Reserve, Mkuzi, KwaZulu-Natal (2016);
- ⇒ Bathusi Environmental/ Savannah Environmental, Avifaunal baseline survey and impact assessment as part of a terrestrial biodiversity impact assessment for the proposed Tshivhaso Coal-fired power plant near Lephalale, Limpopo Province (2016);
- ⇒ Eskom/Baagi, Avifauna and fauna assessment for the proposed Mahikeng main transmission substation and 400kV Pluto to Mahikeng powerline within the Merafong City Local Municipality of Gauteng Province and the Ditsobotla, JB Marks and Mafikeng Local Munisipalities of the North West Province (2018);
- ⇒ Bathusi Environmental/ Savannah Environmental, Avifaunal baseline survey and impact assessment as part of a terrestrial biodiversity impact assessment for the proposed Mutsho power project near Makhado, Limpopo Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 1 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 1 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 2 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 2 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Savannah Environmental/ ABO Wind Lichtenburg 3 PV - Avifaunal baseline Assessment for the 100MW Lichtenburg 3 PV Solar Facility, Lichtenburg, North-West Province (2018);
- ⇒ Bathusi Environmental/ Mills & Otten - African Grass-Owl (*Tyto capensis*) and general bird assessment on the Remainder Portion 332 of the Farm Knopjeslaagte 385 JR, Gauteng (2018);
- ⇒ Nyengere Solutions/ Waterberg Joint Venture - Avifauna, Invertebrate and Bat benchmark surveys for the proposed Waterberg mining project (dry season), Makgabeng, Central Limpopo Province (2018);
- ⇒ Knight Piésold/ Afri-Active Mechanical & Electrical - Avifaunal baseline assessment for the Lanark PV Solar Facility near Dendron (Mogwadi), Limpopo Province (2018);
- ⇒ Nyengere Solutions/ Waterberg Joint Venture - Avifauna, Invertebrate and Bat benchmark surveys for the proposed Waterberg mining project (wet season), Makgabeng, Central Limpopo Province (2019);
- ⇒ Eskom/Bathusi Environmental, environmental management plan; Avifaunal Component for the dismantling of the Grootpan-Brakfontein double circuit powerline near Ogies, Mpumalanga (2019);
- ⇒ Bathusi Environment/Terramanzi, Conflict resolution actions for the proposed Alkantpan Airstrip on a Portion of the Farm Smous Pan 105: Avifaunal Component, Copperton, Northern Cape (2019);
- ⇒ Eskom/EkoInfo, Avifaunal and general terrestrial fauna assessment for a 400kV powerline as required for the East Coast Gas Project, Richards Bay, KwaZulu-Natal (2019).

4 Other Assessments: Facilitation, project management and conduction of environmental scoping exercises, Environmental Impact Assessments, Environmental Management Plans, Feasibility Reports, for a range of projects and issues such as:

- ⇒ Planning and facilitation of environmental awareness workshops (Winterveldt Workshops for the Department of Environmental Affairs and Tourism);
- ⇒ Compilation and evaluation of EIA reports and Environmental Management Plans (EMPs) for both the private and public sector (e.g. Scoping Report for the relocation of oxidation ponds for the Moqhaka Local Municipality and the installation of an underground additive tank for Sasol Oil (Pty) Ltd).
- ⇒ Urban Renewal Projects: Bekkersdal Urban Renewal Project and the Greater Evaton Urban Renewal Project for the Gauteng Department of Housing.
- ⇒ Douglas Collieries (Inkwe Collieries), Biodiversity Assessment and database compilation of the Douglas Collieries (2005);
- ⇒ Orion Group, Ecological Sensitivity Map for the proposed golf course and related facilities, Mont-Aux-Sources (2005);
- ⇒ Johannesburg Roads Agency, Alien Eradication and Rehabilitation Programme for the proposed upgrade of 14th Avenue, Randburg, Gauteng (2006);
- ⇒ City of Joburg Property Development Company, Ecological Management Plan for the Orlando Dam intersection, Soweto, Gauteng (2006);
- ⇒ GJ van Zyl Trust, Alien Eradication Programme for the proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2006);
- ⇒ GJ van Zyl Trust, Fire Management Plan for the proposed development of a resort on the Farm Witpoort 216 JS, Mpumalanga (2006); and
- ⇒ Khutala Collieries (Inkwe Collieries), Biodiversity Assessment and database compilation (2006)

