

Terrestrial Biodiversity Assessment

Proposed Volspruit Mine

Limpopo Province



For:

EcoPartners (Pty.) Ltd.

By:

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TABLE OF CONTENTS

1. DETAILS OF THE SPECIALIST TEAM	6
2. SPECIALIST DECLARATION OF INDEPENDENCE	6
2.1 Shavaughn Davis	6
2.2 David Hoare	7
3. INTRODUCTION	8
3.1 Project Details	8
3.2 Purpose and Scope	9
3.3 Study Area	10
3.4 Assumptions, Limitations and Knowledge Gaps	11
3.4.1 Assumptions	11
3.4.2 Limitations	11
4. METHODS	12
4.1 National Web-Based Environmental Screening Tool	12
4.2 Terrestrial Biodiversity Assessment	15
4.2.1 Desktop Resources and Datasets Consulted	15
4.2.2 Habitat Classification	18
4.3 Plant Species Theme Assessment	18
4.4 Field Survey	19
4.4.1 Timing	19
4.4.2 Approach	20
4.5 Impact Assessment	20
5. TERRESTRIAL BIODIVERSITY RESULTS	23
5.1 Regional Vegetation and National Threatened Ecosystems	23
5.1.1 Central Sandy Bushveld (SVcb12)	23
5.1.2 Springbokvlakte Thornveld (SVcb15)	25
5.2 National Wetland Dataset, National Freshwater Ecosystem Priority Areas (NFEPA) and Ramsar Designation	27
5.3 Strategic Water Source Areas	30
5.4 Provincial Conservation Plan	31
5.5 National Protected Areas	34
5.6 National Protected Areas Expansion Strategy (NPAES)	36
5.7 Important Bird and Biodiversity Areas (IBA's)	38
5.8 Mining and Biodiversity	40
5.9 System Ecology	43
5.10 Habitat Classification	45
5.10.1 Savanna	46
5.10.2 Dense Woodland	47
5.10.3 Koppies	48
5.10.4 Wetlands	50
5.10.5 Transformed/Degraded Land	51

5.11	Potential Faunal Assemblages	53
6.	PLANT SPECIES THEME RESULTS	54
6.1	Red List Plant Species of the Study Area	54
6.2	Plant Species Recorded in the Study Area	58
6.3	Concluding Remarks	58
7.	SITE ECOLOGICAL IMPORTANCE (SEI)	58
8.	IMPACT ASSESSMENT	61
8.1	Terrestrial Biodiversity	62
8.1.1	<i>Destruction and Fragmentation of Habitat</i>	62
8.1.2	<i>Habitat Degradation and Reduced Ecosystem Functioning</i>	69
8.1.3	<i>Direct Disturbance of Fauna</i>	71
8.1.4	<i>Mortality of Individuals or Populations of Species of Conservation Concern</i>	72
8.1.5	<i>Harvesting/Collection for Food/Trade</i>	73
8.1.6	<i>Impact Assessment Table</i>	74
8.2	Plant Species Theme	75
8.2.1	<i>Loss of Populations of Plant Species of Concern</i>	75
8.2.2	<i>Hydrological Impacts Leading to Wetland Habitat Degradation, Leading to Loss of Habitat Supporting Populations of Plant Species of Concern</i>	77
8.2.3	<i>Invasion by Alien Invasive Plant Species</i>	78
8.2.4	<i>Impact Assessment Tables</i>	79
8.3	Cumulative Impacts	80
9.	CONCLUSION	81
10.	REFERENCES	86
11.	APPENDIX 1: QUALIFICATIONS AND CV'S	91
12.	APPENDIX 2: LIST OF PLANT SPECIES RECORDED ON SITE.	103
13.	APPENDIX 3: LIST OF MAMMAL SPECIES PREVIOUSLY RECORDED IN THE QUARTER DEGREE GRID (2428BD).	107
14.	APPENDIX 4: LIST OF AVIFAUNAL SPECIES PREVIOUSLY RECORDED IN PENTADS 2415_2855 & 2420_2855.	109
15.	APPENDIX 5: LIST OF HERPETOFAUNA SPECIES PREVIOUSLY RECORDED IN THE QUARTER DEGREE GRID (2428BD).	115

TABLE OF FIGURES

Figure 1: Location and approximate extent of the amended Volspruit MRA, proposed development footprint and preliminary project area of influence (PAOI).	11
Figure 2. Screening tool map of relative terrestrial biodiversity theme sensitivity.	13
Figure 3. Screening tool map of relative plant species theme sensitivity.	13
Figure 4. Screening tool map of relative animal species theme sensitivity.	14
Figure 5: Map showing the regional vegetation of the area.	27
Figure 6. Extract of the National Wetland Map 5 for the project study area and surrounds, illustrating the study area in relation to the Nylsvley Nature Reserve.	29
Figure 7: Extract of the Atlas of Freshwater Ecosystem Priority Areas for the study area (Nel <i>et al.</i> , 2011).	30
Figure 8. Map showing the project study area in relation to Strategic Water Source Areas (Le Maitre <i>et al.</i> , 2018). The project study area falls within the Nyl & Dorps River Valley Groundwater Strategic Water Source Area.	31
Figure 9: Extract of the Limpopo Conservation Plan for the study area.	34
Figure 10. Extract of the South Africa Protected Areas Database for the MRA.	36
Figure 11. Extract of the National Protected Areas Expansion Strategy Focus Areas (2018) for the study area.	38
Figure 12. Extract of the Important Bird and Biodiversity Area's (IBA's) for the Volspruit MRA. ..	40
Figure 13. Extract of the Mining and Biodiversity Dataset for the amended MRA.	43
Figure 14. Habitat classification within the amended Volspruit MRA.	45
Figure 15: Photographs of savanna habitat observed within the vicinity of the project infrastructure layout (Bottom right shows Springbokvlakte Thornveld vegetation).	47
Figure 16: Photographs of dense woodland habitat observed within the vicinity of the project infrastructure layout.	48
Figure 17: Photographs of koppie habitat observed within the study area (Bottom right shows the profile of the southwest koppie in the distance).	49
Figure 18: Photographs of the Floodplain wetland habitat associated with the Nyl River observed within the study area.	51
Figure 19: Photographs of transformed and/or degraded habitat observed within the vicinity of the project infrastructure layout (clockwise from top left): Centre pivot maize cultivation in the footprint of the proposed north pit, centre pivot maize cultivation, degraded bushveld in the footprint of a cattle kraal, secondary vegetation established in the footprint of past cultivated fields.	53
Figure 20. Site Ecological Importance (SEI) of the study area from a terrestrial biodiversity perspective.	59
Figure 21. Extent and identification of proposed mine infrastructure in relation to the habitat SEI.	62
Figure 22. Habitat SEI and site verified and revised CBA layer intersect with the proposed mine layout.	65

TABLE OF TABLES

Table 1. Results of the environmental screening tool dated 08/12/2021	12
Table 2. Impact assessment criteria	20
Table 3. Definition of significance rating.	21
Table 4. Mitigation prediction criteria.	22
Table 5. Threat status, protection level and endemism estimate of the vegetation types occurring within the study area following the Terrestrial Ecosystem Threat Status and Protection Level (SANBI, 2018b)	23
Table 6. Wetland ecosystem type, and its assigned threat status category (Mbona <i>et al.</i> , 2015), occurring on site.	28
Table 7. Threatened, near threatened or rare plant species that could potentially occur in the study area.	56
Table 8: Evaluation of Site Ecological Importance (SEI) of terrestrial biodiversity habitats in the study area. BI = Biodiversity Importance.	60
Table 9. Extent (in hectares) of the habitat types and habitat SEI within the study area.	60
Table 10. Extent of each mine infrastructure within different habitat SEI and CBA Map Category.	65
Table 11: Environmental impact assessment for potential impacts related to terrestrial biodiversity.....	74
Table 12: Environmental impact assessment for potential impacts related to plant SCC's.	80

1. DETAILS OF THE SPECIALIST TEAM

Details of the Specialists Who Prepared this Report				
Name	Company	Qualifications	SACNASP Accreditation	Role
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Dr David Hoare	David Hoare Consulting (Pty) Ltd	PhD (Botany)	Pr.Sci.Nat. Reg. no. 400221/05 Botany, Ecology	Botanist

2. SPECIALIST DECLARATION OF INDEPENDENCE

2.1 Shavaughn Davis

I, Shavaughn Davis, as the appointed general ecologist/zoologist, hereby declare/affirm the correctness of the information provided in this compliance statement, and that I:

1. meet the general requirements to be independent; and
2. have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
3. am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).



Shavaughn Davis

03 June 2024

Date

2.2 David Hoare

I, David Hoare, as the appointed plant species specialist, hereby declare/affirm the correctness of the information provided in this compliance statement, and that I:

1. meet the general requirements to be independent; and
2. have no business, financial, personal or other interest in the proposed development and that no circumstances have occurred that may have compromised my objectivity; and
3. am aware that a false declaration is an offence in terms of regulation 48 of the EIA Regulations (2014).



Dr David Hoare

12 December 2023

Date

3. INTRODUCTION

3.1 Project Details

Wetland Consulting Services (Pty.) Ltd. (WCS), part of the Wetland Consulting Services Group of Companies, was appointed by EcoPartners (Pty) Ltd to update a terrestrial biodiversity assessment for the proposed mining of platinum group metals via opencast mining methods on the farm Volspruit 326 KP, Mokopane, Limpopo Province.

Volspruit Mining Company (Pty) Ltd proposes the mining of two (2) separate ore bodies through open cast mining on the farm Volspruit 326 KP, Mokopane, Limpopo Province. In addition, areas of the remaining extent of the Farm Zoetveld 294 KR are proposed for the establishment of supporting above ground infrastructure (e.g. residue stockpiles and residue deposits). The mining of these two (2) ore bodies will result in the establishment of two separate opencast pits, the ‘north pit’ and the ‘south pit’. It is estimated that the targeted ore reserves underlying the site equal approximately 56 million tonnes, which suggests that the mine will be in operation for approximately 18-20 years; where the mining of the respective pits will occur in a phased manner. The north pit will be mined between years 1-13, and the south pit between years 13-19. It is proposed that platinum group metals (PGMs) will be mined to a depth of approximately 180 m at the north pit and south pit.

The Volspruit mine development also includes provision for the establishment of an ore processing plant (frother flotation) and smelter complex including a fluidised bed ore roasting plant, a 5MW DC Arc furnace (and an additional 5MW furnace toward ramp up a couple of years into operations) and a Chemical Vapour Metal Recovery Plant (CVMR) for the beneficiation of metal produced.

These plants aim to further process the mined mineral bearing ore into saleable PGM mineral fractions and beneficiate the ore to high value pure metals. This process will produce significant volumes of waste rock and minerals residues which will require waste rock and tailings disposal facilities. The ‘plant site’ is proposed to be established on the farm Volspruit 326 KP, at a site centrally located to the opencast pits and away from the Nyl River and associated wetland.

The site is currently a ‘Green-fields’ site with portions thereof under intense agriculture, as well as having large tracts of minimally disturbed natural vegetation. All relevant surface infrastructure and other infrastructural requirements for the project will need to be developed on the site. Further to the structures and infrastructure mentioned above, the mine’s development will include provision for, inter alia, access roads, administration buildings, workshops, storage/lay-down yards, sewage treatment plants, return water- and storm water dams, explosives store, electricity sub-stations, as well as supporting electrical, sewage and water reticulations.

It is relevant to note that the Volspruit Mining Company (Pty) Ltd has an approved mining right and EMPr for the site. The mining right (MR) area covers 1335,28 ha. The minerals approved for mining relate to Platinum Group Metals (platinum (Pt), palladium (Pd), rhodium (Rh), ruthenium (Ru), osmium (Os) and iridium (Ir)), gold (Au) nickel (Ni), chrome (Cr) and Copper (Cu) and came into effect on the 4th of October 2017 (being the date on which the Environmental Management Programme (EMPr) was approved in terms of Section 39(4) of the Minerals and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002). The MR was awarded for a period of 30 years ending on the 3rd of October 2047 and is subject to conditions set out in the MR that was issued by the Regional Manager of the Limpopo region of the Department of Mineral Resources (DMR), now the Department of Mineral Resources and Energy.

After the issuing of the MR, and based on various optimisation and environmental studies, Volspruit MC changed the layout and location of the waste rock residue stockpile (WRRS), and the layout of the north pit and the tailings residue stockpile (TRS or TSF) from what was previously approved. The update of the biodiversity assessment was required for the Waste Management Licence application that is required for the residue stockpiles (i.e. tailings and waste rock residue stockpiles) and for the environmental authorisation that is required for the change of the mining right area. It should be noted that mining activities have not commenced in the MR area.

3.2 Purpose and Scope

The purpose of this terrestrial biodiversity baseline and impact assessment report is to satisfy certain requirements for environmental authorisation applications with regard to specific ecological sensitivities highlighted through the environmental screening tool. This report contains the Terrestrial Biodiversity and Plant Species Themes. The Animal Species Theme is addressed in separate taxon-specific reports. The Terms of Reference for this report are defined as follows:

- Collation of existing terrestrial biodiversity and sensitive plant species information as relevant to the project study area from published sources and previous specialist studies, as well as a site survey to develop a description of the terrestrial biodiversity and sensitive plant species themes baseline pre-mining;
- An assessment of possible and likely impacts to terrestrial biodiversity and sensitive plant species expected from the proposed development.

3.3 Study Area

The proposed opencast mine will be located on the farm Volspruit 326 KP and the remainder of the farm Zoetveld 294 KR which lie in the Waterberg District Municipality, and approximately 16 kilometres south and west of Mokopane (Potgietersrus) in the Limpopo Province (Figure 1). Immediately adjacent to and forming the western boundary of the site is the Nyl River, which occurs as a relatively wide wetland system on site. The N1 highway from Gauteng to Musina runs to the north-west of the site, approximately 4.8 km from the centre of the site, while an un-surfaced public road traverses the study area from north to south. The remaining boundaries are cadastral boundaries. Approximately 40 km upstream of the site is the Nylsvley Nature Reserve Ramsar Site, while the old Grass Valley Chrome Mine is just outside the site to the north-east. The study area (Volspruit Amended Mining Right Area) covers 3 330 ha and falls within quarter degree square (QDS) 2428BD.

Currently, the project area of influence (PAOI) is considered to include the development footprint, a 500m buffer of the footprint, as well as all wetland/riparian/watercourse habitat immediately adjacent to and downstream of the development footprint up to the downstream edge of the Volspruit Mineral Rights area. The extent of the PAOI has been established based on the following parameters:

- Direct impacts are likely to occur within the development footprint itself.
- The 500m buffer is applied as a conservative estimate of the extent to which indirect impacts such as light, dust, and noise impacts could affect the surrounding environment.
- Watercourses are considered to be sensitive habitats and can act as a conduit for certain impacts, such as water pollution, to affect downstream habitats and species.

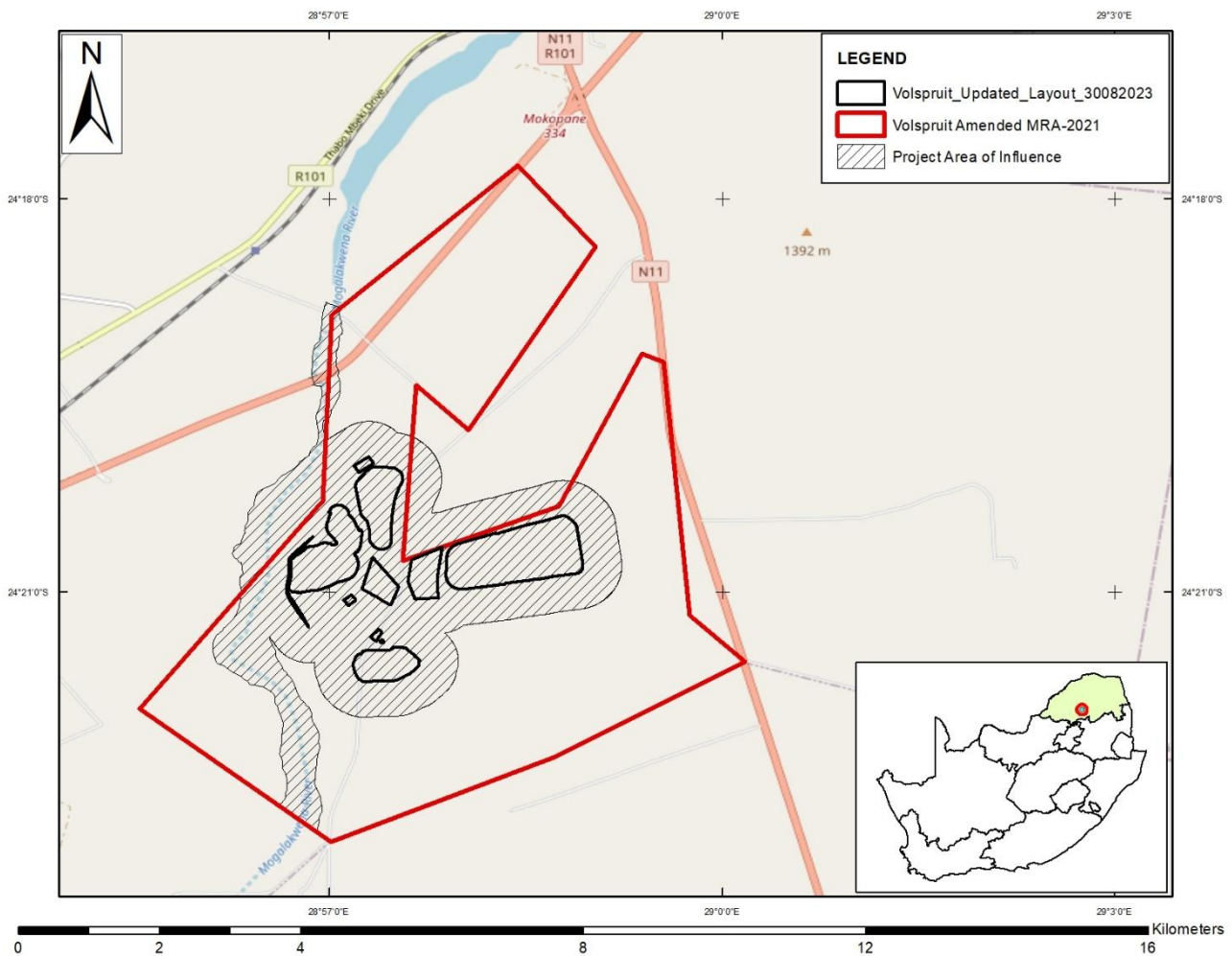


Figure 1: Location and approximate extent of the amended Volspruit MRA, proposed development footprint and preliminary project area of influence (PAOI).

3.4 Assumptions, Limitations and Knowledge Gaps

3.4.1 Assumptions

This report has been prepared for the particular purpose outlined in the Introduction and Terms of Reference above and no responsibility is accepted for the use of this report, in whole or in part, in any other context or for any other purpose.

3.4.2 Limitations

The site is within the Savanna Biome with a peak rainfall season in summer, which occurs from November to April. The timing of the survey in January 2022 is therefore optimal in terms of assessing the habitats and flora of the site. In addition, a part of the area was previously assessed

as part of a discontinued environmental authorisation process undertaken between 2010 and 2012 (WCS, 2012).

4. METHODS

4.1 National Web-Based Environmental Screening Tool

Any development or activity that triggers a listed and specified activity in terms of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as identified by the EIA Regulations, 2014 (as amended) and Listing Notices 1-3, requires environmental authorisation. Regulation 16(1)(b)(v) of the EIA Regulations provides that an applicant for an environmental authorisation is required to submit a report generated by the environmental screening tool as part of its application. When the report generated by the screening tool identifies a theme, the relevant protocol for that theme, including the procedure that must be followed for site sensitivity verification and the information requirements for a relevant specialist report, must be applied.