5 Linear Assessments:

- ⇒ Trans-Caledon Tunnel Authority (TCTA), Proposed Vaal River Eastern Subsytem Augmentation (VRESAP) pipeline from Vaal Marina to Secunda (2005);
- ⇒ PBA International (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Delta-Epsilon 765 kV Transmission lines (2007);
- ⇒ Bohlweki Environmental (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Malelane-Boulders 132 kV Distribution line (2007);
- ⇒ Bohlweki Environmental (in association with Bathusi EC), Ecological Scoping Report for the proposed Eskom Marathon-Delta 132 kV Distribution line (2007);
- ⇒ Strategic Environmental Focus, Avifaunal EIA Report for the proposed Eskom Hendrina-Prairie-Marathon 400 kV Transmission line, Mpumalanga (2007);
- ⇒ Natural Scientific Services cc, Botanical survey for the proposed upgrade of the Transnet railway line between Hotazel, Northern Cape and the Port of Ngqura, Eastern Cape, RSA (2008);
- ⇒ Envirolution Consulting (Pty) Ltd, Ecological Report for the proposed Eskom Apollo-Lepini 400kV transmission line (2009);
- ⇒ Arcus Gibb, An ecological investigation for the Tumelo 132 kV distribution line and power line near Kagiso, Gauteng (2010);
- ⇒ AECOM, Fauna assessment for the proposed upgrade of the Moloto Road through Gauteng, Mpumalanga and Limpopo Provinces (2016);
- ⇒ Envirolution consulting, Terrestrial ecological assessment and rehabilitation plan for the proposed Meyersdal pipeline located within the Meyersdal Nature Estate, Alberton, Gauteng (2017);
- ⇒ Envirolution consulting, Terrestrial ecological assessment for the Witpoortjie distribution line, Witpoortjie, Gauteng (2017);
- ⇒ Envirolution consulting, Terrestrial ecological assessment and rehabilitation plan for a sewer pipeline at the Pomona Spruit system, Kempton Park, Gauteng (2017);
- ⇒ Shangoni Management Services/ Ekurhuleni Metropolitan Municipality - Ecological Evaluation for the upgrade of the Serengeti Sewer Pump Station and rising main, Ekurhuleni Metropolitan Municipality, Pomona, Gauteng (2018);
- ⇒ AdiEnvironmental/Kyllinga Consulting, Ecological Assessment for the Empuluzi - Methula Phase 1 bulk water supply scheme, Mpuluzi, Mpumalanga (2018);
- ⇒ SRK Consulting, Ecological Evaluation for the proposed Baviaanspoort pipeline, northern Pretoria, Gauteng (2019).

B Work conducted in other African countries:

- ⇒ Rural Maintenance, Invertebrate study for four mini-hydroelectric generation plants, Northern Malawi, Africa (2010);
- ⇒ Impacto, An avifaunal study (Phase 1) for the proposed Mpanda Nkwua Dam in the Zambezi River, Mozambique, Tete Province (2010);
- ⇒ Conseil Régional des Pays de la Loire, An avifaunal investigation of the Rusizi and Ruvubu National Parks (Burundi), and the feasibility of establishing an avi-tourism network with specific emphasis on the protection of important flyways used by Palearctic birds - of - prey (2010);
- ⇒ Impacto, An avifaunal study (Phase 2) for the proposed Mpanda Nkwua Dam in the Zambezi River, Mozambique, Tete Province (2011);
- ⇒ Rural Maintenance, Invertebrate scan for the expansion of coal mining activities at Kayelekera, Northern Malawi, Africa (2011);
- ⇒ Rural Maintenance, Invertebrate study for a mini-hydroelectric plant at the Chisanga Falls, Nyika National Park, Malawi (2011);
- ⇒ Impacto/ERM/Enviro-Insight, Avifaunal investigation for the proposed Ncondezi Coal Mine, Tete Province, Mozambique (2011);
- ⇒ Enviro-Insight, Avifaunal investigation for the Riversdale Coal Mine complex, Tete Province, Monzambique (2011);
- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, Avifaunal investigation for the proposed Anadarko Mozambique Area 1 Liquefied Natural Gas plant in northern Mozambique, Cabo Delgado Province, Mozambique (2012);
- ⇒ Coffey Environments/EkoInfo, Avifaunal investigation for the mining of iron ore by Baobab Resources, Tete Province, Mozambique (a scoping-level assessment); and
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An avifaunal and invertebrate assessment for the establishment of a potash mine at Konkoati, Republic of the Congo (2012);
- ⇒ China Union/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore in Bong County, Liberia (2012);
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the mining of iron ore by DMC Congo Mining/Exxaro at Mayoko, Republic of the Congo (2012);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Bomi Hills, ,Bomi County, Liberia (2013);
- ⇒ SRK/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the establishment of an ecological offset for the DMC Congo Mining/Exxaro Iron Ore Mine at Mayoko, Republic of the Congo (2013);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Bea Mountain, Grand Cape Mount County, Liberia (2013);
- ⇒ Western Cluster/ERM/Enviro-Insight, Avifaunal investigation for the proposed mining of iron ore at Mano River, Grand Cape Mount County, Liberia (2013);
- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, DUAT Area Terrestrial Ecology Baseline Augmentation: Avifaunal Component with emphasis on determining important flyways for emblematic non-passerine birds where the potential risk of avian collisions to approaching aircraft is eminent during the establishment of an airstrip, Cabo Delgado Province, Mozambique (2012);

- ⇒ Anadarko Petroleum/ERM/Enviro-Insight, Regional Terrestrial Baseline Report, Avifaunal Component for the Mozambique Gas development with emphasis on critical habitat as per the IFC PS6, Cabo Delgado Province, Mozambique (2012);
- ⇒ WSP/Flora, Fauna and Man Ecological Services, An invertebrate assessment for the establishment of a phosphate mine, Hinda Phosphate Project, Republic of the Congo (2014);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report for the Letseng Diamond Mine, Lesotho (2015);
- ⇒ ASCOM Mining/ Flora, Fauna and Man Ecological Services, An Invertebrate and Avifaunal survey for the proposed mining of gold in western Ethiopia, Ethiopia (2015);
- ⇒ Western Power/Ecotone - A faunal investigation for the proposed development of a hydro-powered generation plant at Sioma, western Zambia (2015);
- ⇒ Aureus Mine/Enviro-Insight, An avifaunal investigation for the proposed mining of gold at the New Liberty Gold Mine, Liberia (2015 - 2016);
- ⇒ SRK/ Flora, Fauna and Man Ecological Services, An invertebrate and avifaunal screen for the proposed mining of phosphate substances at Dougou, part of a mining license extension of the Kola Project, Republic Of Congo (2016);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report (second monitoring session) for the Letseng Diamond Mine, Lesotho (2017);
- ⇒ Western Power/Ecotone - A follow-up wet season faunal investigation for the proposed revised infrastructure for the development of a hydro-powered generation plant at Sioma, western Zambia (2018);
- ⇒ ASCOM Mining/ Flora, Fauna and Man Ecological Services, An Invertebrate and Avifaunal dry season survey for the proposed mining of gold in western Ethiopia, Ethiopia (2018);
- ⇒ SRK/ The Biodiversity Company, An Avifaunal dry season survey for the proposed mining of gold at Siguiri, Guinea, (2018);
- ⇒ Enviro-Insight/ERM, Critical Habitat Review and assessment of threatened Orthoptera taxa as per IFC PS6 at Pugu Hills and Ruvu forest Reserves along the proposed Yapi Merkezi railway line, near Dar-es-Salaam, Tanzania (2019);
- ⇒ De Beers/Bathusi Environmental, An avifaunal monitoring report (third monitoring session) for the Letseng Diamond Mine, Lesotho (2019);

C Additional Experience:

- ⇒ Monitoring and evaluation of the rehabilitation programme for the mining company Richards Bay Minerals (RBM) with special reference to vegetation, bird, small mammal and millipede assemblages.
- ⇒ Other responsibilities include assessment of the ecological standard operating procedures (SOP) according to RBM's environmental management programme in compliance with ISO 14001 environmental standards accreditation process.
- ⇒ Participated in the annual relief programme on the S.A Agulhas voyage to Subantarctic Marion Island (Prins Edward group). Took part in the research to estimate the population dynamics and demography of the alien house mouse (Mus musculus) on the island (under supervision of the University of Pretoria).
- ⇒ Participated in the preparation of a conservation management plan for a game and trout farm in conjunction with Mpumalanga Parks Board (in charge of the bird section) for the farm Nu-Scotland Bavaria.
- ⇒ Lead a successful professional bird tour (party of 12) to the Eastern Zimbabwean highlands and adjacent Mashonaland Plato (10 days).
- ⇒ Lead a successful professional bird tour (party of 9) to the Cape Peninsula, Karoo and West Coast (10 days).
- ⇒ Lead a successful professional bird tour (party of 12) to the Swaziland and Northern Zululand (10 days).
- ⇒ Lead a successful professional bird tour (party of 15) to the Namibia (10 days).
- ⇒ Lead a successful professional bird tour (party of 14) to the Eastern Drakensberg and Lesotho (10 days).

EMPLOYMENT HISTORY:

March 2007 – Current: of Director of Pachnoda Consulting cc
2004- January 2007: Strategic Environmental Focus (Pty) - Terrestrial Ecologist
2003 – 2004: Enviro-Afrik (Pty) Ltd– Environmental Consultant
2001 – 2003: University of Pretoria - Research Assistant

PUBLICATIONS:

- ⇒ McEWAN, K.L., ALEXANDER, G.J., NIEMAND, L.J. & BREDIN, I.P. 2007. The effect of land transformation on diversity and abundance of reptiles. Paper presented at the 50th Anniversary Conference of the Zoological Society of Southern Africa.
- ⇒ NIEMAND, L. 1997. Distribution and consumption of a rust fungus *Ravenelia macowaniana* by micro-lepidopteran larvae across an urban gradient: spatial autocorrelation and impact assessment. Hons publication, University of Pretoria, Pretoria
- ⇒ NIEMAND, L. 2001. The contribution of the bird community of the regenerating coastal dunes at Richards Bay to regional diversity. MSc Thesis, University of Pretoria, Pretoria.
- ⇒ VAN AARDE, R.J., WASSENAAR, T.D., NIEMAND, L., KNOWLES, T., FERREIRA, S. 2004. Coastal dune forest rehabilitation: a case study on small mammal and bird assemblages in northern KwaZulu-Natal, South Africa. In: Martínez, M.L. & Psuty, N. (Eds.) *Coastal sand dunes: Ecology and Restoration*. Springer-Verlag, Heidelberg.
- ⇒ VAN AARDE, R., DELPORT, J. & NIEMAND, L. 1999. Of frogs and men. *Mechanical Technology,* June: 32-33.
- ⇒ VAN AARDE, R., DELPORT, J. & NIEMAND, L. 1999. Gone Frogging. *Getaway,* January: 80-83.

PRESENTATIONS, CONFERENCES & PUBLIC AWARENESS

- ⇒ Co-presenter at the Wetland Training Course (30 July – 3 August 2007) entitled: "Wetland-associated fauna". University of Pretoria, Pretoria.

⇒ Co-presenter and lecturer of the pre-conference training course (entitled "Can rehabilitation contribute towards biodiversity?") at the 3rd Annual LaRSSA (Land Rehabilitation Society of Southern Africa) Conference (8-11 September 2015), Glenburn Lodge, Muldersdrift, Gauteng.

⇒ Technical advisor to the Go/Weg magazine in response to bird and ecological related queries from the public/readers.