An environmental screening report was generated during the proposal phase of the project to identify specialist study requirements for the environmental authorisation. The report highlighted the need for, amongst others, a terrestrial biodiversity assessment (Very High Sensitivity) and plant and species theme assessments related to two sensitive herpetofauna species (both Medium Sensitivity), one avifaunal species (*Sagittarius serpentarius* – High Sensitivity) and two sensitive plant species (both Medium Sensitivity). The screening report was generated again in December 2021 by EcoPartners for submission with the scoping report. The updated screening report differed from the earlier report in that one of the two sensitive herpetofauna species was no longer listed, and one sensitive plant species (*Justicia minima* – Medium Sensitivity) and three sensitive mammal species (*Crocidura maquassiensis*, *Dasymys robertsii* and *Lycaon pictus* – all Medium Sensitivity) were included in the list. Changes to the plant and animal species theme lists are expected to be due to updates to the supporting databases. The ecological sensitivities highlighted in the screening tool generated on the 08/12/2021 are illustrated in Table 1 and Figures 2-4.

Table 1. Results of the environmental screening tool dated 08/12/2021

THEME	SENSITIVITY			
	VERY HIGH	HIGH	MEDIUM	LOW
Terrestrial Biodiversity	X			
Plant Species			X	
Animal Species		X		

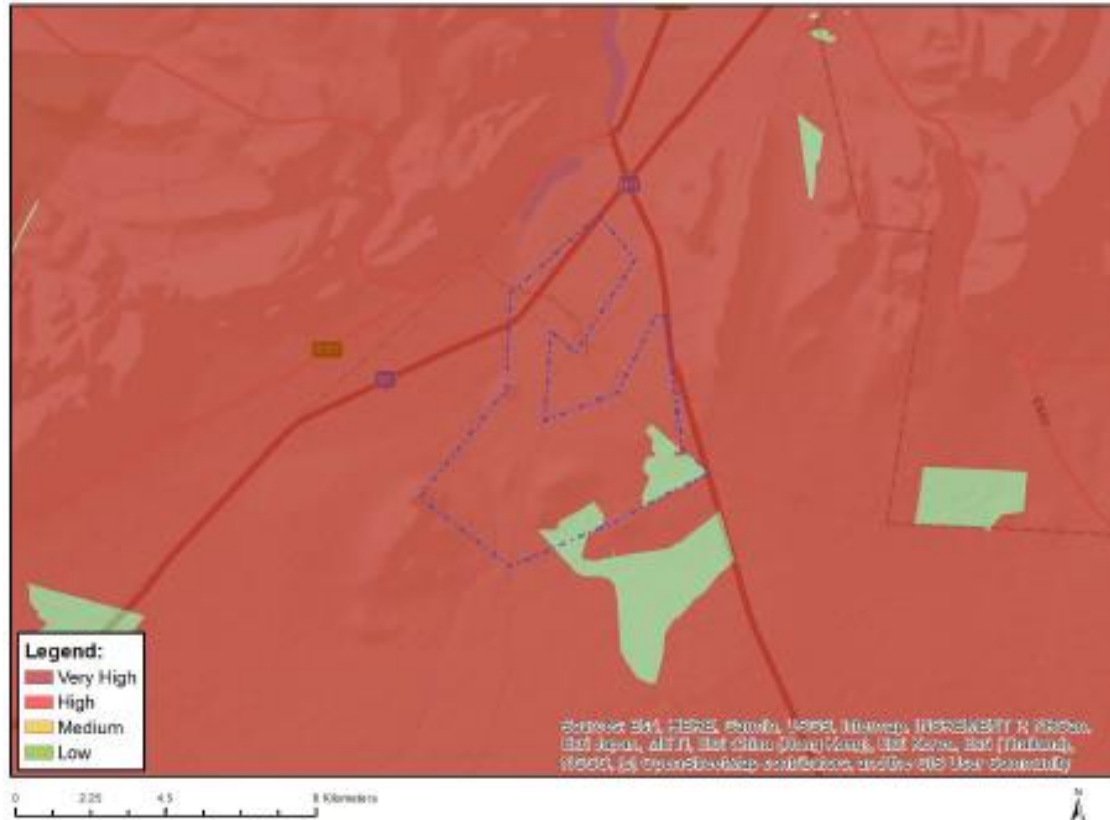


Figure 2. Screening tool map of relative terrestrial biodiversity theme sensitivity.

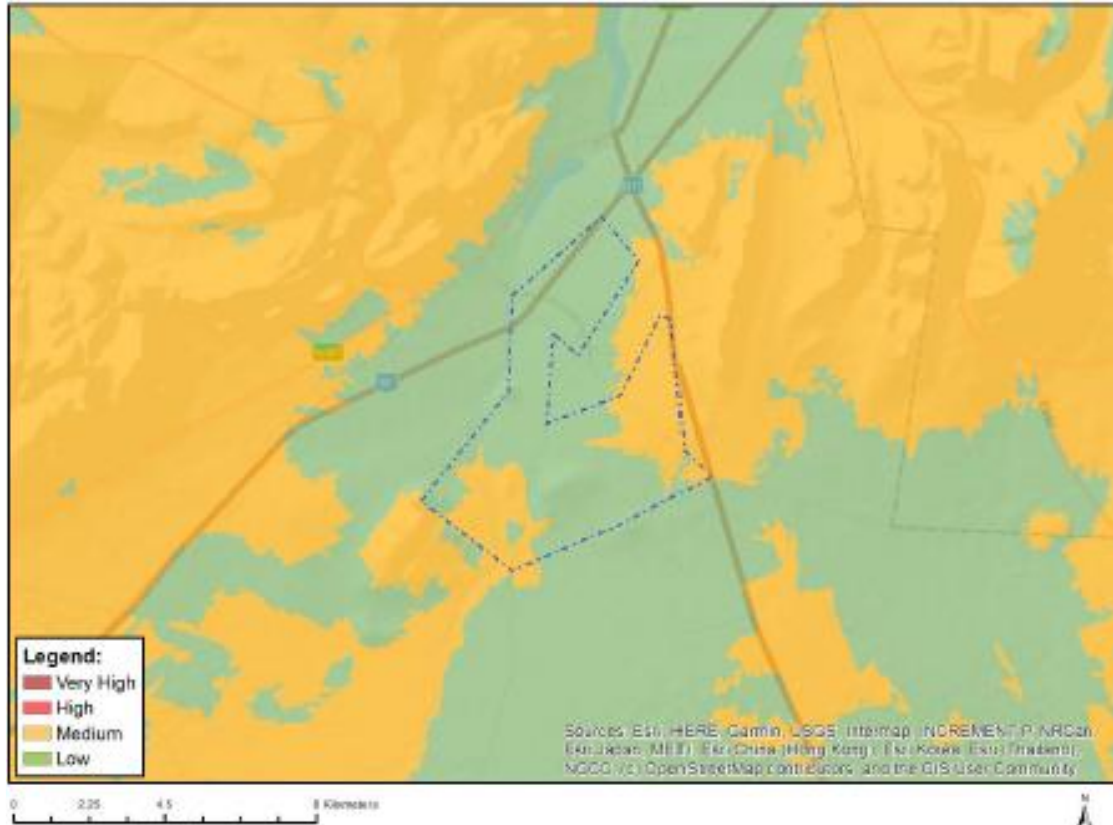


Figure 3. Screening tool map of relative plant species theme sensitivity.

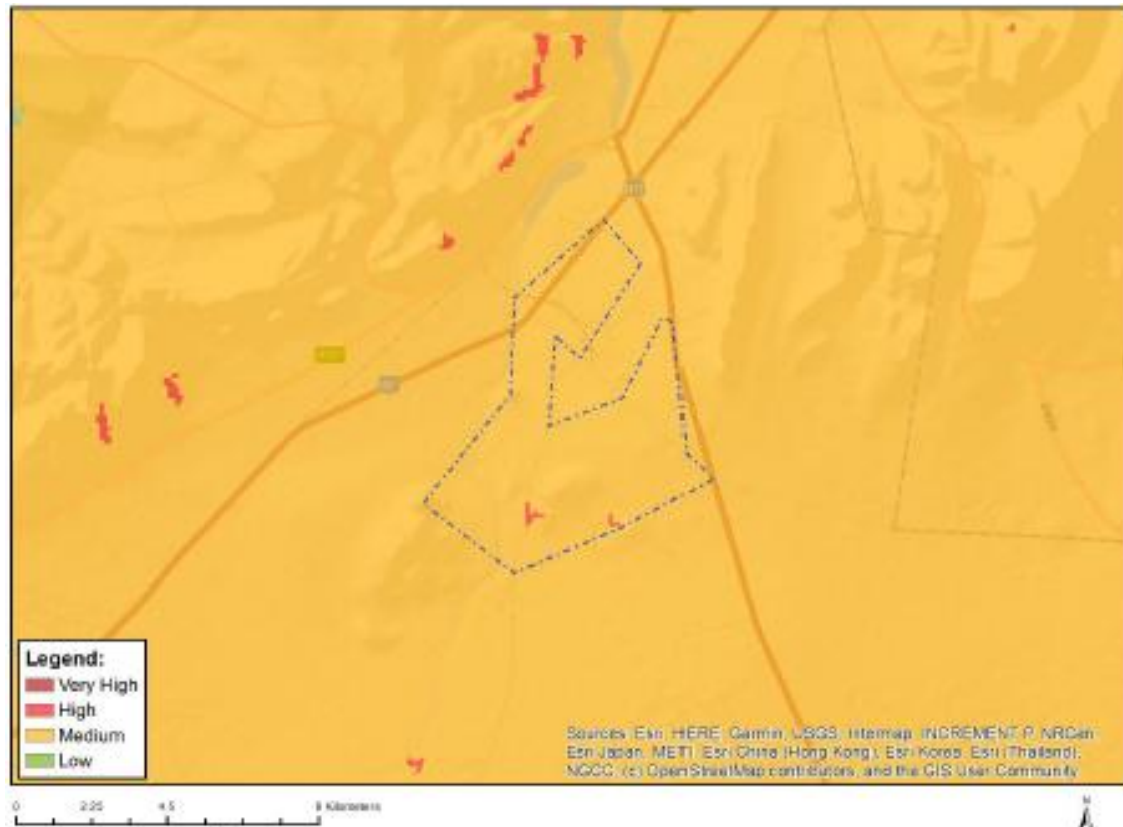


Figure 4. Screening tool map of relative animal species theme sensitivity.

The current ecological sensitivities that triggered the Very High terrestrial biodiversity sensitivity include the following:

TERRESTRIAL BIODIVERSITY THEME	
Sensitivity	Feature(s)
Very High	Critical biodiversity area 1
Very High	Critical biodiversity area 2
Very High	Ecological Support Area 2
Very High	Nature Reserve
Very High	Nature Reserve
Very High	Nature Reserve
Very High	Vulnerable Ecosystem
Very High	Protected Areas Expansion Strategy

As a result of these identified sensitivities a Terrestrial Biodiversity Specialist Assessment must be conducted based on the protocols as published on 20 March 2020. This requirement is addressed in this report.

The plant species theme is indicated as Medium Sensitivity due to the potential presence of several sensitive plant species, including the following:

PLANT SPECIES THEME	
Sensitivity	Feature(s)
Medium	Sensitive species 1252
Medium	Sensitive species 1278
Medium	<i>Justicia minima</i>

As a result of the potential presence of these sensitive species, a full floral assessment is being conducted in accordance with the current guidelines (SANBI, 2020). This requirement is addressed in this report (Section 6).

The animal species theme was highlighted as being of High sensitivity due the potential presence of the following species:

ANIMAL SPECIES THEME	
Sensitivity	Feature(s)
High	Aves-Sagittarius serpentarius
Medium	Mammalia-Crocidura maquassiensis
Medium	Mammalia-Dasymys robertsii
Medium	Mammalia-Lycaon pictus
Medium	Sensitive species 12

As a result of the potential presence of these sensitive species, separate taxa-specific animal species theme assessments are being conducted. The avifaunal, mammal and herpetofauna components are addressed in separate reports and in compliance with the current guidelines (SANBI, 2020).

4.2 Terrestrial Biodiversity Assessment

4.2.1 Desktop Resources and Datasets Consulted

The desktop assessment relied heavily on existing available literature and spatial dataset resources. The following literature and data sources were used to compile information for various aspects of the study area's terrestrial biodiversity:

Regional Vegetation:

- Mucina, L. and Rutherford, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

- South African National Biodiversity Institute 2018. Final Vegetation Map of South Africa, Lesotho and Swaziland [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 23 September 2021.

National Threatened Ecosystems:

- GN1002 of GG34809, NEMBA. 2004. *National List of Ecosystems that are Threatened and in Need of Protection*. National Environmental Management: Biodiversity Act (Act No. 10 of 2004). Republic of South Africa.
- List of Threatened or Protected Terrestrial and Freshwater Species and Regulations

National Freshwater Ecosystem Priority Areas:

- Nel, J.L., Driver, A., Strydom, W.F., Maherry, A., Peterson, C., Hill, L., Roux, D.J., Nienaber, S., Van Deventer, H. Swartz, E. and Smith-Adao, L.B. 2011. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission, Gezina. WRC Report No. TT 500/11

Strategic Water Source Areas:

- Water Research Commission. 2017 Surface and Groundwater SWSA [Vector] 2017. Available from the Biodiversity GIS website, downloaded on 15 December 2021.

Provincial and Regional Conservation Plans:

- Desmet, P. G., Holness, S., Skowno, A. & Egan, V.T. (2013) Limpopo Conservation Plan v.2: Technical Report. Contract Number EDET/2216/2012. Report for Limpopo Department of Economic Development, Environment & Tourism (LEDET) by ECOSOL GIS.
- LEDET (2016). Waterberg District Bioregional Plan. Compiled by ECOSOL GIS for Limpopo Department of Economic Development, Environment and Tourism (LEDET), Polokwane. January 2016.
- Limpopo Department of Economic Development & Tourism. 2018 Limpopo Province Map of Critical Biodiversity Areas and Ecological Support Areas [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 20 December 2021
- The Limpopo Environmental Management Act, 2003

South Africa Protected Areas:

- Department of Environmental Affairs. 2013. Classification and definition of protected areas and conservation areas.
- South Africa Protected Areas Database (SAPAD_OR_2021_Q2) retrieved from the Department of Forestry, Fisheries and the Environment website (https://egis.environment.gov.za/data_egis/data_download/current). downloaded on 15 December 2021.

National Protected Areas Expansion Strategy (NPAES):

- Department of Environmental Affairs. 2016. National Protected Areas Expansion Strategy for South Africa 2016. Department of Environmental Affairs, Pretoria, South Africa.
- South African National Parks. NPAES Focus Areas 2010 [vector geospatial dataset] 2010. Available from the Biodiversity GIS website, downloaded on 14 December 2021.

Important Bird and Biodiversity Areas (IBA's):

- Marnewick MD, Retief EF, Theron NT, Wright DR, Anderson TA. 2015. Important Bird and Biodiversity Areas of South Africa. Johannesburg: BirdLife South Africa.
- BirdLife South Africa. Important Bird Areas 2015 [vector geospatial dataset] 2015. Available from the Biodiversity GIS website, downloaded on 17 December 2021.

Mining and Biodiversity:

- Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute. 2013. Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector. Pretoria. 100 pages.
- South African National Biodiversity Institute. Mining and Biodiversity Guidelines 2012 [Raster] 2012. Available from the Biodiversity GIS website, downloaded on 15 December 2021.

Potential Faunal Assemblages:

- Skinner, J. D. & Chimimba, C. T. 2005. *The mammals of the southern African subregion*. 3rd Ed. Cambridge University Press, Cape Town. 814pp.
- Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., & Davies-Mostert, H.T., (eds.). 2016. The 2016 Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

- 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.
- Branch, B. 1998. Field Guide to the Snakes and other Reptiles of Southern Africa. Struik Publishers, Cape Town. 399pp.
- Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature, Cape Town. 488pp.
- Minter, L.R., M. Burger, J.A. Harrison, H.H. Braack, P.J. Bishop, and D. Kloepfer, eds. 2004. Atlas and Red Data Book of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.
- REPTILEMAP. 2021. The Southern African Reptile Conservation Assessment (SARCA, now ReptileMAP). <http://vmus.adu.org.za/>
- FROGMAP. 2021. The Southern African Frog Atlas Project (SAFAP, now FrogMAP). <http://vmus.adu.org.za/>
- MAMMALMAP. 2021. Virtual Museum of African Mammals. <http://mammalmap.adu.org.za/>
- Southern African Bird Atlas Project 2. FitzPatrick Institute of African Ornithology. <http://sabap2.birdmap.africa/>. Accessed on 13 December 2021.

4.2.2 Habitat Classification

Vegetation units were manually mapped within the Volspruit mining right area (MRA) and surrounding area at a desktop level using recent satellite imagery (courtesy of Google Earth Pro). Google Earth Pro also provides historical imagery for a period up to 15 years ago, which aided in the determination of certain vegetation types, as well as the levels of disturbance. The habitat classification was verified and refined during the site surveys undertaken during January 2022.

4.3 Plant Species Theme Assessment

- Broad vegetation types occurring on site were obtained from Mucina and Rutherford (2006), with updates according to the SANBI BGIS website (<http://bgis.sanbi.org>). The description of

each vegetation type includes a list of plant species that may be expected to occur within the particular vegetation type.

- Plant species that could potentially occur in the general area were extracted from the NewPosa database of the South African National biodiversity Institute (SANBI) for the quarter degree grid/s in which the site is located.
- The IUCN Red List Category for plant species, as well as supplementary information on habitats and distribution, was obtained from the SANBI Threatened Species Programme (Red List of South African Plants, <http://redlist.sanbi.org>).
- Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (<http://posa.sanbi.org>) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species was then assessed by comparing the habitat requirements with those habitats that are likely to occur there.
- Regulations published for the National Forests Act (Act 84 of 1998) (NFA) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g., van Wyk & van Wyk, 1997) and from the SANBI Biodiversity Information System website (<http://sibis.sanbi.org/>) for quarter degree grid/s in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed and were considered as being at risk of occurring there.

4.4 Field Survey

4.4.1 Timing

The site visit was undertaken in January 2022 (wet season) by both a zoologist and botanist to assess the faunal and floral components of terrestrial biodiversity. The site is within the Savanna Biome with a peak rainfall season in summer, which occurs from November to April. The timing of the survey is therefore optimal in terms of assessing the flora and habitats of the site. In addition, a section of the area was previously assessed as part of a discontinued environmental authorisation process undertaken in 2010-2012 (WCS, 2012).

4.4.2 Approach

During the field surveys, major natural variation, such as vegetation, aspect, slope, substrate, etc., on site was assessed and select locations were traversed on foot, with the focus on areas directly within the footprint of the proposed development. A hand-held Garmin GPSMap 64s was used to record a track within which observations were made.

Aerial imagery from Google Earth was used to identify and assess habitats on site. Patterns identified from satellite imagery were verified on the ground. During the field survey, particular attention was paid to ensuring that all habitat variability was covered physically on the ground.

Digital photographs were taken of features of interest that were seen on site, as well as of habitat in different parts of the site.

4.5 Impact Assessment

To ensure uniformity, the assessment of potential impacts was addressed in a standard manner so that a wide range of impacts is comparable. For this reason a clearly defined rating scale was utilised to assess the impacts associated with the proposed development. Each impact identified was assessed in terms of status, extent, duration, probability and magnitude.