46 CURRICULUM VITAE OF RIAAN A. J. ROBBESON (PR.SCI.NAT.)

Date of Birth: 13th April 1969
Nationality: South African
Address: PO Box 77448, Eldoglen, 0171
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Telephone Contact: +27 (0)12 658 5579
Email: riaan@bathusi.org

Consulting experience: 23 years
Name of Firm: Bathusi Environmental Consulting cc
Position: Member, Specialist Investigator (Ecology and Botany)
Years with BEC: 20 years
Profession: Environmental Scientist, Ecologist, Botanist

Education

DEGREE / DIPLOMA	FIELD	INSTITUTION
B.Sc.	Botany and Zoology (major subjects), Geography, Chemistry, Genetics	University of Pretoria (1987 – 1991)
B.Sc. (Hons)	Botany	University of Pretoria (1992)
M.Sc.	Plant Ecology	University of Pretoria (1994 – 1998)
Visual Basic Programming	Computer Programming and Basic Programme Development	Unischool (University of Pretoria), 1999

Affiliations

CLASS	PROFESSIONAL SOCIETY	YEAR OF REGISTRATION
Pr.Sci.Nat.	South African Council of Natural Scientific Professions (SACNASP) (Ecological Scientist & Botanical Scientist, Reg no: 400005/03)	2003
Cert.Sci.Nat.	South African Council of Natural Scientific Professions (SACNASP) (Zoological Scientist)	2021

Key Attributes

Riaan has always been a passionate ecologist. Since a young age his interest in ecology and his passion and understanding of the natural environment has guided him towards a lifelong commitment to a profession in the natural sciences. After obtaining his B.Sc. degree, with zoology and botany as major subjects in 1990, he committed to post-graduate studies, ultimately obtaining his Masters degree in Plant Ecology at the University of Pretoria in 1998, while working as a research assistant and team member of the National Grassland Biome Project between 1994 and 1998. His involvement in specialist environmental studies followed naturally after graduation in 1998, and he has since been passionately involved in numerous ecological studies with the main emphasis on botanical assessments as part of environmental applications.

Between 1997 and 1999 Riaan was a co-founder of EkoInfo cc and contributed to the general management and consulting responsibilities. In 1999 Riaan, as the sole member, established Bathusi Environmental Consulting cc with the objective of conducting ecological studies with a holistic approach and a strong emphasis of the inclusion of faunal disciplines. Towards this objective, the development of working relations with numerous other specialists was, and still remains, a major priority. Inter-disciplinary collaboration on numerous projects enabled Riaan to acquire a working knowledge of these disciplines, including invertebrates, mammals, herpetofauna and birds.

During his career that spans 20 years, Riaan has acquired extensive experience in the evaluation of the status and reaction of the natural environment to development, across the ecological spectrum of plants, animals, and biophysical attributes of the receiving environment. In addition to pure scientific investigations and ecological investigations, he has also successfully developed and

implemented several biodiversity monitoring programmes on mining areas. In addition to a vast knowledge of the Grassland and Savanna Biomes, Riaan also utilises every possible opportunity to expand his knowledge of other biomes of southern Africa; he also contributed to international projects in Botswana, Lesotho, and Mozambique. Riaan displays an enthusiastic, always willing and 'can do' approach to projects and is able to work either as part of a team environment, or in isolation.

Apart from being committed to his professional career, other personal interests of Riaan include wildlife and sports photography, birding (currently at 556 species), and a life-long passion for sport. He is the holder of five Comrades bronze medals between 2005 and 2010. He is also a frequent competitor in ultra-endurance mountain bike events across South Africa and socially plays golf and squash.

Relevant Computer Skills

⇒ MS Word
⇒ MS Excel
⇒ MS Access
⇒ GIS Arcview 3.2 (a)
⇒ Google Earth
⇒ Adobe Photoshop CS & Lightroom 2.6
⇒ Visual Basic Programming

Employment Record

POSITION	COMPANY	JOB DESCRIPTION	DURATION
Research Assistant	University of Pretoria	Botanical surveys, plant identifications, data capturing, data analysis, report compilation, phytosociological descriptions, Post graduate Masters Publications	1994 - 1998
Member	EkoInfo cc	Project acquisition, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports	1995 - 1999
Member	Bathusi Environmental Consulting	Project acquisition, project management, site investigations, data analysis, report compilation, GIS mapping, selected peer review for publications and specialist reports, financial administration	1999 - present

Experience & Project Contributions

The development of accurate and comprehensive biodiversity studies that forms an integral part of successful environmental applications for a wide range of clients represents a major focus of BEC. To achieve this objective Riaan is committed to effective acquisition of projects, involvement and management of other specialist investigators as well as the ecological integration and interpretation of biodiversity data and reports to present a holistic overview of the ecological receiving environment.

Riaan has contributed to more than 400 environmental projects and reports that include a range of specialist fields, including biodiversity impact assessments and scoping reports, biodiversity Fatal Flaw assessments, environmental audits, ecological screening assessments, botanical assessments, vegetation sampling, classification, description and mapping, the development and implementation of environmental monitoring programmes, Red Data flora assessments, invasive species management programmes, compilation of Environmental Management Programme Reports, etc.

The range of clients that are assisted by BEC include environmental companies, private developers, mining houses (gold, diamond, iron, coal, sand), parastatals, traditional coal-energy producers, alternative energy producers (coal-fired, UCG, solar), property developers, etc.

Languages

English: RWS - Excellent
Afrikaans: RWS – Excellent

Selected Reports and Projects

The following projects are presented as a brief selection of the contributions to more than 400 projects and reports between 1999 and 2019.