Table 2. Impact assessment criteria

Status		
Positive	+	Impact will be beneficial to the environment (a benefit).
Negative	-	Impact will not be beneficial to the environment (a cost).
Neutral	0	Where a negative impact is offset by a positive impact, or mitigation measures, to have no overall effect.
Magnitude		
Minor	2	Negligible effects on biophysical or social functions / processes. Includes areas / environmental aspects which have already been altered significantly, and have little to no conservation importance (negligible sensitivity*).
Low	4	Minimal effects on biophysical or social functions / processes. Includes areas / environmental aspects which have been largely modified, and / or have a low conservation importance (low sensitivity*).
Moderate	6	Notable effects on biophysical or social functions / processes. Includes areas / environmental aspects which have already been moderately modified, and have a medium conservation importance (medium sensitivity*).
High	8	Considerable effects on biophysical or social functions / processes. Includes areas / environmental aspects which have been slightly modified and have a high conservation importance (high sensitivity*).
Very high	10	Severe effects on biophysical or social functions / processes. Includes areas / environmental aspects which have not previously been impacted upon and are pristine, thus of very high conservation importance (very high sensitivity*).
Extent		
Site only	1	Effect limited to the site and its immediate surroundings.

Local	2	Effect limited to within 3-5 km of the site.
Regional	3	Activity will have an impact on a regional scale.
National	4	Activity will have an impact on a national scale.
International	5	Activity will have an impact on an international scale.
Duration		
Immediate	1	Effect occurs periodically throughout the life of the activity.
Short term	2	Effect lasts for a period 0 to 5 years.
Medium term	3	Effect continues for a period between 5 and 15 years.
Long term	4	Effect will cease after the operational life of the activity either because of natural process or by human intervention.
Permanent	5	Where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Probability of occurrence		
Improbable	1	Less than 30% chance of occurrence.
Low	2	Between 30 and 50% chance of occurrence.
Medium	3	Between 50 and 70% chance of occurrence.
High	4	Greater than 70% chance of occurrence.
Definite	5	Will occur, or where applicable has occurred, regardless or in spite of any mitigation measures.

Once the impact criteria have been ranked for each impact, the significance of the impacts was calculated using the following formula:

$$\text{Significance} = (\text{Magnitude} + \text{Duration} + \text{Extent}) \times \text{Probability}$$

As is evident from the above equation, the extent (spatial scale), magnitude, duration (time scale) and the probability of occurrence of each identified impact was assigned a value according to the impact assessment criteria (presented in **Table 2**, above) and used to calculate the significance of each impact.

A Significance Rating was then calculated by multiplying the Severity Rating with the Probability. The maximum value that can be reached through the described impact evaluation process is 100 SP¹. The scenarios for each environmental impact were rated as High (SP≥60), Moderate (SP 31-60) and Low (SP<30) significance as shown in **Table 3**.

Table 3. Definition of significance rating.

¹SP: Significant Points.

Significance of predicted NEGATIVE impacts		
Low	0-30	Where the impact will have a relatively small effect on the environment and will require minimum or no mitigation.
Medium	31-60	Where the impact can have an influence on the environment and should be mitigated.
High	61-100	Where the impact will definitely influence the environment and must be mitigated, where possible.
Significance of predicted POSITIVE impacts		
Low	0-30	Where the impact will have a relatively small positive effect on the environment.
Medium	31-60	Where the positive impact will counteract an existing negative impact and result in an overall neutral effect on the environment.
High	61-100	Where the positive impact will improve the environment relative to baseline conditions.

Once the significance rating of an impact before mitigation has been determined, the reversibility of the impact, ‘replaceability’ of the affected resources and the potential of the impact to be further mitigated were also determined. These factors are explained in **Table 4** below and play an important role in the determination of the level and type of mitigation performed or to be implemented. **Table 4** sets out the criteria that were used to assess the reversibility, loss of resources and potential for further mitigation.

Table 4. Mitigation prediction criteria.

Reversibility of impact		
Reversible	1	The impact on natural, cultural and / or social structures, functions and processes is totally reversible.
Partially	2	The impact on natural, cultural and / or social structures, functions and processes is partially reversible.
Irreversible	3	Where natural, cultural and / or social structures, functions or processes are altered to the extent that it will permanently cease, i.e. impact is irreversible.
Irreplaceable loss of resources		
Replaceable	1	The impact will not result in the irreplaceable loss of resources.
Partially	2	The Impact will result in a partially irreplaceable loss of resources.
Irreplaceable	3	The impact will result in the irreplaceable loss of resources.
Potential of impacts to be mitigated		
High	1	High potential to mitigate negative impacts to the level of insignificant effects, or to improve management to enhance positive impacts.
Medium	2	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.
Low	3	Little or no mechanism exists to mitigate negative impacts.

5. TERRESTRIAL BIODIVERSITY RESULTS

5.1 Regional Vegetation and National Threatened Ecosystems

The study area is located within the Savannah Biome and the Central Bushveld Bioregion of South Africa. The specific vegetation types expected to occur on site have been classified as Central Sandy Bushveld (SVcb12) across most of the site, and a small section of Springbokvlakte Thornveld (SVcb15) (Figure 5) occurring in the extreme south of the project area. Both vegetation types are briefly described below, including expected species composition. Previously, the area within the Nyl floodplain was described as Subtropical Freshwater Wetlands, but this mapping category is no longer included in the 2018 version of the national vegetation map. Springbokvlakte Thornveld is considered Vulnerable in terms of the National List of Ecosystems that are Threatened and in Need of Protection (GN1002 of 2011) and according to the Terrestrial Ecosystem Threat Status and Protection Level (SANBI, 2018b) (Table 5).

Table 5. Threat status, protection level and endemism estimate of the vegetation types occurring within the study area following the Terrestrial Ecosystem Threat Status and Protection Level (SANBI, 2018b)

Vegetation type	Threat status	Protection level	Endemism estimate
Springbokvlakte Thornveld (SVcb15)	Vulnerable	Poorly Protected	Endemic
Central Sandy Bushveld (SVcb12)	Least Concern	Poorly Protected	Endemic

5.1.1 Central Sandy Bushveld (SVcb12)

Distribution

Limpopo, Mpumalanga, Gauteng and North-West Provinces: Undulating terrain occurs mainly in a broad arc south of the Springbokvlakte from the Pilanesberg in the west through Hammanskraal and Groblersdal to GaMasemola in the east. A generally narrow irregular band along the northwestern edge of the Springbokvlakte (including Modimolle) extending into a series of valleys and lower-altitude areas within the Waterberg including the upper Mokolo River Valley near Vaalwater, the corridor between Rankins Pass and the Doorndraai Dam, and the lowlands from the Mabula area to

south of the Hoekberge. Some isolated sandy rises are found on the Springbokvlakte. Altitude about 850–1 450 m.

Vegetation & Landscape Features

Low undulating areas, sometimes between mountains, and sandy plains and catenas supporting tall, deciduous Silver Terminalia (*Terminalia sericea*) and Wild Syringa (*Burkea Africana*) woodland on deep sandy soils (with the former often dominant on the lower slopes of sandy catenas) and low, broad-leaved *Combretum* woodland on shallow rocky or gravelly soils. Species of *Acacia* (*Vachellia* / *Senegalia*), *Ziziphus* and *Euclea* are found on flats and lower slopes on eutrophic sands and some less sandy soils. Umbrella Thorn (*Vachellia tortilis*) may dominate some areas along valleys. Grass-dominated herbaceous layer with relatively low basal cover on dystrophic sands.

Geology & Soils

The large southern and eastern parts of this area are underlain by granite of the Lebowa Granite Suite and some granophyre of the Rashoop Granophyre Suite (both Bushveld Complex, Vaalian). In the north, the sedimentary rocks of the Waterberg Group (Mokolian Erathem) are most important. Specifically, sandstone, conglomerate and siltstone of the Alma Formation and sandstone, siltstone and shale of the Vaalwater Formation. Well-drained, deep Hutton or Clovelly soils often with a catenary sequence from Hutton at the top to Clovelly on the lower slopes; shallow, skeletal Glenrosa soils also occur.

Climate

Summer rainfall with very dry winters. Effectively three seasons, namely a cool dry season from May to mid-August, a hot dry season from mid-August to about October and a hot wet season from about November to April. Mean Annual Precipitation (MAP) from about 500–700 mm. Frost fairly infrequent. Mean monthly maximum and minimum temperatures for Goedeheop (in the northern part of this vegetation unit) 35.3°C and –3.1°C for November and June, respectively.

Important Taxa

Tall Trees: *Senegalia burkei* (d), *Vachellia robusta*, *Sclerocarya birrea* subsp. *caffra*.

Small Trees: *Burkea africana* (d), *Combretum apiculatum* (d), *C. zeyheri* (d), *Terminalia sericea* (d), *Ochna pulchra*, *Peltophorum africanum*, *Rhus leptodictya*.

Tall Shrubs: *Combretum hereroense*, *Grewia bicolor*, *G. monticola*, *Strychnos pungens*.

Low Shrubs: *Agathisanthemum bojeri* (d), *Indigofera filipes* (d), *Felicia fascicularis*, *Lasiosiphon sericocephalus*.

Geoxylic Suffrutex: *Dichapetalum cymosum* (d).

Woody Climber: *Asparagus buehneri*.

Graminoids: *Brachiaria nigropedata* (d), *Eragrostis pallens* (d), *E. rigidior* (d), *Hyperthelia dissoluta* (d), *Panicum maximum* (d), *Perotis patens* (d), *Antheophora pubescens*, *Aristida scabrivalvis* subsp. *scabrivalvis*, *Brachiaria serrata*, *Elionurus muticus*, *Eragrostis nindensis*, *Loudetia simplex*, *Schmidtia pappophoroides*, *Themeda triandra*, *Trachypogon spicatus*.

Herbs: *Dicerocaryum senecioides* (d), *Barleria macrostegia*, *Blepharis integrifolia*, *Crabbea angustifolia*, *Evolvulus alsinoides*, *Geigeria burkei*, *Hermannia lancifolia*, *Indigofera daleoides*, *Justicia anagalloides*, *Kyphocarpa angustifolia*, *Lophiocarpus tenuissimus*, *Waltheria indica*, *Xerophyta humilis*.

Geophytic Herb: *Hypoxis hemerocallidea*.

Succulent Herb: *Aloe greatheadii*.

Biogeographically Important Taxa (Central Bushveld endemics)

Graminoid: *Mosdenia leptostachys*.

Herb: *Oxygonum dregeanum* subsp. *canescens* var. *dissectum*.

Remarks

Paperbark Thorn (*Vachellia sieberiana*) occurs in the transition zone with grassland in the east, while Common Hook-thorn (*Senegalia caffra*) and African Beech (*Faurea saligna*) are dominant in the transition zone to SVcb 17 Waterberg Mountain Bushveld in the western parts of this unit. Central Sandy Bushveld is similar to SVcb 16 Western Sandy Bushveld, but the former is generally moister and cooler and generally lacks species such as Blue Thorn (*Senegalia erubescens*) and Knob Thorn (*Senegalia nigrescens*). The climate seasons described above also apply to many other vegetation units of the Central Bushveld Bioregion. This vegetation unit includes probably the most intensively studied South African savanna field site of the South African Savanna Ecosystem Programme in the Nylsvley Nature Reserve (Limpopo Province).

5.1.2 Springbokvlakte Thornveld (SVcb15)

Distribution

Limpopo, Mpumalanga, North-West and Gauteng Provinces: Flats from Zebediela in the northeast to Hammanskraal and Assen in the southwest as well as from Bela-Bela and Mookgophong in the northwest to Marble Hall and Rust de Winter in the southeast. Altitude about 900–1 200 m.

Vegetation & Landscape Features

Open to dense, low thorn savanna dominated by *Acacia* species or shrubby grassland with a very low shrub layer. Occurs on flat to slightly undulating plains.

Geology & Soils

Rocks are part of the volcano-sedimentary Karoo Supergroup. Most abundant in the area are the mafic volcanics (tholeiitic and olivine basalts and nephelinites) of the Letaba Formation, then the mudstones of the Irrigasie Formation and the shale, with sandstone units, of the Eccia Group. Soils are red-yellow apedal, freely drained with high base status and self-mulching, black, vertic clays. The vertic soils, with a fluctuating water table, experience prolonged periods of swelling and shrinking during wet and dry periods, considerable soil cracking when dry, a loose soil surface, high calcium carbonate content and gilgai micro-relief.

Climate

Summer rainfall with very dry winters. MAP about 500–650 mm. Frost fairly infrequent in winter. Mean monthly maximum and minimum temperatures for Warmbaths–Towoomba are 35.2°C and –2.0°C for October and July, respectively. Corresponding values are 36.8°C and –1.2°C for Marble Hall for January and June, respectively.

Important Taxa

Small Trees: *Vachellia karroo* (d), *Senegalia luederitzii* var. *retinens* (d), *Senegalia mellifera* subsp. *detinens* (d), *Vachellia nilotica* (d), *Ziziphus mucronata* (d), *Vachellia tortilis* subsp. *heteracantha*, *Boscia foetida* subsp. *rehmanniana*.

Tall Shrubs: *Euclea undulata* (d), *Searsia engleri* (d), *Dichrostachys cinerea*, *Diospyros lycioides* subsp. *lycioides*, *Grewia flava*, *Tarchonanthus camphoratus*.

Low Shrubs: *Vachellia tenuispina* (d), *Ptycholobium plicatum*.

Succulent Shrub: *Kleinia longiflora*.

Herbaceous Climbers: *Momordica balsamina*, *Rhynchosia minima*.

Graminoids: *Aristida bipartita* (d), *Dichanthium annulatum* var. *papillosum* (d), *Ischaemum afrum* (d), *Setaria incrassata* (d), *Aristida canescens*, *Brachiaria eruciformis*.

Herbs: *Aspilia mossambicensis*, *Indigastrum parviflorum*, *Nidorella hottentotica*, *Orthosiphon suffrutescens*, *Senecio apiifolius*.

Biogeographically Important Taxon (Central Bushveld endemic)

Graminoid: *Mosdenia leptostachys*.

Remark

The high clay content of the soil increases soil moisture stress and SVcb 15 Springbokvlakte Thornveld is more xeric (having less available moisture) than adjacent vegetation units (except for SVcb 27 Sekhukhune Plains Bushveld in the extreme northeast).

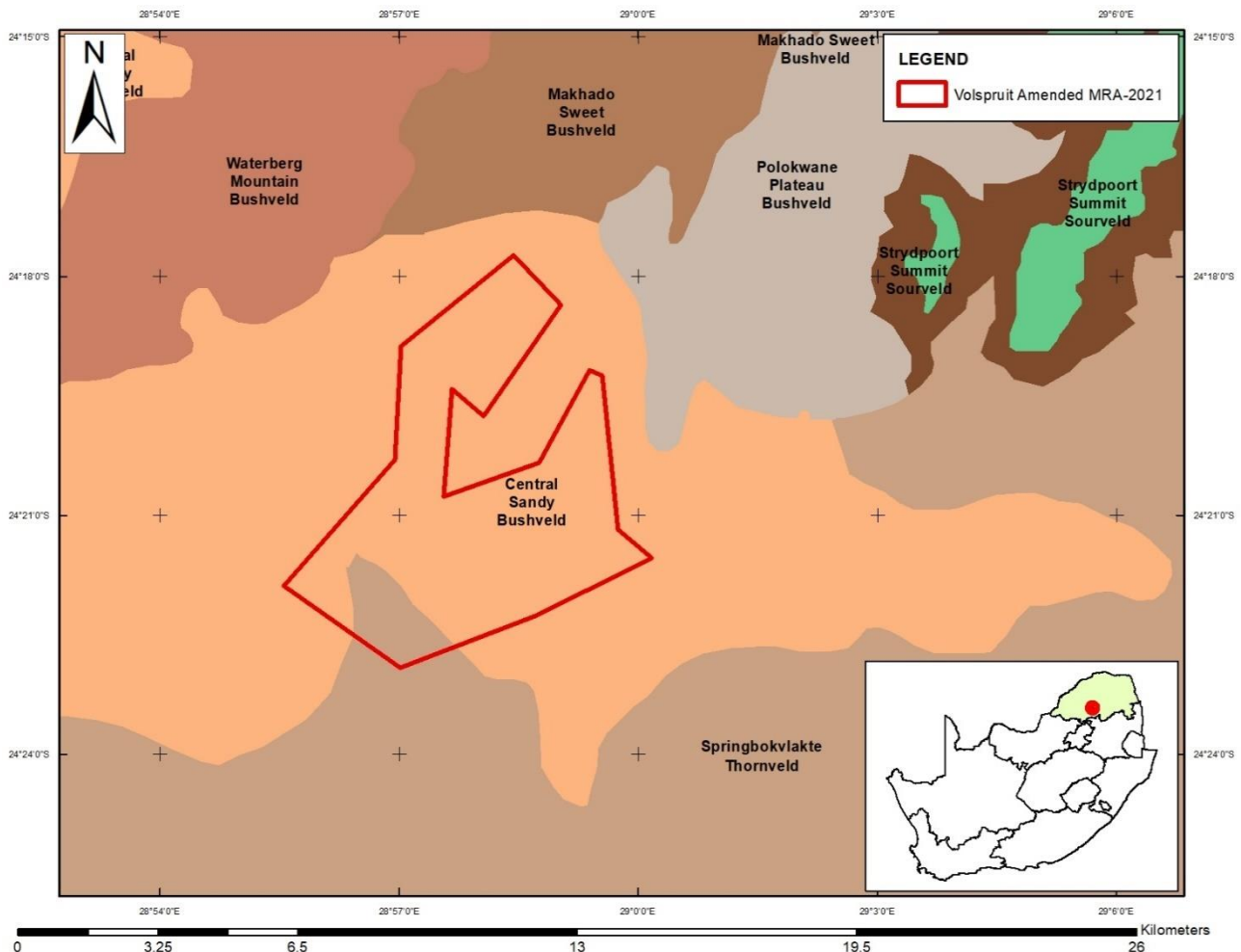


Figure 5: Map showing the regional vegetation of the area.

5.2 National Wetland Dataset, National Freshwater Ecosystem Priority Areas (NFEPA) and Ramsar Designation

The most recent national wetland dataset, the National Wetland Inventory 5 (CSIR, 2018), was consulted to provide an indication of the occurrence of wetland habitat on site and within the immediate area, as illustrated in Figure 6. Based on the National Wetland Map 5 a large Floodplain wetland associated with the Nyl River extends into the project study area. Only 2 further wetland types are highlighted as occurring within the general vicinity of the study area, namely Depression and Seep wetlands. However, it is noted that the National Wetland Map 5 dataset is based

predominantly on desktop and/or remote sensing data and as such must be considered Low Confidence data, especially at the scale of an individual project site. Field verification will thus be required to provide a more accurate representation of wetland extent and types on site.

The National Wetland Map 5 (CSIR, 2018) also determined the Ecosystem Threat Status (ETS) and Ecosystem Protection Level (EPL) for all wetland ecosystem types in South Africa. Threat categories for the wetland ecosystem types represented within the project study area and surrounds are indicated in Table 6.

Table 6. Wetland ecosystem type, and its assigned threat status category (Mbona *et al.*, 2015), occurring on site.

Wetland Ecosystem Type	Ecosystem Protection Level	Ecosystem Threat Status
Central Sandy Bushveld Bioregion (Floodplain)	Not Protected	Critically Endangered
Central Sandy Bushveld Bioregion (Depression)	Poorly Protected Least Concern	Least Concern
Central Sandy Bushveld Bioregion (Seep)	Not Protected	Critically Endangered

The greater Nylsvley wetland is approximately 65km long and varies in width from approximately 5km at its widest point to 100m at its narrowest (WRC Report TT441/09). Overall, it covers approximately 24 250 ha, which makes it the largest Floodplain vlei in South Africa (Rogers and Higgins, 1993). The Nylsvley Nature Reserve, a Ramsar wetland of international importance, is located along the floodplain and conserves a portion of the Floodplain. The location of the greater Nylsvley wetland showing the approximate extent of the floodplain as well as the location of the study area and the Nylsvley Nature Reserve is shown in Figure 6 as well.