⇒ **Biodiversity Impact Assessments (EIAs):**

- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Impact Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Biodiversity Impact Assessment and development of the biodiversity EMP for the proposed Kalkaar Solar Project in the Northern Cape Province. 2014. For SLR Consulting on behalf of SolarReserve, South Africa.
- Terrestrial biodiversity Impact Assessments of the proposed Tshivhaso Power Station near Lephalale in the Limpopo Province (Savanna Environmental). 2016. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed expansion of the existing Kao Diamond Mine in the Kingdom of Lesotho (EIMS). 2016. For Savannah Environmental. For Environmental Impact Management Services (EIMS). In collaboration with Ecocheck Environmental Services.
- Biodiversity Impact Assessments of the Medupi Power Station near Lephalale in the Limpopo Province. 2006. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.
- Impact Assessment for a proposed holiday destination in the Okavango Delta in the Republic of Botswana (@Land Landscape Architects). 1997. In collaboration with Ekotrust cc.
- Terrestrial Impact Assessment for a proposed hunting concession in the Okavango Delta in the Republic of Botswana (Ekotrust). 1997.
- Terrestrial Biodiversity Impact Assessment for the GOPE Diamond Mine in the Central Kalahari Game Reserve in the Republic of Botswana. 2008. For Marsh Vikela. In collaboration with Ecocheck Environmental Services.
- Botanical Assessments for the proposed expansion of a holiday destination in Mozambique (EkoInfo cc). 2005. In collaboration with EkoInfo cc and Ecocheck Environmental Services.
- Terrestrial biodiversity Impact Assessments of the proposed Steelpoort Pumped Storage Scheme. 2007. For Royal HaskoningDHV, previously Bohlweki Environmental. In collaboration with Ecocheck Environmental Services.

⇒ **Biodiversity Scoping Assessments:**

- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments of the proposed NEO 1 20MW Solar PV Plant that will be situated in the Mafeteng District of the Kingdom of Lesotho. 2018. For Royal HaskoningDHV. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Terrestrial Biodiversity (flora, fauna, avifauna) Scoping Assessments for the proposed Mutsho Power Project near Makhado, Limpopo Province. 2018. For Savannah Environmental. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.

⇒ **Biodiversity Screening Assessments:**

- Ecological Screening Assessments of 14 K-Routes for the Gauteng Province Department of Roads and Transport as part of the road expansion project. 2018. For Royal HaskoningDHV. In collaboration with Feathers Environmental Services.
- Terrestrial biodiversity screening assessment of the proposed Enviroblast Titanobel development in Gauteng Province. 2016. For Mills & Otten Environmental Consultants.
- Ecological Screening Assessment of the proposed Waterberg Heavy Haul railway project. 2015. For Royal HaskoningDHV

⇒ **Environmental Management Programme Reports (EMPR's):**

- Development of an Environmental Management Report for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of Animal Conflict Resolution approach for the Alkantpan Runway as part of the Copperton Wind Energy Project in the Northern Cape Province (fauna and avifauna). For Terramanzi Group. 2019. In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of Biodiversity Action Programme report for the Matla Mine in the Mpumalanga Province. 2014. For Groundwater Consulting Services (GCS). In collaboration with Pachnoda Consulting and Ecocheck Environmental Services.
- Development of an Environmental Management Programme for the proposed Aspen Lakes residential development in Gauteng Province. 2014. For Mills & Otten Environmental Consultants.
- Development of Off-Site Mitigations recommendations for the proposed Majuba Power Station Ashing Expansion Project in the Mpumalanga Province. 2014. For Eskom. In collaboration with Ecocheck Environmental Services.
- Environmental Management Programme for the Vygeboom Power Line. 2019. For Royal HaskoningDHV (previously SSI).

⇒ Biological/ Biodiversity Monitoring Reports:

- Deployment of a biological monitoring programme to ascertain the breeding status of Grey-headed Gulls at the proposed Zenprop Skymall Property near O.R. Tambo International Airport in Gauteng Province. 2017. For Mills and Otten Environmental Consulting cc. In collaboration with Pachnoda Consulting.
- Development and deployment of a biennial faunal monitoring programme for the Letšeng Diamond Mine in the Kingdom of Lesotho (Letšeng Diamonds). Since 2015, ongoing. For Letšeng Diamonds. In collaboration with Pachnoda Consulting, Ecocheck Environmental Services and Enviro-Insight.
- Development and deployment of biodiversity monitoring programme at the Woestalleen Colliery properties in the Mpumalanga Province (Woestalleen Colliery, NuCoal). 1997 – 2008. In collaboration with EkoInfo cc.
- Floristic monitoring surveys within the Blesbokspruit river in the Gauteng Province to determine the effect of acid mine drainage. In collaboration with EkoInfo cc.
- Development and implementation of a biodiversity monitoring programme for the Ghaghoo Diamond Mine in Botswana. 2013. For VDDB Engineers, Marsh Vikela, Ghagoo Diamond Mine. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Basic Assessment Reports:

- Terrestrial biodiversity Basic Assessment report for the proposed Etna – Trade powerline in the Gauteng Province (Eskom). 2016. In collaboration with Ecocheck Environmental Services.
- Ecological Basic Assessment of the proposed expansion of the Rietspruit Dam near Ventersdorp in the North-West Province. 2015. For Royal HaskoningDHV.

⇒ Species at Risk Assessments and Studies:

- Ecological status of the (Near Threatened) *Trachyandra erythrorrhiza* community in Esther Park from 2011 (ongoing) as part of compliance for the Bombela Concession Company. 2018. For Bombela Concession Company.
- Final walkdown and marking of protected tree species within the Thabametsi Power Project development footprint, the Medupi-Thabametsi 400 kV line, the Matimba-Thabametsi 400kV Line and the Thabametsi 33 kV line. 2018. For Savannah Environmental. In collaboration with Feathers Environmental Services and Ecocheck Environmental Services.
- Medicinal plants survey on a portion of the Farm Vlakfontein 30-IR in the Gauteng Province. 2017. For Mills & Otten Environmental Consultants.
- Final walkdown and marking of protected tree species within the Masa – Selomo 400 kV lines in the Limpopo Province. 2016. For Babcock International. In collaboration with Ecocheck Environmental Services.
- Search and rescue operation of medicinal plants at the proposed Vorna Valley development in Midrand, Gauteng Province. 2016. For Abland Developers.
- Protected species survey for the proposed water facility expansion at Giyani in the Limpopo Province. 2015. For EIMS.
- Red Data flora investigation for the proposed Irene Development within the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.