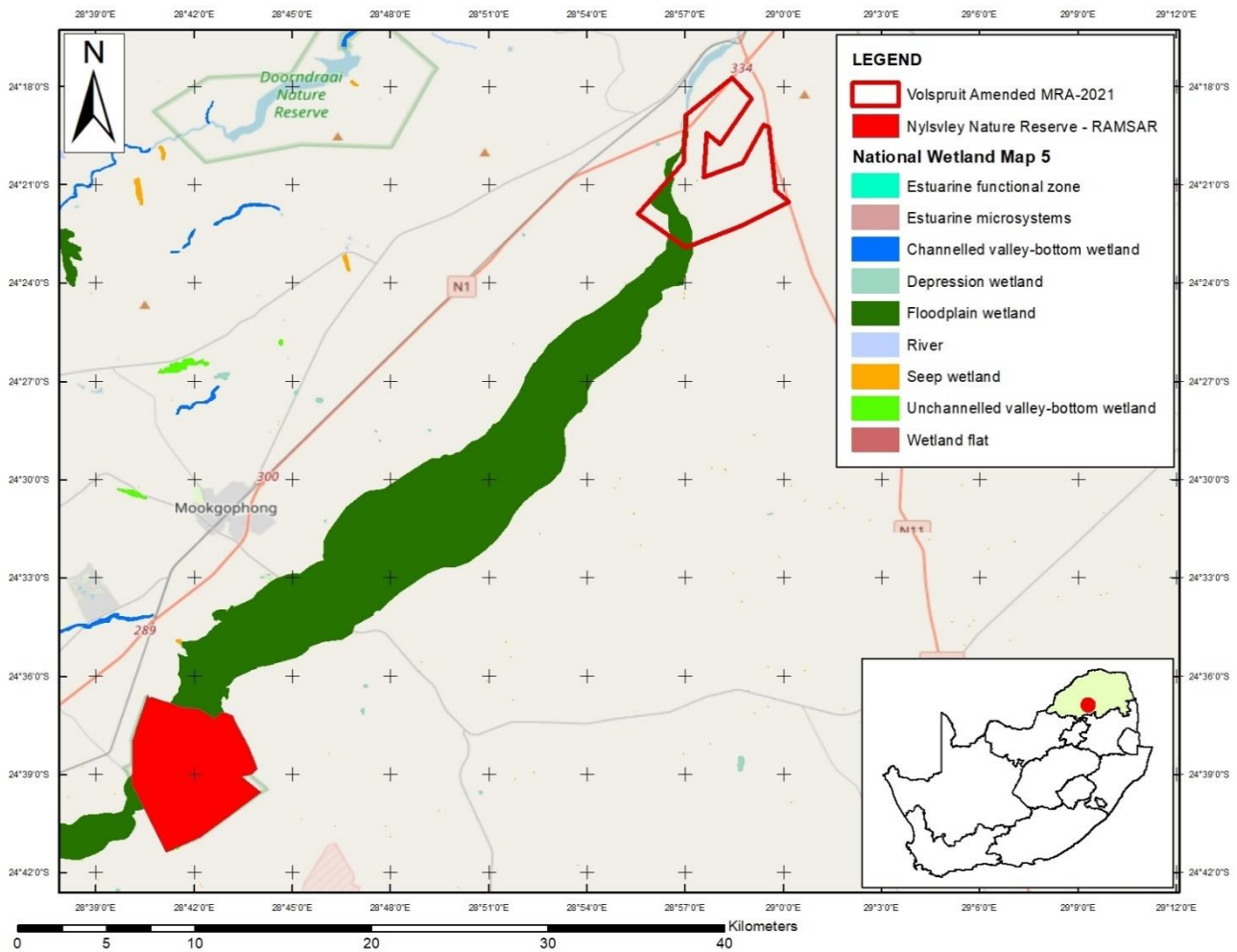


Figure 6. Extract of the National Wetland Map 5 for the project study area and surrounds, illustrating the study area in relation to the Nylsvley Nature Reserve.

An earlier iteration of the National Wetland Map was included in the National Freshwater Ecosystem Priority Areas Project (NFEPA), which culminated in the Atlas of Freshwater Ecosystem Priority Areas (Nel *et al.*, 2011). Freshwater Ecosystem Priority Areas (FEPAs) were identified through a systematic biodiversity planning approach that incorporated a range of biodiversity aspects such as ecoregion, current condition of habitat, presence of threatened vegetation, fish, frogs and birds, and importance in terms of maintaining downstream habitat. An extract of the FEPA wetlands and rivers datasets are provided in Figure 7. The Nyl River and associated wetland habitat are classified as a wetland FEPA. In addition, the study area lies within the catchment of the Nyl River which is classified as an Upstream Management Area which are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

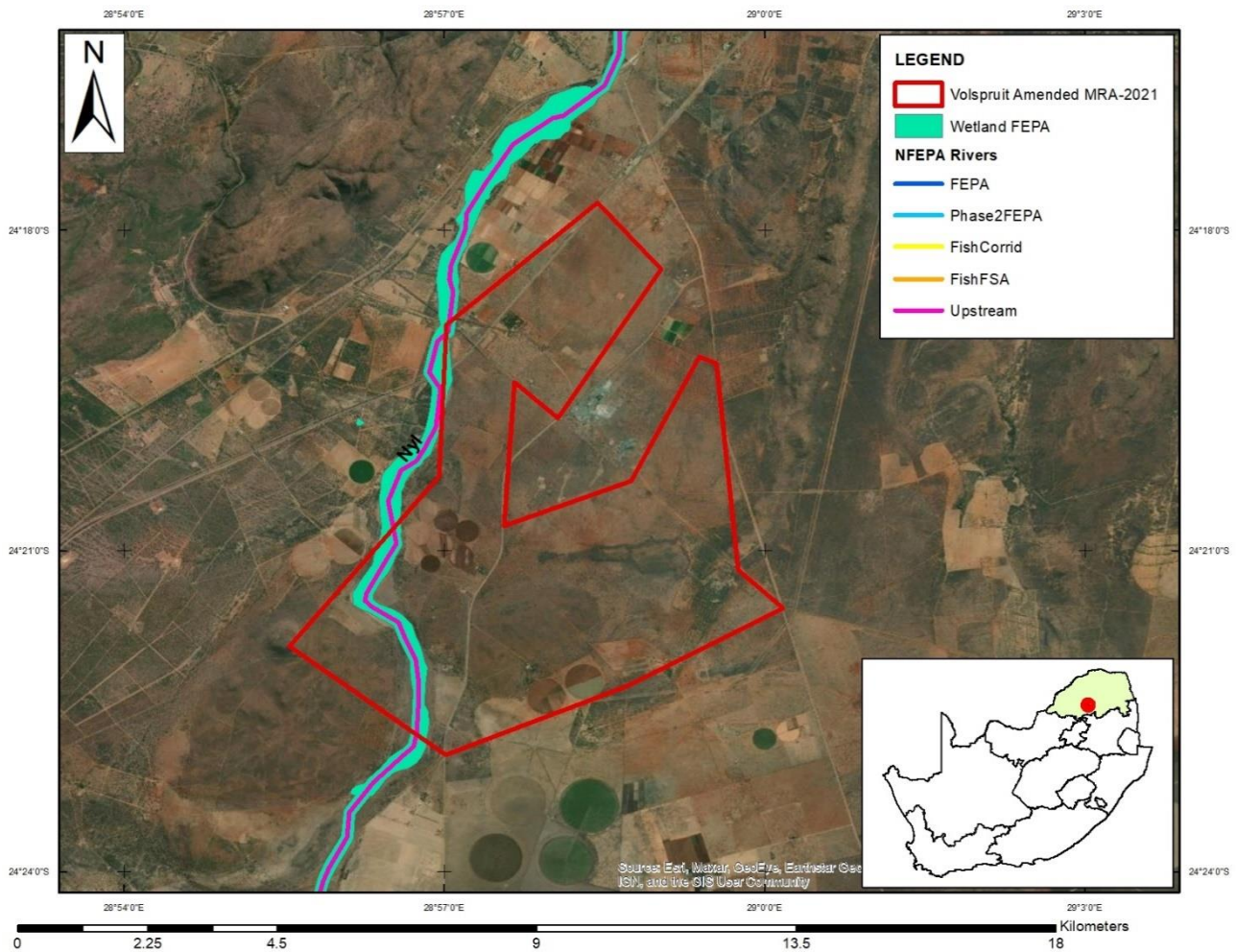


Figure 7: Extract of the Atlas of Freshwater Ecosystem Priority Areas for the study area (Nel et al., 2011).

5.3 Strategic Water Source Areas

Strategic Water Resource Areas (SWSAs) within South Africa were identified by Le Maitre, Seyler, Holland, Smith-Adao, Nel, Maherry, and Witthüser, (2018) as part of a Water Research Commission Project (Report No. TT 743/1/18) and are defined by the authors “as areas of land that either: (a) supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; or (b) have high groundwater recharge and where the groundwater forms a nationally important resource; or (c) areas that meet both criteria (a) and (b).”

Figure 8 below shows the amended Volspruit MRA in relation to the delineated Strategic Water Source Areas (Le Maitre et al., 2018). The project study area falls within the Nyl & Dorps River Valley Groundwater Strategic Water Source Area. This highlights the area as being nationally important

due to a high groundwater availability and due to the fact that the available groundwater forms an important resource for water supply.

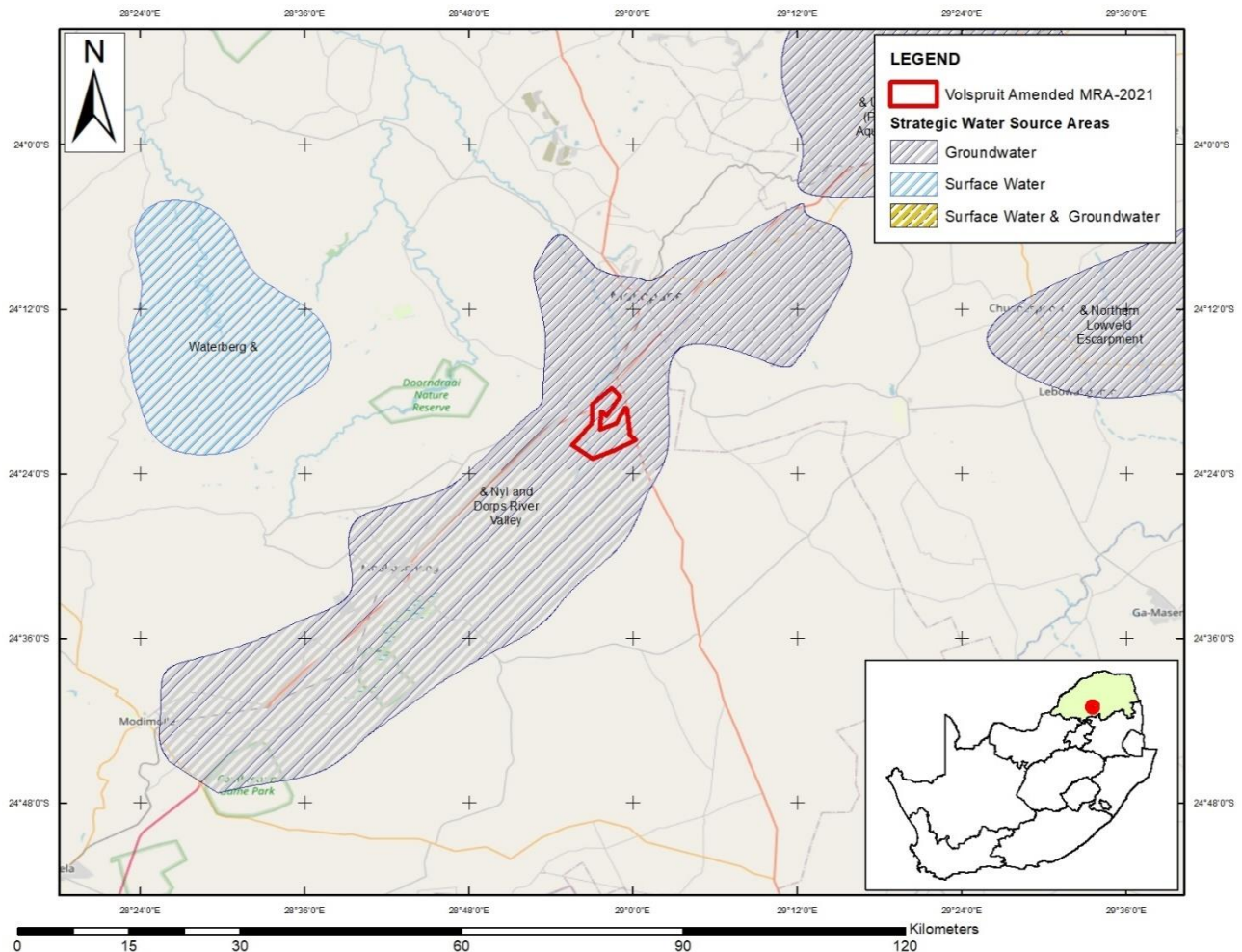


Figure 8. Map showing the project study area in relation to Strategic Water Source Areas (Le Maitre *et al.*, 2018). The project study area falls within the Nyl & Dorps River Valley Groundwater Strategic Water Source Area.

5.4 Provincial Conservation Plan

An extract of the Limpopo Conservation Plan (Desmet, Holness, Skowno and Egan, 2013), as updated for the area through the Waterberg District Bioregional Plan (LEDET, 2016) shows the bulk of the project study area being classified as a Critical Biodiversity Area 1 (2784 ha), with smaller areas classified as Ecological Support Area 2 (238 ha) or No Natural Habitat Remaining (307 ha) (Figure 9). Desmet *et al.* (2013) specifically highlight the Nylsvley Nature Reserve and the entire Nyl floodplain, which lies at the eastern foothills of the Waterberg Plateau, as being nationally unique. The area has exceptionally high bird diversity and bird numbers primarily due to the presence of this

RAMSAR wetland and is home to the Near Threatened Giant bullfrog (*Pyxicephalus adspersus*), and other threatened species. The Nyl River floodplain is one of South Africa's largest inland floodplain systems. The abstraction of water for agriculture upstream of the wetland has significantly reduced the hydrological functioning of the wetland system. Currently, expansion of mining within the floodplain severely threatens this globally important wetland system.

The following definitions for CBAs and ESAs are provided according to Desmet *et al.* (2013) and LEDET (2016):

Critical Biodiversity Areas are areas of the landscape that need to be maintained in a natural or near-natural state in order to ensure the continued existence and functioning of species and ecosystems. In other words, if these areas are not maintained in a natural or near-natural state then biodiversity targets cannot be met. Maintaining an area in a natural or near-natural state can include a variety of biodiversity-compatible land uses and resource uses. CBA1, which encompasses the majority of the site includes irreplaceable sites and critical linkages in biodiversity corridors, and are considered "irreplaceable" or "must have" sites that must remain in good ecological condition if biodiversity targets are to be achieved (LEDET, 2016). Critical Biodiversity Area 2 (CBA2) lie outside of, but immediately adjacent to the MRA. CBA2 sites are also required to meet biodiversity pattern targets, however, the features represented in these areas are more widespread or not threatened, and there are choices as to where in the landscape targets for these features can be achieved. These are considered "optimal" sites as there are alternative sites available to meet targets (LEDET, 2016). The critical biodiversity areas that cover the MRA were previously split between CBA1 and CBA2 according to the Limpopo Conservation Plan Version 2 (LCPv2 released in 2013), but subsequently all critical biodiversity areas within the MRA have been upgraded to CBA1 according to the more recent Waterberg District Bioregional Plan (LEDET, 2016) dataset ("*Limpopo_CBA_2018_merged_ALBERS*").

The CBA1 areas currently extending across the MRA have been allocated as such to meet a variety of biodiversity targets as efficiently as possible, and as such any given area may contribute towards meeting a range of feature targets. In the case of the MRA, the CBA1 areas have been classified as such due to the following considerations and biodiversity targets:

- **Conservation farms and private nature reserves** – the MRA supports or lies in close proximity to several private nature reserves (see Section 5.5).
- **Designed Ecological Corridor layer** – Ecological corridors, also referred to as biodiversity corridors, can be landscape structures of various size, shape and habitat composition that maintain, establish or re-establish natural landscape connectivity. They can have a continuous or interrupted structure or a structure of stepping stones (LEDET, 2016). Maintaining connectivity is critical for long-term persistence of biodiversity in the face of on-

going climate change. Connected natural landscapes allow biodiversity to respond and adapt to the impacts of climate change.

- **FEPA and Wetland: Wetland FEPA** - FEPA rivers and wetlands are considered important due to their present ecological state; their representation of the diversity of river ecosystems; and, presence of rare/threatened biodiversity (see Section 5.2).
- **Important Bird Area: Nyl River Floodplain** - identified due to the large number of waterbirds that occur in the floodplain. During flood periods more than 80 000 bird individuals can be found. The floodplain is one of the most important waterbird breeding areas in South Africa. See Section 5.7.
- **River corridors** - These corridors provide important landscape-level connectivity in the landscape that support both river/hydrological processes as well as terrestrial ecosystem processes (e.g. species movement). Maintaining landscape connectivity through a defined corridor network is a cornerstone of a climate change adaptation strategy (LEDET, 2016).
- **VEG SANBI: Central Sandy Bushveld, Springbokvlakte Thornveld, and Subtropical Freshwater Wetlands** – Inclusion of the various vegetation types ensures that biodiversity targets are met and adequate levels of protection are achieved. See Section 5.1.

Ecological Support Areas are areas that are not essential for meeting biodiversity representation targets/thresholds but which nevertheless play an important role in supporting the ecological functioning of CBAs or protected areas, or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration. The degree of restriction on land use and resource use in these areas may be lower than that recommended for CBAs.

According to Desmet *et al.* (2013), it is recommended that land uses including quarrying and opencast mining (includes surface mining, dumping & dredging) are not biodiversity compatible and ideally should not be permitted or are actively discouraged activities in all CBAs and ESAs.

A specific outcome of this terrestrial biodiversity assessment is to verify the CBAs mapped for the study area as part of the Waterberg District Bioregional Plan (LEDET, 2016).

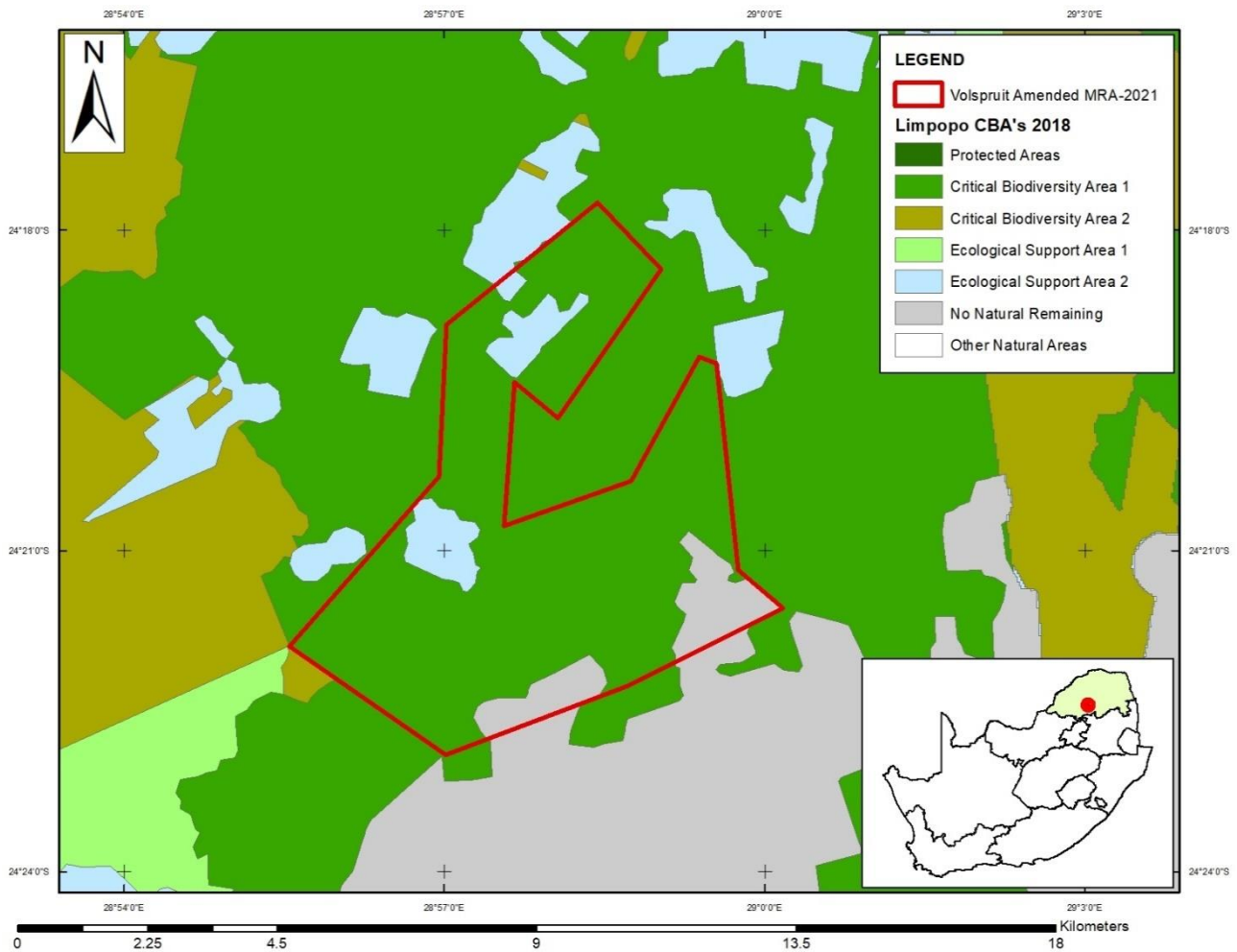


Figure 9: Extract of the Limpopo Conservation Plan for the study area.