⇒ Alien and Invasive Species Management Programmes:

- Development of a management plan for invasive fauna species at the Duvha Power Station in Gauteng Province. 2018. For Eskom. In collaboration with Ecocheck Environmental Services.
- Development of a management plan for alien and invasive plants at the Duvha Power Station in Mpumalanga Province. 2017. For Eskom.
- Development of a management plan for alien and invasive plants at the Majuba Power Station in Mpumalanga Province. 2017. For Eskom.
- Development of a management plan for alien and invasive plant at the Mercedes Benz (South Africa) Plant in Centurion, Gauteng Province. 2017. For Ingen Engineers.
- Survey of alien and invasive plant species for Exxaro Mining Properties in the Mpumalanga Province. 2018. For Ulwando.

⇒ Biodiversity Sensitivity Analysis:

- Sensitivity analysis for the proposed Mogale 1 (Doornbosch 308) development in Gauteng Province. 2016. For Greenergy.

⇒ Ecological Baseline Assessments and Descriptions:

- Baseline ecological assessment of the Mothae Diamond Mine in the Kingdom of Lesotho. 2017. For Sustain Consulting, Mothae Diamond Mine. In collaboration with Ecocheck Environmental Services.
- Baseline assessment of the proposed Tshwane Freight Terminal in the Gauteng Province. 2016
- Botanical assessments for the proposed Mmamabula Power Lines in the Republic of Botswana. 2006. For EkoInfo cc.
- Botanical surveys in the Tswalu Desert Reserve. 1997. For Ekotrust.
- Ecological Baseline Assessment of the proposed Golwe Development near Vhuri Vhuri in the Limpopo Province. 2007. For AgriDev Consultants. In collaboration with Ecocheck Environmental Services.

⇒ Biodiversity Risk Assessments:

- Risk assessment for the Sappi Enstra Mill in the Gauteng Province. 2016. For WSP Group.
- Assessment of potential damage to trees adjacent to ATC tower infrastructure in Lyttelton and Waterkloof in the Gauteng Province. 2015. For ATC.

⇒ Research, interpretation, analysis of aerial photographs and other:

- Sitting member of the Environmental Monitoring Committee (EMC) for Medupi Power Station (Eskom). 2007 – 2019. For Eskom (Medupi).
- Peer review of the biodiversity impact assessment report for the National Road 3: Keeversfontein to Warden expansion. 2014. For Cave Klapwijk & Associates.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Gauteng Province. 1999. For ISCW. In collaboration with EkoInfo cc.
- Development and deployment of provincial floristic surveys to correlate remote sensing vegetation degradation patterns in the Mpumalanga Province (ISCW). 1999. For ISCW. In collaboration with EkoInfo cc.
- Determination of the effect of uncontrolled fires in selected areas within the Sabi Sands Reserve as part of insurance claims. 2001. For Deneys Reitz Attorneys. In collaboration with EkoInfo cc.
- Determination of the impact of Quelea control actions in wetlands on the vegetation in selected wetland regions in the Free State Province. 2000. For ISCW. In collaboration with EkoInfo cc.
- Establishing wind and visual breaks through planting of trees at selected properties of Woestalleen Colliery in the Mpumalanga Province. 2002. For Woestalleen Colliery. In collaboration with EkoInfo cc.
- Ground truthing of landcover mapping procedures within the Gauteng Province. 2004. For SEF.
- Herpetological assessment of the proposed Moruladal Development in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants.
- Assessment of Bushbabies at the proposed Wittkoppen Ext 112 in the Gauteng Province. 2004. For Mills & Otten Environmental Consultants. In collaboration with Ecocheck Environmental Services cc.

- Avifaunal surveys for the proposed H2 Power Plant Development near Bronkhorstspruit in the Mpumalanga Province. 2017. For Feathers Environmental Services.

⇒ **Green Certification**

- Ecological Green Building Certification for the proposed Woodmead Development in Gauteng Province. 2018. For Mills & Otten Environmental Consultants.

⇒ **GIS and related**

- Mapping and GIS digitising of maps for the National VEGMAP project. 2000. For Ecotrust.

Selected Reference Contact List

Company	Name	Telephone	email
Babcock South Africa	Donovan Fredrighi	011 739 8200	donovan.fedrighi@babcock.co.za
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Eskom (Medupi Power Station)	Emile Marell	082 560 4618	MarellEm@eskom.co.za
Feathers Environmental Consulting	Megan Diamond	082 683 0970	megan@feathersenv.co.za
ISCW/ LNR	Lianda Lotter	012 808 8000	lotterl@arc.agric.za
LEAP – Landscape Architects and Environmental Planners	Gwen Theron	012 344 3582	gwen.theron@telkomsa.net
Letšeng Diamond Mine	Bongani Nthloko	+27 710 554 078	ntlokob@letseng.co.ls
Mills & Otten	Kirstin Otten	011 486 0062	kirstin@millsandotten.co.za
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** please note that this list represents an abridged selection of companies, additional contact details can be provided upon request*

Certification

I, the undersigned, certify that to the best of my knowledge and belief, the above data correctly describe me, my qualifications and experience.