5.5 National Protected Areas

“While the primary roles of the protected area network are representation of all ecosystems, ecological sustainability and climate change resilience, protected areas also deliver significant socio-economic benefits, especially in rural areas, thus contributing to South Africa’s overall development goals.” (Department of Environmental Affairs, 2016)

The definition of protected areas according to the National Environmental Management: Protected Areas Act, (Act 57 of 2003) sets out the “System of Protected Areas”, which consists of the following kinds of protected areas -

1. Special nature reserves,
2. National parks,
3. Nature reserves and

4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003);
5. World heritage sites declared in terms of the World Heritage Convention Act;
6. Marine protected areas declared in terms of the Marine Living Resources Act;
7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and
8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970). Private nature reserve means privately owned land declared as a nature reserve under section 23 of the National Environmental Management: Protected Areas Act, 2003.

Several declared private nature reserves lie partially within or immediately adjacent to the study area (Figure 10), namely:

- Doelen Private Nature Reserve (extending partially into the Volspruit MRA in the south);
- Webtex Estates Private Nature Reserve;
- Naboom Private Nature Reserve;
- Palmer Private Nature Reserve; and
- Somerset Private Nature Reserve.

“Private nature reserve” means privately owned land declared as a nature reserve under section 23 of the National Environmental Management: Protected Areas Act, 2003.

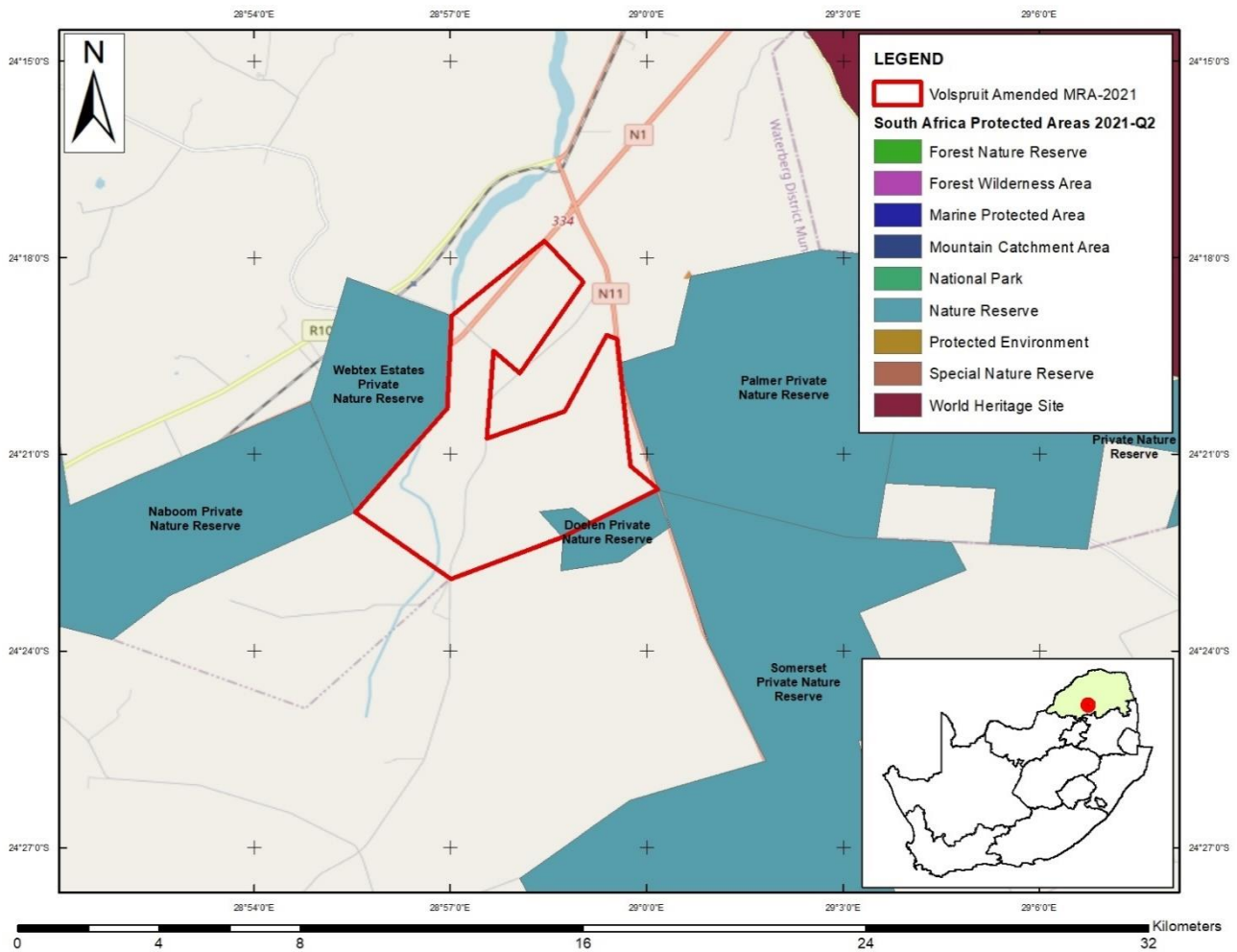


Figure 10. Extract of the South Africa Protected Areas Database for the MRA.

5.6 National Protected Areas Expansion Strategy (NPAES)

The goal of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES has set targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large, protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the initial development of the National Protected Area Expansion Strategy 2008 (NPAES), which has been revised and updated in full nationally in 2018 (Department of Environmental Affairs, 2018). The focus areas present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with

strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems.

The 2018 NPAES dataset indicates that a NPAES focus area overlaps with the southwestern corner of the MRA (Figure 11). According to an earlier iteration of the strategy (Department of Environmental Affairs, 2016), the Nylsvlei (and adjacent Makapan) area is a high value site which is under threat and has therefore been prioritised. *“The Limpopo priority areas comprehensively target the full range of biodiversity features in the province including under-protected terrestrial and freshwater ecosystems, landscape corridors and major areas important for threatened species”* (Department of Environmental Affairs, 2016).

These areas should not necessarily be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints, and opportunities.

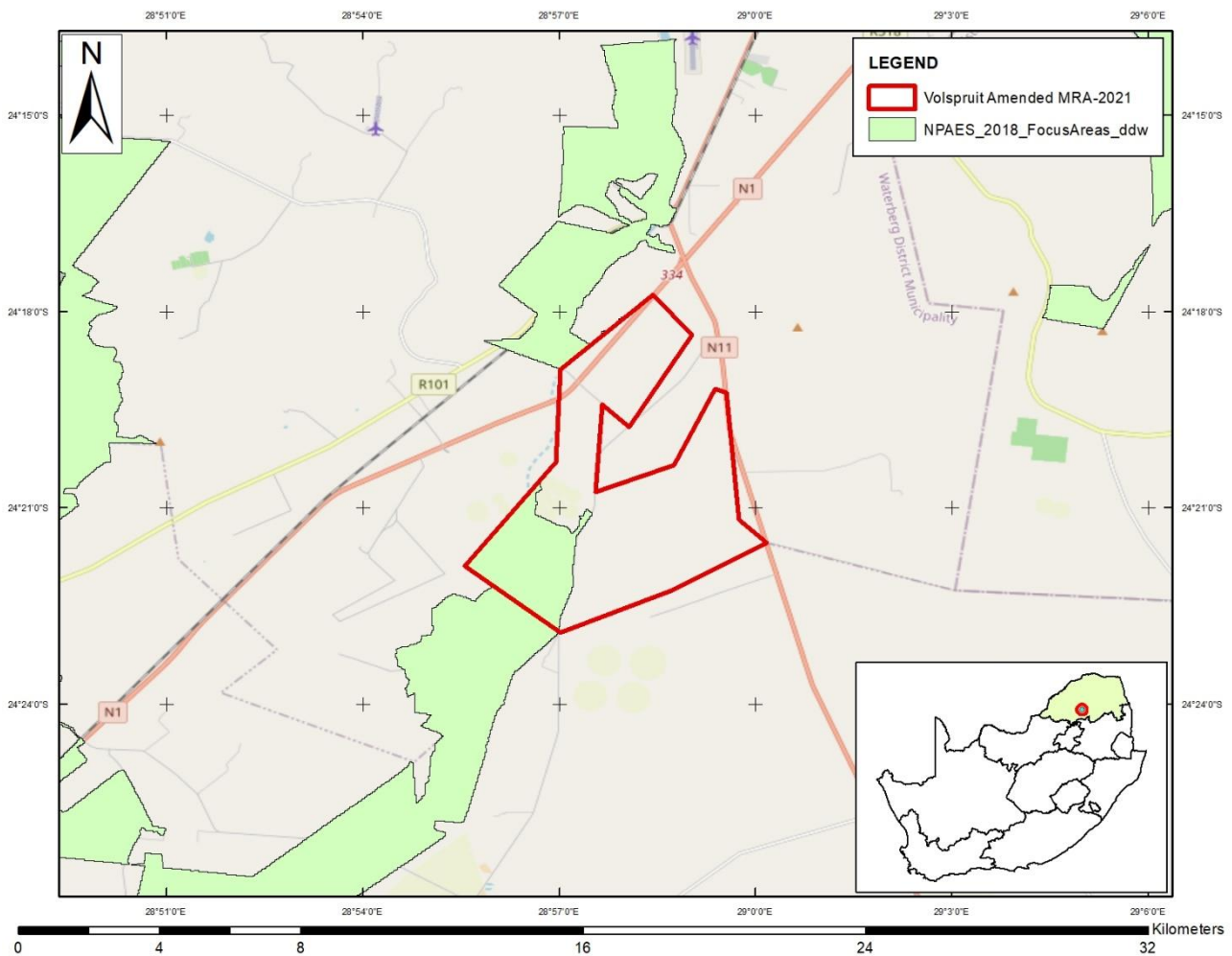


Figure 11. Extract of the National Protected Areas Expansion Strategy Focus Areas (2018) for the study area.

5.7 Important Bird and Biodiversity Areas (IBA's)

Marnewick, Retief, Theron, Wright & Anderson (2015) define IBA's as "sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative and scientifically agreed criteria. The criteria are based on the presence of threatened species, assemblages of restricted-range and biome-restricted species, and large concentrations of congregatory species, referred to collectively as IBA 'trigger' species. Birds have been shown to be effective indicators of biodiversity hotspots, and so IBAs hold a large and representative proportion of other taxa too. Therefore, the conservation of IBAs ensures both the survival of a correspondingly large variety and abundance of other biodiversity and the integrity of ecosystem services that also support human well-being."

The Nyl River Floodplain is a Global IBA and meets the following IBA Criteria:

- A1: Globally Threatened Species - The site regularly holds significant numbers of a globally threatened species, or other species of global conservation concern.
- A3: Biome Restricted Assemblages - The site is known or thought to hold a significant component of a group of species whose distributions are largely or wholly confined to one biome.
- A4: Congregations – The Nylsvley River Floodplain qualifies on the following criteria:
 - i.) The site is known or thought to hold, on a regular basis, >1% of the Afro-tropical population of a congregatory waterbird species.
 - iii.) The site is known or thought to hold, on a regular basis, >20 000 waterbirds.

According to the Waterberg District Bioregional Plan (LEDET, 2016), “*The Nyl River Floodplain Important Bird Area was identified due to the large number of waterbirds that occur in the floodplain. During flood periods more than 80 000 bird individuals can be found. The floodplain is one of the most important waterbird breeding areas in South Africa.*” It supports several threatened species, such as the Vulnerable African grass owl (*Tyto capensis*) and Secretary bird (*Sagittarius serpentarius*), and the Near Threatened Black-winged pratincole (*Glareola nordmanni*). Barred wren-warbler (*Calamonastes fasciolatus*), Burchell's starling (*Lamprotornis australis*), Kurrichane thrush (*Turdus libonyanus*) and White-bellied sunbird (*Cinnyris talatala*) are also Least Concern biome-restricted birds that are present.

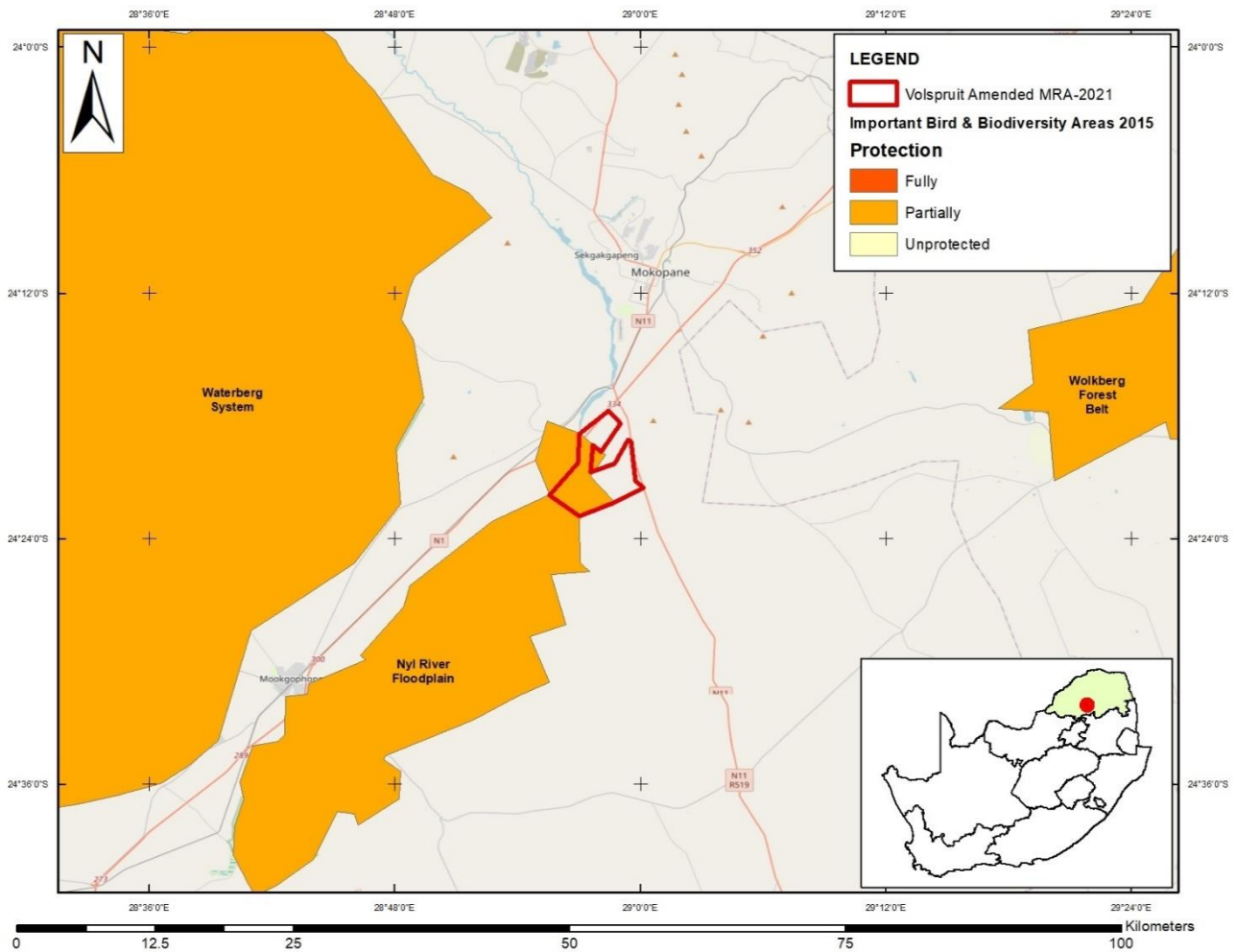


Figure 12. Extract of the Important Bird and Biodiversity Area's (IBA's) for the Volspruit MRA.

5.8 Mining and Biodiversity

Spatial biodiversity planning has supported the identification of biodiversity priority areas that are important for conserving a representative sample of ecosystems and species, for maintaining ecological processes, or for the provision of ecosystem services (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute, 2013). These biodiversity priority areas take into account categories, such as:

- Protected areas
- World Heritage Sites and their legally proclaimed buffers
- Critically endangered and endangered ecosystems
- Critical Biodiversity Areas

- River and wetland Freshwater Ecosystem Priority Areas (FEPAs), and 1km buffer of river and wetland FEPAs
- Ramsar Sites
- Protected area buffers
- Transfrontier Conservation Areas (remaining areas outside of formally proclaimed PAs)
- High water yield areas
- Coastal Protection Zone
- Estuarine functional zones
- Ecological support areas
- Vulnerable ecosystems
- Focus areas for land-based protected area expansion and focus areas or offshore protection.

The previous sections highlight that many of the above categories intersect with the amended Volspruit MRA.

Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, and South African National Biodiversity Institute (2013) groups the biodiversity priority areas into four categories according to their biodiversity significance and implications for mining (Legally Protected, Highest Biodiversity Importance, High Biodiversity Importance, and Moderate Biodiversity Importance). The amended Volspruit MRA intersects in the west with an area designated “Highest Biodiversity Importance” and with a small area designated “High Biodiversity Importance” (Figure 13). The majority of the north pit, a small area of the south pit and areas of surface infrastructure fall within the areas classified as “Highest Biodiversity Importance”.

Highest Biodiversity Importance Areas include critically endangered and endangered ecosystems, Critical Biodiversity Areas (or equivalent areas) from provincial spatial biodiversity plans, river and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs, and Ramsar Sites. These areas pose the highest risk to mining. Environmental screening, environmental impact assessment (EIA) and their associated mining specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licences, and environmental authorisations. *If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services.* These areas are viewed as necessary to ensure

protection of biodiversity, environmental sustainability, and human well-being. An EIA should include the strategic assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. This assessment should fully take into account the environmental sensitivity of the area, the overall environmental and socio-economic costs and benefits of mining, as well as the potential strategic importance of the minerals to the country. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts and may specify biodiversity offsets that would be written into licence agreements and/or authorisations.