Riaan A. J. Robbeson (Pr.Sci.Nat.)

47 REFERENCES

ADU-UCT (2017) *Animal Demography Unit Virtual Museum.* Available at: vmus.adu.org.za.

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on 2010.

BATES, M.F, BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J. & DE VILLIERS, M.S. (eds). 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho, and Swaziland. *Suricata 1*. South African National Biodiversity Institute, Pretoria.

BAUER, H., PACKER, C., FUNSTON, P.F., HENSCHEL, P. & NOWELL, K. 2016. *Panthera leo*. The IUCN Red List of Threatened Species 2016: e.T15951A115130419. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T15951A107265605.en

BIRDLIFE SOUTH AFRICA. 2018. *BirdLife South Africa Checklist of Birds in South Africa*, 2018.

BUCKLAND, S.T., ANDERSON, D.R., BURNHAM, K.P., LAAKE, J.L. 1993. *Distance Sampling: Estimating abundance of biological populations*. Chapman and Hall, London.

CHILD, M.F., ROXBURGH, L., DO LINH SAN, E., RAIMONDO, D. & DAVIES-MOSTERT, H.T. (eds) 2016. *The Red List of Mammals of South Africa, Swaziland and Lesotho*. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

CONVENTION ON BIOLOGICAL DIVERSITY. Signed 1993 and ratified 2 November 1995.

DAVIES-MOSTERT HT, PAGE-NICHOLSON S, MARNEWECK DG, MARNEWICK K, CILLIERS D, WHITTINGTON-JONES B, KILLIAN H, MILLS MGL, PARKER D, POWER J, REHSE T, CHILD MF. 2016. *A conservation assessment of Lycaon pictus*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

DEL HOYO, J., ELLIOTT, A. & CHRISTIE, D.A. eds. 1992-2011. *Handbook of the Birds of the World.* Vol 1-16. Lynx Edicions, Barcelona.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS AND TOURISM. 2001. Environmental Potential Atlas. DEAT, Pretoria.

ENDANGERED WILDLIFE TRUST. 2002. The Biodiversity of South Africa 2002. Indicators, Trends and Human Impacts. Struik Publishers, Cape Town.

FISHPOOL, L.D.C. 1997. *Important Bird Areas in Africa: IBA criteria: categories, species lists and population thresholds*. BirdLife International, Cambridge.

FRIEDMANN,Y. & DALY, B. 2004. *Red Data Book of the Mammals of South Africa: A Conservation Assessment*. CBSG South Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

Gill, F, D Donsker, & P Rasmussen (Eds). 2021. IOC World Bird List (v 11.1). Doi 10.14344/IOC.ML.10.2. http://www.worldbirdnames.org/

GOBUSH, K.S., EDWARDS, C.T.T, BALFOUR, D., WITTEMYER, G., MAISELS, F. & TAYLOR, R.D. 2021. *Loxodonta africana*. The IUCN Red List of Threatened Species 2021: e.T181008073A181022663. https://dx.doi.org/10.2305/IUCN.UK.2021-1.RLTS.T181008073A181022663.en

GOVERNMENT GAZETTE [of the Republic of South Africa]. 2001. Amendments to the Conservation of Agricultural Resources Act, 1983 (Act No.43 of 1983). Government Gazette, 429 (22166) of 30 March 2001. Department of Agriculture, Republic of South Africa.

HARDAKER, T. 2019. *Southern African Bird List* - Version 09 - 06 July 2019.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. (eds.). 1997. *The Atlas of Southern African Birds. Vol. 1 & 2*. BirdLife South Africa, Johannesburg.

HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. (eds.) 2005. *Roberts – Birds of Southern Africa*, VIIth ed. The Trustees of the John Voelker Bird Book Fund, Cape Town.

HOFFMAN T. & ASHWELL A. 2001. Nature Divided: Land degradation in South Africa. University of Cape Town Press, Cape Town

INTERNATIONAL UNION FOR CONSERVATION OF NATURE. 2020. http://www.iucnredlist.org/

IUCN Red List of Threatened Species. Version 2019.1. http://www.iucnredlist.org/.

KNOBEL, J. 1999. The magnificent natural heritage of South Africa. Sunbird Publishing, South Africa.

MARNEWICK, M.D., RETIEF, E.F., THERON, N.T., WRIGHT, D.R. AND ANDERSON, T.A. 2015. *Important Bird and Biodiversity Areas of South Africa*. Johannesburg: BirdLife South Africa.

MEASEY, G.L. (ed). 2010. Ensuring a future for South Africa's frogs: a strategy for conservation research on South African amphibians. *SANBI Biodiversity Series* 19, National Biodiversity Institute, Pretoria.

MECENERO, S, BALL, J.B., EDGE, D.A., HAMER, M.L., HENNING, G.A., KRÜGER, M., PRINGLE, E.L., TERBLANCHE, R.F. & WILLIAMS, M.C. (eds.) 2013. *Conservation assessment of butterflies of South Africa, Lesotho and Swaziland: Red list and atlas*. Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town.

MILLER S, RIGGIO J, FUNSTON P, POWER RJ, WILLIAMS V, CHILD MF. 2016. *A conservation assessment of Panthera leo*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. & KLOEPFER, D. 2004. *Atlas and Red data Book of the Frogs of South Africa, Lesotho and Swaziland*. SI/MAB Series #9. Smithsonian Institution, Washington, D.C.

MPUMALANGA TOURISM AND PARKS AGENCY. MBSP Terrestrial Assessment 2014 [Vector] 2014. Available from the Biodiversity GIS website, downloaded on 02 July 2020

MUCINA, L. & RUTHERFORD, M.C. (eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

NATIONAENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (Act No. 10 of 2004).

PIETERSEN D, JANSEN R, SWART J, KOTZE A. 2016. *A conservation assessment of Smutsia temminckii*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

SELIER SAJ, HENLEY M, PRETORIUS Y, GARAI M. 2016. A conservation assessment of *Loxodonta africana*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

SKINNER, J.D. & CHIMIMBA, C.T. (Revisers). 2005. *Mammals of the Southern African Subregion*. Cambridge University Press, London.

STUART, C. & STUART, M. 2015. *Stuart's Field Guide To Mammals Of Southern Africa, including Angola, Zambia and Malawi*. Struik Nature, Cape Town.

SUTHERLAND, W.J. (ed.). 2006. Ecological Census Techniques, 2nd ed. Cambridge University Press, UK.

TAYLOR, M.R., PEACOCK, F. & WANLESS, R. (eds.). 2015. *The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland*. BirdLife South Africa, Johannesburg.

TAYLOR, P. 1998. *The smaller mammals of KwaZulu-Natal*. University of Natal Press, Pietermaritzburg.

THREATENED SPECIES PROGRAMME (TSP). 2007. *Interim Red Data List of South African Plant Species*. Produced in collaboration with the National Botanical Institute (NBI), NORAD and the Department of Environmental Affairs and Tourism (DEAT).

UNEP. 2002. Global Environment Outlook –3: Past, present, and future perspectives. United Nations Environment Programme, Earthscan Publications Ltd, London.

VAN RIET, W., P. CLAASSEN, J. VAN RENSBURG, T. VILJOEN & L. DU PLESSIS. 1997. *Environmental Potential Atlas for South Africa*. J.L. van Schaik, Pretoria.

VAN WILGEN B.W. & VAN WYK E. 1999. Invading alien plants in South Africa: impacts and solutions. In: People and rangelands building the future.

VAN WYK B. & GERICKE N. 2000. People's Plants. Briza Publications, Pretoria.

VISSER D.J.L. (1984). The Geology of the Republics of South Africa, Transkei, Bophutatswana, Venda and Ciskei and the Kingdoms of Lesotho and Swaziland. Fourth Edition. Department of Mineral and Energy Affairs. Republic of South Africa.

WIESEL, I., MAUDE, G., SCOTT, D. & MILLS, G. 2008. *Hyaena brunnea*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. http://www.iucnredlist.org/.

WILSON, D.E. & MITTERMEIER, R.A. eds 2009. *Handbook of the mammals of the world. Vol 1. Carnivores*. Lynx Editions, Barcelona.

WOOD, J., Low, A.B., Donaldson, J.S., & Rebelo, A.G. 1994. *Threats to plant species through urbanisation and habitat fragmentation in the Cape Metropolitan Area, South Africa*. In: Huntley, B.J. (Ed.) Botanical Diversity in Southern Africa. National Botanical Institute, Pretoria.

WOODHALL, S. 2005. *Field guide to the butterflies of South Africa*. Struik Publishers, Cape Town.

WYNBERG R. 2002. A decade of biodiversity conservation and use in South Africa: tracking progress from the Rio Earth Summit to the Johannesburg World Summit on Sustainable Development. South African Journal of Science 98: 233-243.

List of field guides and information sources:

- ⇒ A field guide to wild flowers of KwaZulu-Natal and the Eastern Region (Pooley, 2005)
- ⇒ A guide to grasses of southern Africa (van Oudtshoorn, 2012)
- ⇒ Alien weeds and invasive plants. A complete guide to declared weeds and invaders in South Africa (Henderson, 2001)
- ⇒ BRAHM (Botanical Research and Herbarium Management System (newposa.sanbi.org, accessed 2020/12/28)
- ⇒ Field guide to the Orchids of northern South Africa and Swaziland (McMurtry, et. al., 2008)
- ⇒ Field guide to trees of southern Africa (van Wyk and van Wyk, 2013)
- ⇒ Field guide to Wild Flowers of the Highveld (van Wyk & Malan, 1998)
- ⇒ Guide to Aloes of South Africa (van Wyk & Smith, 1996)
- ⇒ Guide to trees introduced in southern Africa (Glen & van Wyk, 1997)
- ⇒ Medicinal Plants of South Africa (van Wyk, Oudtshoorn & Gericke, 2009)
- ⇒ People's Plants (van Wyk & Gericke, 2000)
- ⇒ Poisonous plants of South Africa (van Wyk, van Heerden, van Oudtshoorn, 2005)
- ⇒ Probleem Plante van Suid Afrika (Bromilow, 1996)
- ⇒ Problem plants and alien weeds of South Africa (Bromilow, 2010)
- ⇒ Red Data List of southern African Plants (Hillton-Taylor, 1995)
- ⇒ South Africa's National Listed Invasive Species (www.invasives.org)
- ⇒ Succulents of southern Africa (Frandsen, 2017)
- ⇒ The Vegetation of South Africa, Lesotho, and Swaziland (Mucina & Rutherford, 2006)
- ⇒ Trees and shrubs of Mpumalanga and Kruger National Park (Schmidt, Lotter & McClellan, 2002)
- ⇒ Wild flowers of Northern South Africa (Fabian & Germishuizen, 1997)
- ⇒ Wild flowers of the Limpopo Valley (van der Walt, 2009)
- ⇒ www.sabap2.birdmap.africa