High Biodiversity Importance Areas include protected area buffers (including buffers around National Parks, World Heritage Sites and Nature Reserves), Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas), other identified priorities from provincial spatial biodiversity plans, High water yield areas, Coastal Protection Zone, estuarine functional zone. These areas pose a high risk to mining. These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and limitations for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.

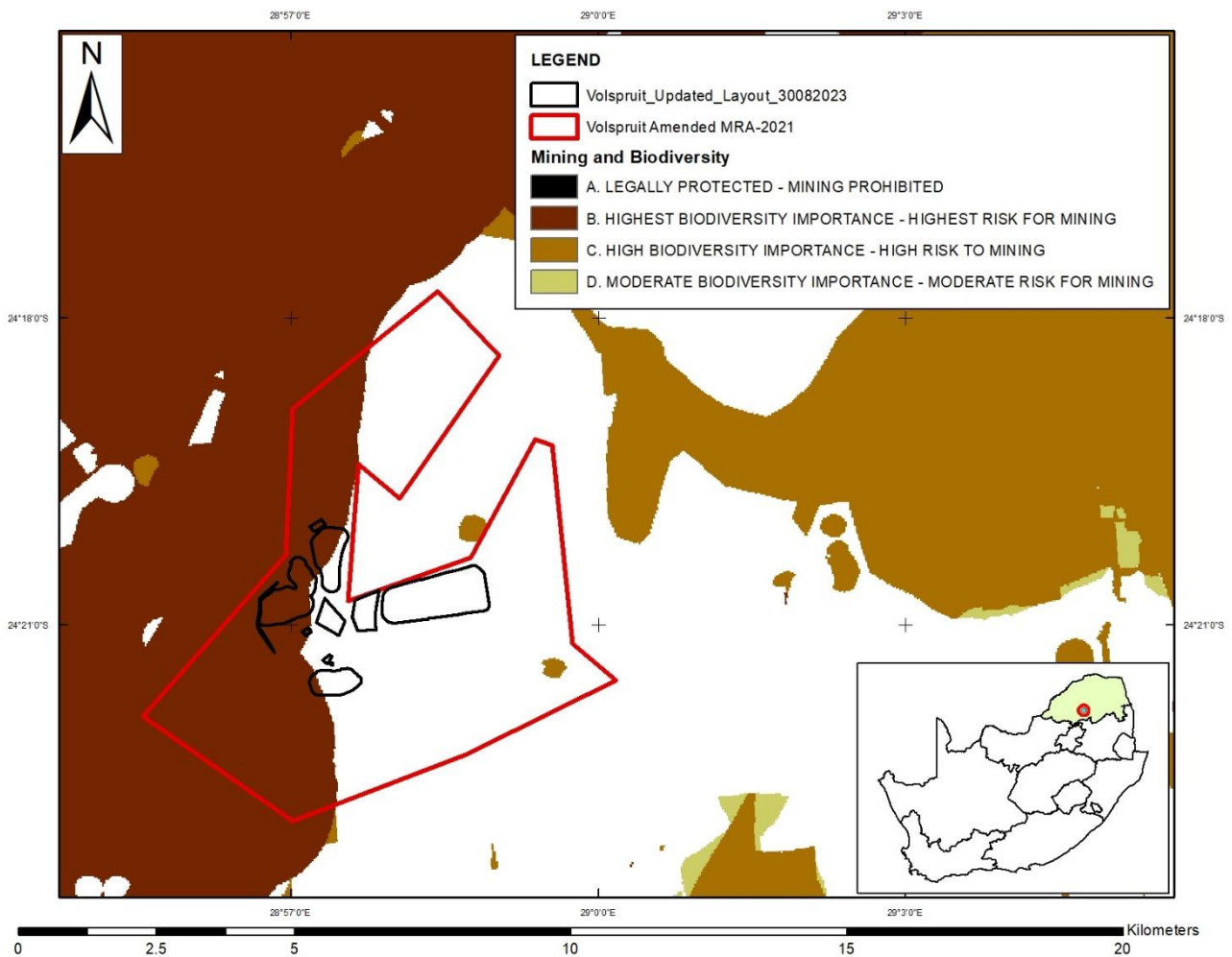


Figure 13. Extract of the Mining and Biodiversity Dataset for the amended MRA.

5.9 System Ecology

The study area supports two broad ecosystems or habitats that have distinct ecological drivers and support various ecological processes and functioning, namely vegetation units of the Savanna biome and the large Floodplain wetland associated with the Nyl River.

According to Low and Rebelo (1996) Savanna is characterized by a grassy ground layer and a distinct upper layer of woody plants. Important ecological drivers that play a role in delimiting this biome, but also in encouraging its spatial diversity include climate (temperature, rainfall volume and seasonality), geology, fire and herbivory. A major factor delimiting the biome is the lack of sufficient rainfall which prevents the upper layer from dominating, coupled with fires and grazing, which keep the grass layer dominant (Low and Rebelo, 1996). Important pressures within Savanna include overgrazing, which can lead to reduced vegetation cover, altered species composition, increased woody species coverage, reduced biodiversity, and increased erosion risk, and alteration to the natural fire regime, which can lead to changes in species composition, enhancement of bush

encroachment, decline in basal cover and soil erosion. Other detrimental impacts include habitat fragmentation, vegetation clearing (primarily for cultivation), climate change and illegal harvesting. Land use changes that lead to a reduction in the extent of natural habitat, cause fragmentation of remaining habitat, or alter the natural fire and herbivory patterns within Savanna would affect one or more of the ecosystem's drivers and would also impact on ecological processes in the system, such as primary production, nutrient cycling, and natural disturbance regimes. Consequently, the functionality of this ecosystem would be affected.

Wetlands can be considered as significant landscape features and habitats critical to ecosystem functioning. They provide numerous important ecosystem services, such as flood attenuation, streamflow regulation, carbon storage, water quality enhancement, resource provision, and biodiversity maintenance through habitat provision and their importance (alongside other watercourses) as ecological corridors providing connectivity between other ecosystems or habitats. The importance of the Nylsvley floodplain is highlighted in its classification as a FEPA wetland and the designation of the Nylsvley Nature Reserve, which encompasses a section of the Nylsvley Floodplain, as a Ramsar wetland of international importance (see Section 5.2 for further details). In terms of larger hydrological processes, the study area falls within the Nyl & Dorps River Valley Groundwater Strategic Water Source Area. This highlights the area as being nationally important due to a high groundwater availability and due to the fact that the available groundwater forms an important resource for water supply (see Section 5.3). The wetlands on site are expected to support a relatively high species diversity. In particular, the ephemeral nature of the wetland and the kind of vegetation and microhabitats it provides account for the floodplain being attractive to a wide variety of wetland bird species, many of which breed in large numbers in years of suitable rainfall (Marnewick *et al.* 2015).

Changes in the functionality of wetland habitats can often be driven by changes to the supporting hydrology. According to Marnewick *et al.* (2015) the Nylsvley floodplain is the largest wetland of its kind in South Africa and is a grass-dominated, seasonally inundated floodplain, that requires precipitation of at least 10% above the annual mean to produce significant inundation. In years of poor rainfall, it may not flood at all. This suggests that a reduction in precipitation (both directly onto the wetland and within its supporting catchment) could have a significant negative impact on the persistence of the Nylsvley Floodplain as it currently exists. Human-driven changes that are likely to reduce catchment flow inputs to the wetland include (but are not limited to) water abstraction in the catchment (primarily for agricultural purposes), flow impoundment in dams and other impoundments upstream and within tributaries, and any other activities that threaten the surface and groundwater resources that support the wetland. Changes to the characteristics of the wetland could lead to a reduction in its ability to function optimally and facilitate important ecological processes

such as primary production, nutrient cycling, water purification, biotic interactions, and population dynamics, to name a few.

5.10 Habitat Classification

Based on the desktop mapping and field survey, the study area was found to support several differing vegetation or habitat types, including wetlands, savanna, dense woodland, koppies and transformed or degraded areas in which human activity has negatively affected the integrity of the vegetation, resulting in a complete loss of, or change in, vegetation.

Each of these habitats is expected to support a range of different species, as well as a number of species adapted specifically to the ecotones between habitats. Figure 14 illustrates a primarily botanical habitat classification for the site, and each broad vegetation unit is discussed in greater detail in the following sections.

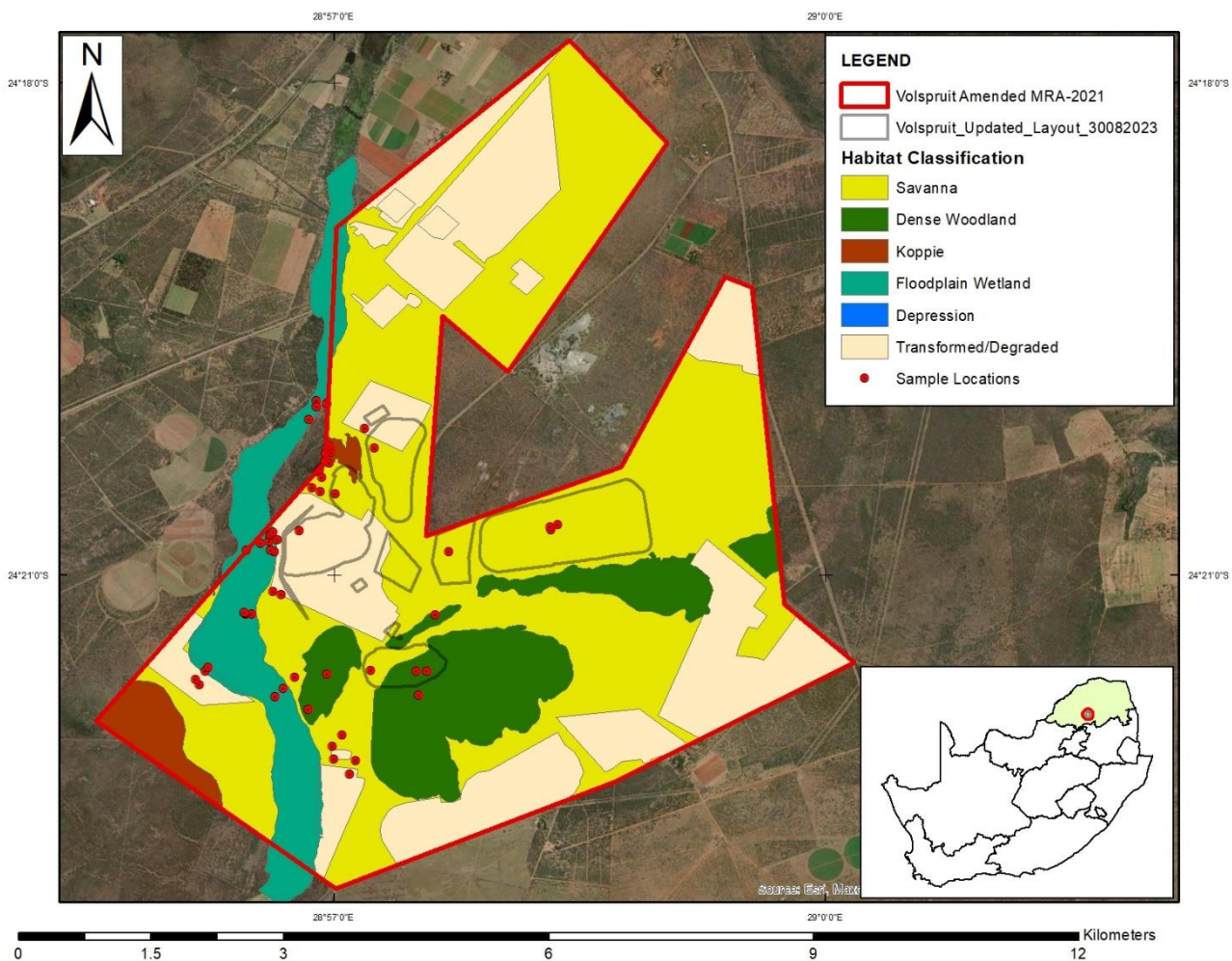


Figure 14. Habitat classification within the amended Volspruit MRA.

5.10.1 Savanna

Savanna vegetation typical of the Central Sandy Bushveld vegetation unit covers large areas of the site. The terrain is flat to gently sloping and the soils are predominantly red sands of varying depth. The vegetation is open bushveld/savanna with a relatively well developed, graminoid-dominated basal layer interspersed with woody shrubs and small to medium sized trees. Common woody species include species of *Acacia* (*Vachellia*/*Senegalia*) and *Combretum*, *Ziziphus mucronata*, *Searsia pyroides*, *Grewia flava*, and *Searsia lancea*, amongst others.

In the extreme south of the site, to the east of the Nyl River, a small area of Springbokvlakte Thornveld (Vulnerable) was confirmed to occur. It lies completely outside of the proposed mining infrastructure footprint and is not expected to be affected by the proposed mining activity in any significant way. The Springbokvlakte Thornveld is characterised by flat terrain and dark vertic soils and the tree species *Vachellia tortilis* dominates the woody vegetation. The basal layer is grass dominated with good cover. In areas of disturbance, the grass *Cenchrus ciliaris* dominates the ground cover.

Avifaunal species such as the Tawny Eagle (*Aquila rapax*, Endangered), Lanner Falcon (*Falco biarmicus*, Vulnerable), Marabou Stork (*Leptoptilos crumenifer*, Near Threatened) and European Roller (*Coracias garrulus*, Near Threatened) could occur in, or utilise this habitat (Enviro-Insight, 2022b). The Secretarybird (*Sagittarius serpentarius*, Vulnerable) was confirmed on site utilising transformed habitat for foraging purposes but is also anticipated to utilise intact grassland with scattered trees and shrubs, as is found within the intact savanna habitat in the region, for foraging and roosting/breeding purposes.

Figure 15 provides photographs of the savanna habitat encountered within the study area.



Figure 15: Photographs of savanna habitat observed within the vicinity of the project infrastructure layout (Bottom right shows Springbokvlakte Thornveld vegetation).

5.10.2 Dense Woodland

Dense woodland habitat units occur as discrete patches within the broader savanna vegetation that occurs extensively across the study area. The dense woodland habitat observed on site conforms with the low, broad-leaved *Combretum* woodland described as occurring within the Central Sandy Bushveld vegetation type (SANBI, 2018). The woodland is dominated by moderately dense *Combretum apiculatum* occurring on shallow, gravelly to rocky low hills with occasional small rocky crests (though instances of this habitat occurring on flatter terrain were observed). Species of *Searsia* and *Vachellia/Senegalia* trees are also present at low densities within the *Combretum* dominated woodland. The basal layer is grass dominated with low to moderate grass cover. According to the herpetofauna assessment (Enviro-Insight, 2022a), this habitat is suitable for Sensitive species 12, but is not considered ideal due to a lack of large boulders to form good refugia. The avifauna assessment (Enviro-Insight, 2022b) noted that species such as the Tawny Eagle (*Aquila rapax*, Endangered), Lanner Falcon (*Falco biarmicus*, Vulnerable), Abdim's Stork (*Ciconia*

abdimii, Near Threatened), and European Roller (*Coracias garrulus*, Near Threatened) all have a medium probability of utilising the woodland habitat, though these bird species forage widely and cannot be considered explicitly reliant on this habitat.

Disturbance within this habitat includes clearing of vegetation along access tracks and fence lines and within the footprint of homesteads. Figure 16 provides photographs illustrating typical, *Combretum*-dominated dense woodland within the study area.



Figure 16: Photographs of dense woodland habitat observed within the vicinity of the project infrastructure layout.

5.10.3 Koppies

The koppies present within the study area are distinguished from dense woodland on low hills based primarily on slope (as established in the herpetofauna assessment compiled by Enviro-Insight, 2022a). Hills with a slope greater than 5° (8.8%) were classified as koppies. As such, the koppie habitat is characterised by dense woodland on steeper sloping, rocky terrain with shallow, red soils. The vegetation consists of a well-developed woody canopy and low to moderate basal coverage

including grasses, forbs and succulents. The woodland on the koppie to the east of the Nyl River, is characterised by species such *Combretum apiculatum*, *Combretum molle*, species of *Vachellia/Senegalia* and *Grewia*, *Croton gratissimus*, and *Commiphora mollis*. The koppies on site introduce spatial heterogeneity into the landscape due to the differing aspects, slopes and altitudes present, all contributing to differing soil, light, temperature and hydrological conditions. This increased habitat diversity supports greater faunal and floral diversity both within the koppie habitat and across the greater landscape. The koppies on site have a high probability of supporting a herpetofauna SCC (Sensitive species 12) due to the presence of suitable rocky habitat on the slopes (Enviro-Insight, 2022a).

Disturbance is limited to small areas of vegetation clearing along tracks, fence lines, and in the case of the north-eastern koppie, at the summit and in a small rock borrow pit on the side slope. Figure 17 includes photographs of this habitat type observed on site.



Figure 17: Photographs of koppie habitat observed within the study area (Bottom right shows the profile of the southwest koppie in the distance).

5.10.4 Wetlands

A significant natural feature on site is the Nyl River and associated Floodplain wetland that flows along the western boundary of the MRA from south to north, and which provide a spectrum of habitats, from open water within the channel, dense reed beds along and within the channel, and moist tall and short grassland within both the seasonally and temporarily inundated edges of the Floodplain (WCS, 2012). This wetland is an important hydrological feature in the general area with importance for agriculture and domestic water supply, as well as being of high biodiversity importance well beyond the current study area, as it provides an important forage and water resource which attracts a large variety of species, particularly aquatic and avifaunal species, and acts as an important natural corridor and linear migratory route. Within the context of the greater Nyl River floodplain, the section of floodplain on site represents approximately 1.57 % of the entire Nyl floodplain (WCS, 2022).

Within the study area, the southern reaches of the Floodplain are characterised by a broad, flat, grassed wetland with no defined channel observed in these areas, as is the case with large portions of the greater Nyl Floodplain to the south of the site. Zonation of the vegetation on site does however indicate that the central region of the Floodplain is inundated more frequently and that most surface flows will be confined to this section. This central section of the Floodplain is dominated by a variety of short to tall sedges and grass species. As one moves outward from the centre of the floodplain the sedges then make way for a grass dominated community. The outer edges are expected to be inundated only during larger flood events, though the soils would still become saturated for short periods during most years, as indicated by the presence of many facultative wetland grass species. Several dams impound flows within the wetland onsite and at the time of the site visit in February 2022, open water was present in these dams and shallow surface water was evident across much of the floodplain. In addition to the floodplain, two small depressions are present along the western edge of the floodplain and open water was present in a deep quarry to the east of the floodplain. It appears that the quarry is used as a watering point for game and additional flows are pumped into the quarry.

The wetland habitat is expected to support a rich faunal and floral community and supports, or has the potential to support, a number of SCC's including the Maquassie Musk Shrew (*Crocidura maquassiensis*, Vulnerable) and African Marsh Rat (*Dasymys robertsii*, Vulnerable) (Enviro-Insight, 2022c), Greater Painted-snipe (*Rostratula benghalensis*, Vulnerable), Yellow-billed Storks (*Mycteria ibis*, Endangered), and African Marsh Harrier (*Circus ranivorus*, Endangered) (Enviro-Insight, 2022b). A Southern African python (*P. natalensis*), a species that has been downgraded from Vulnerable to Least Concern, was observed within the floodplain immediately downstream of the study area during the 2011/2012 surveys (WCS, 2012).

Disturbance within this habitat includes damming of flows in earthen farm dams, clearing of vegetation within the footprint of cultivation within the seasonal to temporary edges of the wetland, placement of a shallow earth berm along a section of the western and eastern bank, and abstraction of flows within the wetland's catchment leading to reduced flow to the wetland and lower likelihood of regular inundation of the Floodplain. Figure 18 provides photographs illustrating the wetland habitat observed on site within the Nyl River Floodplain.



Figure 18: Photographs of the Floodplain wetland habitat associated with the Nyl River observed within the study area.

5.10.5 Transformed/Degraded Land

The study area and surrounds are currently, and have in the recent past been, utilised for various forms of agriculture, including irrigated and dryland cultivated crops, livestock grazing and game farming. As a consequence, some areas of natural vegetation have become significantly and extensively degraded or completely transformed compared to the surrounding natural vegetation typical of the area. There are two areas of significant centre-pivot irrigated lands on site, as well as

other minor cultivated areas. There are also large areas that were previously cultivated but are not currently under cultivation. These have mostly reverted to secondary vegetation and in areas visited adjacent to the wetland habitat are characterised by very low density of *Vachellia/Senegalia* shrubs or small trees and extensive grasses, often dominated by the grass *Cenchrus ciliaris*. In some areas it appears that the naturally occurring woody vegetation has been partially cleared, possibly to increase the extent of grazing for livestock. Degraded or transformed habitats still have the capacity to support biodiversity to a degree, as evidenced by a Secretarybird (*Sagittarius serpentarius*, Vulnerable) observed foraging in an agricultural fallow area (Enviro-Insight, 2022b). Figure 19 provides photographs of some of the disturbed areas encountered on site.

The extent of transformed or degraded habitat verified within the study area exceeds the extent of areas of the study area identified as “No Natural Remaining” or as ESA’s (which can include ecosystems moderately to significantly disturbed but still able to maintain basic functionality). Portions of the study earmarked as CBA1 according to LEDET (2016) are actually transformed or degraded and their classification as CBA1 may be more appropriately revised to ecological support areas.



Figure 19: Photographs of transformed and/or degraded habitat observed within the vicinity of the project infrastructure layout (clockwise from top left): Centre pivot maize cultivation in the footprint of the proposed north pit, centre pivot maize cultivation, degraded bushveld in the footprint of a cattle kraal, secondary vegetation established in the footprint of past cultivated fields.

5.11 Potential Faunal Assemblages

Habitat selection by an animal takes into account a number of biotic and abiotic factors including: vegetation community composition and structure, topography, pedology, climate, distance to water, presence of rocky outcrops, trees, predators and sufficient food. The level of human disturbance is also an important factor influencing habitat selection. The study area encompasses a number of different habitat types as discussed above, and as such, is expected to support a range of faunal species associated with these differing habitats.

A review of the virtual museum resources and SABAP2 indicates that approximately 256 bird, 40 mammal, 34 reptile and 13 amphibian species have previously been recorded in QDS 2428BD, which contains both the proposed development footprint and the PAOI. The species lists generated by the various online resources are provided in Appendices 3 – 5. However, it is expected that the true species richness of the study area is greater than this. In support of this expectation, a previous

biodiversity assessment study undertaken within a portion of the current MRA (WCS, 2012) estimated that, based on a review of literature available at that time regarding faunal species distribution ranges, approximately 270 bird, 101 mammal, 72 reptile and 28 amphibian species could occur within the study area, assuming that their habitat requirements are met. The specialist herpetofauna study (Enviro-Insight, 2022a) confirmed the presence of 10 of the amphibian and reptile species previously recorded in the QDS (according to REPTILEMAP and FROGMAP), and identified 4 additional species - *Hemidactylus mabouia*, *Breviceps adspersus*, *Pyxicephalus edulis*, and *Ptychadena mossambica*. The avifauna assessment study (Enviro-Insight, 2022b) confirmed the presence of 133 bird species, including the Vulnerable Secretarybird. The potentially high species richness within the study area can, in part, be attributed to the presence of both aquatic and terrestrial habitats which broaden the range of available habitats, thereby accommodating a greater variety of species.

Of the faunal species potentially occurring on site, a number of Species of Conservation Concern (SCC) may occur. The likelihood of occurrence of SCC's is addressed in separate Animal Species Theme reports that have been compiled in response to the outcomes of the environmental screening tool assessment for the site as detailed in Section 4.1.

6. PLANT SPECIES THEME RESULTS

A broad habitat map was produced and provides context for the general occurrence of plant species, as well as likely habitat for plant species of concern, which are usually restricted to specific habitat types. The habitat classification map is shown in Figure 14.

The main natural habitats on site are savanna on the plains, dense woodland on the low hills, koppies on the steeper sloping hills and wetland-related habitats within the Nyl River, including permanent and seasonal wetland vegetation. There are also significant areas of current cultivation and old lands on site.

6.1 Red List Plant Species of the Study Area

A database search was undertaken for listed plant species previously recorded in Limpopo Province. For each of these, the geographical distribution was assessed to determine whether there was any likelihood of it occurring in the general area that includes the site. Those species that have a possible geographical distribution that includes the site are listed in Table 7. It mostly excludes species that

are known to occur within the Waterberg, unless they have specific habitat requirements that would allow them to occur in surrounding areas.

There are seventeen threatened, near threatened or rare species on this list, of which two are almost certain to occur on site or nearby, three have a high chance of occurring there and seven have a medium probability of occurring on site. **There are therefore five threatened, near threatened or rare species that could occur in the study area.**

Table 7. Threatened, near threatened or rare plant species that could potentially occur in the study area.

Family	Taxon	Common Name	Status	Distribution and Habitat	Likelihood of occurrence on site
ROSACEAE	<i>Prunus africana</i>	Red Stinkwood	VU	Widespread in Africa from the southern Cape, through KwaZulu-Natal, Swaziland and northwards in to Zimbabwe and central Africa and the islands of Madagascar and Comoros. Evergreen forests near the coast, inland mistbelt forests and afro-montane forests up to 2100 m.	LOW, no suitable habitat
OPHIOGLOSSACEAE	<i>Ophioglossum gracillimum</i>	Adder's tongue	EN	Limpopo, Mpumalanga. In South Africa near Polokwane and Bronkhorstspuit. Also occurs in central Africa. Seasonally moist areas in open deciduous woodland. Depends on mycorrhizal associations, 1000-1300 m. Not previously recorded nearby but recorded sparsely over wide area that includes site.	MEDIUM, possible habitat on site or nearby
ACANTHACEAE	<i>Justicia minima</i>	Shrimp plant	Rare	Limpopo, Waterberg District. Rocky river beds. Previously recorded in grid and adjacent grids.	HIGH , habitat suitable, previously recorded in grid.
POACEAE	<i>Eulalia aurea</i>	Silky Browntop	NT	Waterberg in Limpopo, widespread in southern and eastern Africa, from Botswana to Kenya. In water, along rivers and in occasionally inundated soils.	MEDIUM, suitable habitat
POACEAE	<i>Elytrophorus globularis</i>	No common name	VU	Nylsvley in South Africa. Also in tropical Africa extending south to Namibia, Botswana and east to Tanzania. Wet depressions and vleis, seasonally submerged, bottom-rooted or floating at edges of vleis and pans.	VERY HIGH , habitat very suitable, previously recorded in Nylsvlei wetland.
CELASTRACEAE	<i>Elaeodendron transvaalense</i>	Bushveld Saffron	NT	In South Africa it is restricted to eastern, summer rainfall areas from the KwaZulu-Natal coast northwards through eastern Mpumalanga into Limpopo and North West provinces. Savanna or bushveld, from open woodland to thickets, often on termite mounds.	HIGH , habitat very suitable, previously recorded in grid.
HYACINTHACEAE	<i>Drimia sanguinea</i>	Rooislangkop	NT	Northern Cape and across to Limpopo and Mpumalanga Provinces, Namibia, Botswana, and Zimbabwe. Savanna. Open veld and scrubby woodland in a variety of soil types.	MEDIUM, suitable habitat
	<i>Sensitive species 1252</i>		VU	Eastern and southern mesic parts of South Africa. Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	MEDIUM, suitable habitat
APOCYNACEAE	<i>Brachystelma gerrardii</i>	Gerrard's Brachystelma	EN	KwaZulu-Natal, Waterberg, Wolkberg and Swaziland. Open grassland, 400-1800 m.	LOW, no suitable habitat
APOCYNACEAE	<i>Brachystelma hirtellum</i>	No common name	NT	Waterberg, Bela-Bela to Mookgophong and Zimbabwe. Bushveld.	MEDIUM, suitable habitat,
	<i>Sensitive species 1278</i>		EN	Polokwane to Mookgophong. Rocky outcrops and hill slopes in short, open sparse woodland.	MEDIUM, suitable habitat
CUCURBITACEAE	<i>Cucumis humifructus</i>	Aardvark Cucumber	VU	Eastern and southern tropical Africa, in Gauteng and Limpopo and from Kenya to northern Namibia. Central Sandy Bushveld. Woodland and grassland, deep sand, 1350-1500 m.	HIGH , habitat very suitable, previously recorded in grid.
HYACINTHACEAE	<i>Bowiea volubilis</i> subsp. <i>volubilis</i>	Climbing Green Lily	VU	Eastern Cape to Limpopo Province. Low and medium altitudes, usually along mountain ranges and in thickly vegetated river valleys, often under bush clumps and in boulder screes, sometimes found scrambling at the margins of karroid, succulent bush in the Eastern Cape. Occurs in bushy kloofs at the coast and inland in KwaZulu-Natal. In Gauteng, Mpumalanga and North West Province it is often found in open woodland or on steep rocky hills usually in well-shaded situations. Tolerates wet and dry conditions, growing predominantly in summer rainfall areas with an annual rainfall of 200-800 mm	MEDIUM, suitable habitat

Terrestrial Biodiversity Assessment – Proposed Volspruit Mine, Limpopo Province
December 2023

Family	Taxon	Common Name	Status	Distribution and Habitat	Likelihood of occurrence on site
ORCHIDACEAE	<i>Brachycorythis conica subsp. transvaalensis</i>	Albertina Sisulu Orchid	CR	Gauteng, Limpopo, Mpumalanga, Waterberg to Balfour. Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000-1 705 m.	LOW, no suitable habitat
ZAMIACEAE	<i>Encephalartos eugene-maraisii</i>	Waterberg Cycad	EN	Grow on sandstone hills and rocky ridges of the Waterberg region. They grow in open grassland and savanna.	LOW, no suitable habitat
POACEAE	<i>Oryza longistaminata</i>	Wild Rice	VU	Nylsvlei & surrounding farms. Altitude 900-1000 m; seasonally flooded areas, wetlands. In water in pans, pools & streams, floodpans, and long rivers; sometimes forms pure stands or may be mixed with Vossia. Previously found at Moordrift and in the grid 2428DA at Naboomspruit.	VERY HIGH recorded nearby
CORNACEAE	<i>Curtisia dentata</i>	Assegai	NT	Evergreen forest from coast to 1800m. Cape Peninsula to Chimanimani	LOW, no suitable habitat

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

6.2 Plant Species Recorded in the Study Area

A checklist of plant species occurring on site is provided in Appendix 2.

6.3 Concluding Remarks

Desktop information, previous field data collection on site, and mapping from aerial imagery confirms patterns provided in the DEA Online Screening Tool for the Plant Species theme, with the exception that there are numerous possible species of concern for the site that are not flagged in the Online Screening Tool having a high likelihood of occurring on site. Two of these are Vulnerable species and, if they are found to occur on site or nearby, would automatically raise the sensitivity of the site for the Plant Species theme to HIGH or VERY HIGH (confirmed habitat for SCC). Neither species was recorded during the field survey. However, water levels were very high at the time of the site visit and it is possible that they were submerged and not visible, or that they were dormant at the time of the survey.

7. SITE ECOLOGICAL IMPORTANCE (SEI)

The species protocol guidelines (SANBI 2020) describe Site Ecological Importance (SEI) as a “standardised metric for identifying site-based ecological importance for species, in relation to a proposed project with a specific footprint and suite of anticipated activities”. The determination of SEI allows for rapid spatial inspection and evaluation of anticipated impacts of a proposed development within the context of on-site habitats and SCC, and also facilitates integration of inputs from different specialist studies. The outcomes of the various plant and animal theme studies, as well as the findings of the terrestrial biodiversity study itself were all taken into consideration in determining the overall SEI from a terrestrial biodiversity perspective.

SEI was evaluated for each of the habitats mapped in the study area, and the results are provided in Table 8. The outcome of the SEI assessment is also illustrated in Figure 20. A habitat sensitivity assessment conducted as part of a previous biodiversity assessment of the site (WCS, 2012) obtained similar results, with wetland habitat assessed as being of Very High sensitivity and other intact natural habitat being assessed as being of Medium to High sensitivity. The results of this SEI assessment indicate that the proposed mining project infrastructure footprint overlaps moderately with High SEI habitat associated with the Nyl River Floodplain, and dense woodland. The proposed project footprint overlaps more extensively with Medium SEI savanna habitat. Table 9 details the area of each habitat type and habitat SEI for the study area. Transformed or degraded habitat which

is Very Low SEI extends over 29% of the MRA, and Medium SEI Savanna habitat makes up almost 50% of the study area. High SEI habitat (wetlands, dense woodland and koppie habitat) cover 21% of the MRA in total.

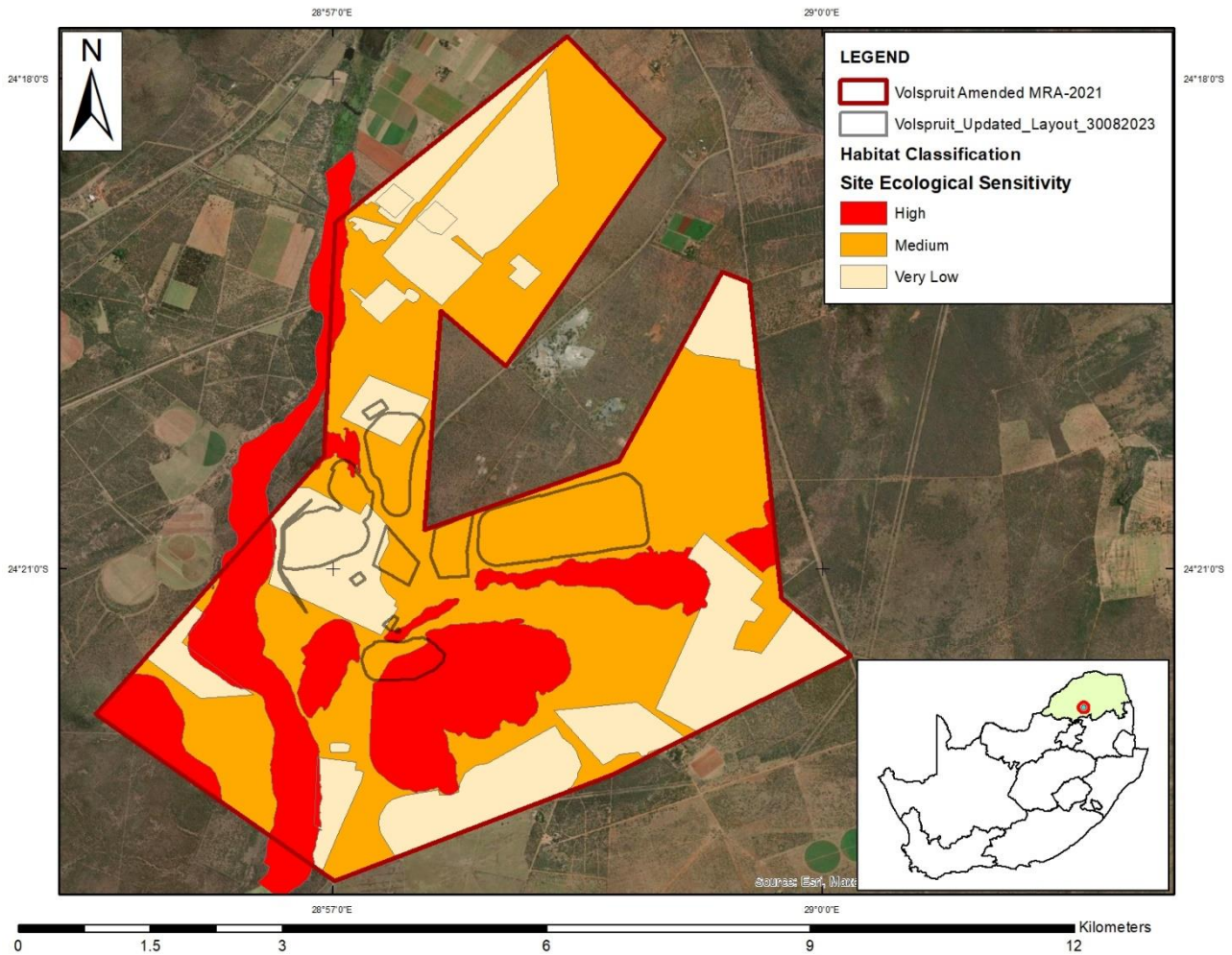


Figure 20. Site Ecological Importance (SEI) of the study area from a terrestrial biodiversity perspective.

Table 8: Evaluation of Site Ecological Importance (SEI) of terrestrial biodiversity habitats in the study area. BI = Biodiversity Importance.

Habitat	Conservation Importance	Functional Integrity	Receptor Resilience	Site Ecological Importance
Floodplain Wetland	High – confirmed or highly likely occurrence of plant, avifauna and mammal SCC's.	Very High - Very large (> 100 ha) intact area for any conservation status of ecosystem type, high habitat connectivity serving as functional ecological corridors, minimal current negative ecological impacts	High - Habitat that can recover relatively quickly (~ 5–10 years) to restore > 75% of the original species composition and functionality	HIGH (BI = Very High)
Savanna	Low – no SCC's, ecosystem not listed within the development footprint	Very High - Very large (> 100 ha) intact area for any conservation status of ecosystem type, high habitat connectivity serving as functional ecological corridors, minimal current negative ecological impacts	Medium - Will recover slowly (~ more than 10 years) to restore > 75% of the original species composition and functionality	MEDIUM (BI = Medium)
Koppie	Medium - Highly likely occurrence of populations of threatened species (herpetofaunal species) listed under Criterion A only and which have more than 10 locations	High - Large (> 20 ha but < 100 ha) intact area for any conservation status of ecosystem type, only minor current negative ecological impacts.	Very Low - Habitat that is unable to recover from major impacts – complete functionality cannot be restored if excavations take place on the koppie itself	HIGH (BI = Medium)
Transformed/Degraded	Low - Confirmed presence of foraging avifauna SCC. No natural habitat remaining.	Very low - Several major current negative ecological impacts	Very High - Habitat that can recover rapidly	VERY LOW (BI = Very Low)
Dense Woodland	Medium - Highly likely occurrence of populations of threatened species (herpetofaunal species) listed under Criterion A only and which have more than 10 locations	Very High - Very large (> 100 ha) intact area for any conservation status of ecosystem type, high habitat connectivity serving as functional ecological corridors, minimal current negative ecological impacts	Medium – Will recover slowly (> 10 years) to restore > 75% of the original species composition	HIGH (BI = High)

Table 9. Extent (in hectares) of the habitat types and habitat SEI within the study area.

Habitat Classification	Habitat SEI	Area (Ha)	Percentage of the MRA
Dense Woodland	High	417.3	12.54%
Depression	High	0.1	0.00%
Floodplain Wetland	High	199.5	5.99%
Koppie	High	81.9	2.46%
Savanna	Medium	1656.6	49.76%
Transformed/Degraded	Very Low	973.9	29.25%
Grand Total		3329.4	100%

8. IMPACT ASSESSMENT

Impact assessments have been completed separately for the aspects of terrestrial biodiversity and the plant species theme as per the methodology detailed in Section 4.5. Refer to Section 3.1 for a description of the proposed project. For each aspect, the nature of potential impacts is first discussed, and possible mitigation measures recommended. Thereafter, the quantitative impact assessments are provided in tabular form. Figure 21 shows the proposed mine plan layout in relation to the Site Ecological Importance (SEI).

An earlier iteration of the mine plan had the proposed North Pit opencast pit extending right up to the delineated wetland habitat (High SEI habitat), with the flood protection berm around the North Pit extending into the Floodplain wetland. Approximately 0.87 hectares of marginal wetland habitat would have been directly affected and lost as a result, with a disturbance edge of 330m fronting directly onto the Floodplain wetland habitat adjacent to the large dam. However, as part of the environmental authorisation process and resulting from various specialist feedback sessions and workshops, the proposed North Pit layout was adjusted to ensure that all wetland habitat and a 50m wetland buffer zone were excluded from the proposed disturbance footprint. However, adjustment of the North Pit footprint to avoid wetland habitat has resulted in the new North Pit Layout extending further north and now extending into the Koppie habitat (High SEI habitat). According to the herpetofaunal study (Enviro-Insight, 2022a), *“the northern pit and waste rock dump overlap with the High SEI habitats of the koppie (8.4 ha and 2.4 ha respectively). However, the majority of this overlap is due to the proposed infrastructure overlapping with the 200 m buffer of the sensitive koppie habitat. The koppie itself is only overlapped by the northern mining pit by 0.84 ha.”*

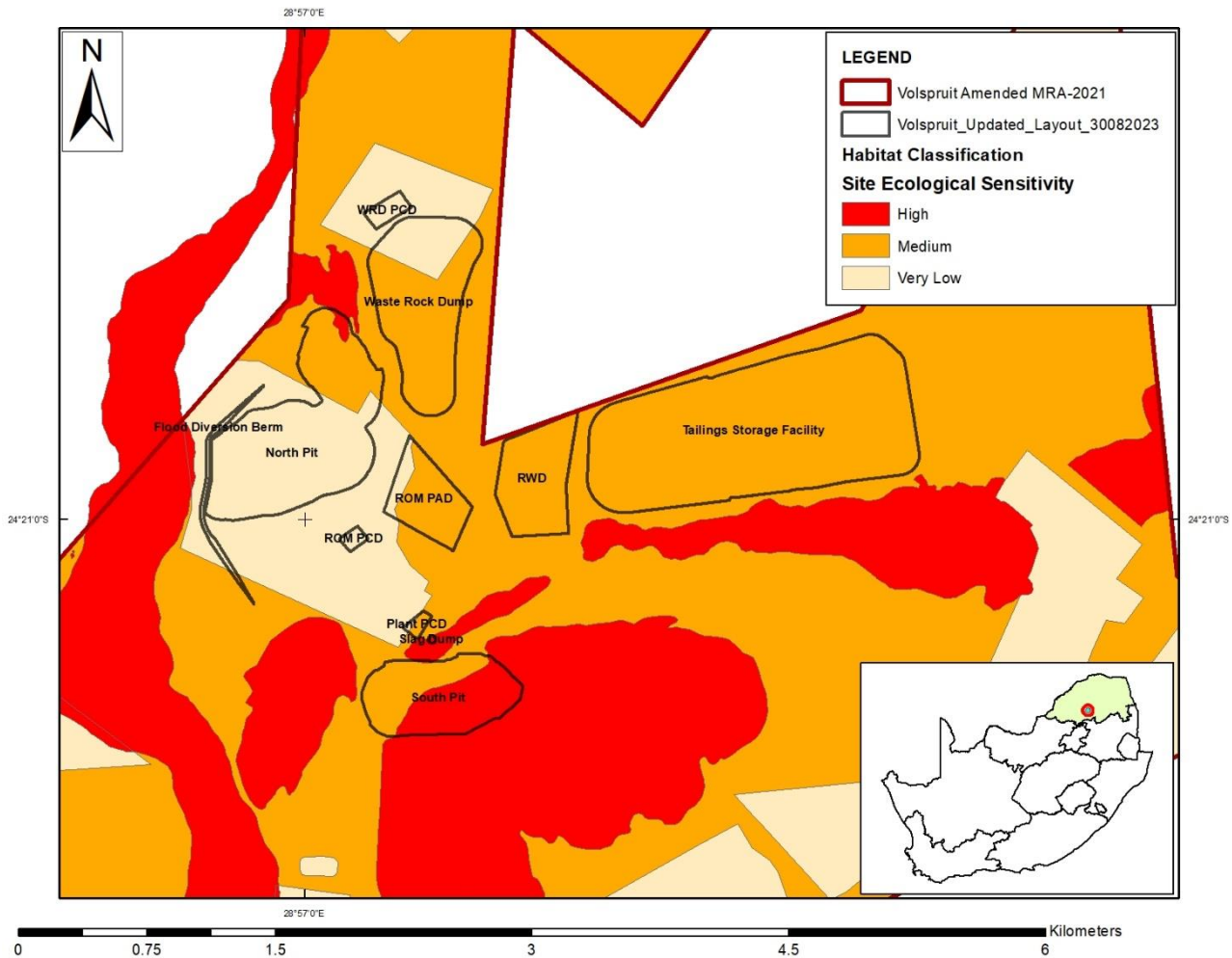


Figure 21. Extent and identification of proposed mine infrastructure in relation to the habitat SEI.

8.1 Terrestrial Biodiversity

There are various potential impacts associated with development of the proposed mine, which are discussed in some detail below.

8.1.1 Destruction and Fragmentation of Habitat

During the construction activities required to establish the opencast pits and surface infrastructure, large areas of vegetation will be cleared. This will result in a loss of habitat for those species utilizing the area. Even small losses in vegetation could have a serious impact on the remaining habitat and could negatively affect the biodiversity of the area, and the continued presence of unique and SCC fauna and flora that these habitats support. The development footprint and PAOI lie fully within areas classified as CBA1 and ESA2 according to LEDET (2016). Figure 22 shows the overlap of the proposed mine layout to the various habitat SEI and the site verified and revised CBA map

categories². Table 10 provides the areas of each mine infrastructure that falls into different CBA map categories, and habitat SEI categories. As mentioned in the initial project description, the Volspruit Mining Company (Pty) Ltd has an approved mining right and EMP_r for the site (effective 4th of October 2017 and valid for a 30 year period). The infrastructures forming part of the current environmental authorisation amendment alone (the amended flood protection berm, revised north pit footprint, WRRS and TRS) will result in the unavoidable and potentially permanent loss and fragmentation of areas of natural habitat, including habitat evaluated as being of High and Medium SEI, and earmarked in the gazetted Waterberg District Bioregional Plan as CBA1 (approximately 180ha) (areas with high irreplaceability i.e. areas essential for meeting biodiversity targets, and critical linkages in the provincial biodiversity corridor network where existing conversion of natural landscapes to other uses has severely restricted options for maintaining connectivity in the natural landscape).

According to Desmet *et al.* (2013), it is recommended that land uses including quarrying and opencast mining (includes surface mining, dumping & dredging) are not biodiversity compatible and ideally should not be permitted or are actively discouraged activities in all CBA's and ESA's. The site is largely within a CBA1 area (LEDET, 2016), with some old lands indicated as ESAs. This pattern was largely confirmed from the site survey, with the exception that some CBA1 areas were noted to be transformed or degraded habitat, as indicated in the habitat map, and these areas are not consistent with being CBA1, and would more appropriately be classified as ESAs or "No Natural Habitat Remaining", but could potentially be rehabilitated to ESA level.

The northern ore pit lies primarily within disturbed, cultivated fields, and will therefore not lead to a large loss of natural habitat, except where it extends marginally into natural savanna and koppie habitat in the north. The southern ore pit extends across several intact habitat/vegetation types (dense woodland and savanna) and may lead to a large loss of one or more of these habitat types, which may support SCC's. The southern pit also extends marginally into a NPAES Focus Area. Surface infrastructure that intersects with, and will lead to the destruction of high SEI habitat includes the following (see also Figure 21):

- Northern ore pit – Koppies (marginally)
- Southern ore pit – dense woodland

² As mentioned in Section 5.10.5 (discussing the transformed and degraded habitats), the extent of transformed or degraded habitat verified within the study area exceeds the extent of areas of the study area identified as "No Natural Remaining" or as ESA's (which can include ecosystems moderately to significantly disturbed but still able to maintain basic functionality). Portions of the study earmarked as CBA1 according to LEDET (2016) are actually transformed or degraded and their classification as CBA1 may be more appropriately revised to ecological support areas.

- Plant area and plant pollution control dam (PCD) - dense woodland
- Clean water outlet structures - dense woodland

In addition, infrastructure such as both pits, the tailings residue stockpile³ (TRS), ROM stockpile, waste rock dump, plant area and PCD, product stockpile PCD and various linear infrastructure will all lead to the destruction of habitat classified as CBA1 and medium SEI.

Some habitat fragmentation on a small scale is expected to occur related to all vegetation clearing and habitat loss. However, the main sources of habitat fragmentation are expected to be from the construction of linear infrastructure, such as access roads to the pits, which may act as barriers to the movement of mobile species to a greater or lesser extent. Habitat fragmentation and disturbance caused by construction activities and the potential barriers and hazards created by linear infrastructure, such as roads and power-lines, could lead to an interruption of daily or seasonal migration routes for mobile species.

The destruction of habitat is expected to occur primarily during the construction phase but may spill over into the operational phase as opencast pits and stockpiles expand.

³ Identified as the Tailings Storage Facility in various maps.

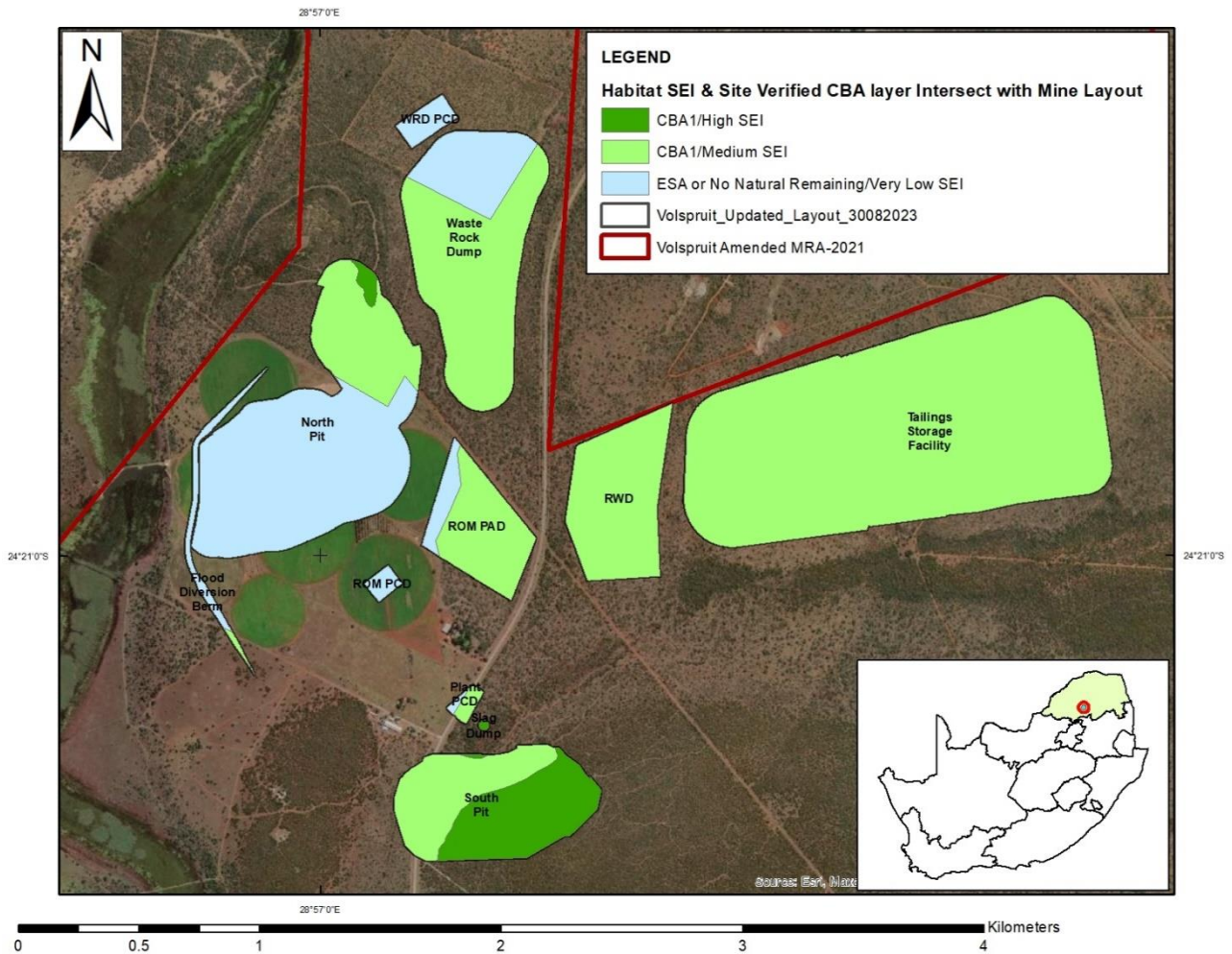


Figure 22. Habitat SEI and site verified and revised CBA layer intersect with the proposed mine layout.

Table 10. Extent of each mine infrastructure within different habitat SEI and CBA Map Category.

Infrastructure Type	Area in Hectares			Grand Total
	CBA1 & High SEI	CBA1 & Medium SEI	ESA or No Natural Remaining & Very Low SEI	
Flood Diversion Berm	0.0	0.3	2.6	2.9
North Pit	1.0	16.5	48.6	66.1
Plant PCD	0.0	0.9	0.2	1.2
ROM PAD	0.0	13.5	2.8	16.3
ROM PCD	0.0	0.0	1.2	1.2
RWD	0.0	22.9	0.0	22.9
Slag Dump	0.1	0.0	0.0	0.1
South Pit	17.3	14.7	0.0	32.0
Residue Stockpile (Tailings)	0.0	126.9	0.0	126.9
Residue Stockpile (Waste Rock)	0.0	34.6	11.8	46.4
WRD PCD	0.0	0.0	2.6	2.6
Grand Total	18.4	230.2	69.8	318.4

Mitigation Measures

The mitigation hierarchy (avoid, minimise, restore, offset) must be applied in addressing this impact, as with others. High SEI habitat and CBA1 destruction cannot be fully avoided, primarily due to pit, and resource, location, without significant further adjustment of the mine layout. Though large-scale adjustment of the pit locations is unlikely to be feasible, it is recommended that the layout of other surface infrastructures be reconsidered to lie outside of High SEI habitat if possible. Verified CBA1 and High SEI areas should be avoided wherever feasible.

A biodiversity management plan must be developed and implemented for the entire MRA, and funding, and all other required resources, must be allocated for effective implementation of the biodiversity management plan.

Additionally, mitigation measures should be aimed at minimizing the loss of vegetation and habitat wherever possible within areas of natural habitat (CBA1 [high and medium SEI]) by ensuring that all construction areas are fenced and construction activities are limited to within the fenced areas.

Measures to protect adjacent, undeveloped areas from degradation will need to be strictly enforced, as described for the impact “Habitat degradation”.

All buffers specified by the faunal, floral and wetland specialists and all mitigation measures put forward by the same with regards to minimising the impact to High or Very High SEI habitats, such as wetlands, koppies, dense woodland, etc. should be adhered to.

Even with the application of the avoidance measures that have already been applied in redesign of the north pit, and further avoidance and minimisation mitigation measures recommended above, a significant residual impact will remain. According to SANBI (2021), for developments with associated environmental impacts that cannot be completely avoided and/or minimised (e.g. opencast mining), restoration or rehabilitation is required. It is therefore recommended that at the conclusion of the mine’s life, all areas of natural habitat previously cleared should be rehabilitated, with the objective of creating ecologically functional habitats where feasible. In the case of surface infrastructures that can be removed post mining (such as temporary material stockpiles and support infrastructure, offices, roads, etc.), rehabilitation should be feasible, though it will require careful planning, oversight, and financial consideration. It is strongly recommended that the opencast pits be backfilled during closure as far as possible. Priority should be given to complete infilling of the north pit (if fill material is limited) to limit the ingress of water to this pit post closure. The infilled pit/s should be rehabilitated with the objective of establishing habitat of a similar structure and function to the surrounding natural Savanna habitat. A rehabilitation plan must be compiled by a suitably qualified ecologist to determine the extent to which the remaining impact can be reversed. This rehabilitation plan should address

all terrestrial biodiversity aspects impacted by the mining activities and infrastructures and should aim to create ecologically functional habitats. If rehabilitation of all disturbance footprints could be achieved, then the overall impact significance can be reduced to Medium as per the post-mitigation rating detailed for this impact in Table 11. However, it has been confirmed that certain infrastructures, such as the TRS, and WRRS will not be removed. The flood protection levee will also remain in place. It is unlikely that these, and the north and south pits, can be fully rehabilitated to closely approximate the pre-mining landscape in terms of form or ecological functioning, given that the stockpiles and berm will represent an altered landform profile and fill material for the pits will be limited once the resource is extracted, and this will affect the final landform achievable. In instances such as these, where infrastructures will not, or cannot, be removed, or where rehabilitation will not be sufficient to return the disturbed areas to a state that reflects the pre-mining biodiversity support capability or ecosystem functionality (as may be the case with one or both of the opencast pits or remaining stockpiles), rehabilitation alone will not be sufficient to address the residual impact, and a biodiversity offset should be considered. SANBI (2021) states that *“If significant residual environmental impacts associated with a development would remain after avoidance, minimisation, and restorative measures were to be taken, then biodiversity offsets may be required. Typically, biodiversity offsets are defined as conservation measures where actions are implemented to achieve measurable conservation outcomes which compensate for the significant negative residual impacts of the development.”* The current biodiversity offset guidelines make provision for offsetting of residual negative impacts remaining once all foregoing steps in the mitigation hierarchy have been considered to their full and feasible extent. However, one of the stated principles to be considered when taking decisions in relation to biodiversity offsets is that residual impacts on irreplaceable biodiversity cannot be offset. CBA1 is considered to be irreplaceable, especially where the feature(s) driving the designation as a CBA 1 is significantly negatively affected or will be compromised beyond its Biodiversity Target (SANBI, 2023). The features driving the designation as a CBA1 in the case of the amendment activities locations includes “designated ecological corridor” and the vegetation type present – both of which will be negatively affected by the development. Based on the offset guidelines, offsetting the affected Central Sandy Bushveld vegetation type (Least Concern, Poorly Protected) would attract a starting offset ratio of 1:1. However, a multiplier ranging from 1.5 (applicable to CBA2) up to 30 may be required⁴.

A wetland and biodiversity offset strategy (EScience Associates, 2015) was compiled for the proposed Sylvania Volspruit Platinum Mine and submitted as additional information to LEDET in

⁴ It is recommended in the Guideline (SANBI, 2023) that significant negative impacts on biodiversity in CBA 1s are avoided because of the irreplaceability of those sites. For this reason, a punitive 30:1 ratio is applied to all CBA sites. For significant residual negative impacts on biodiversity in CBA 2s, it is recommended that the Starting Offset Ratio (D) is multiplied by a factor of 1.5.

2015. This offset strategy recommended biodiversity offsets based on the best information and offset guidelines available at that time. However, as the submission to DMRE was in 2014, it is uncertain whether the DMRE is aware of, or reviewed, the offset document as part of the authorisation process, and therefore, whether the implementation of the offsets recommended have been made a condition of the authorisation already awarded. It may be the case that offset strategy will need to be revised to reflect the current situation and updated mine plan for the project, and the currently applicable biodiversity offset guidelines.

The situation with the proposed project is also complicated by the fact that the mining right and EMPr were authorised in 2017 and only amendments to certain project infrastructures are currently seeking environmental authorisation. The timing of the initial environmental studies that informed the 2017 authorisation (2010-2012), the authorisation itself (2017), and the timing of release of the various biodiversity assessment and offset guidelines and relevant biodiversity spatial plans and datasets create a complicated situation in terms of what should be applied and how to realise the most beneficial outcome from a biodiversity perspective. The situation results in uncertainty surrounding what should and should not be considered a fatal flaw to the project and what the practical implications are.

As most of the proposed infrastructures that extend into areas designated CBA1 (designated as CBA1 or CBA2 at the time of the earlier supporting studies in 2012) are technically already authorised under the existing and approved mining right and EMPr, with uncertainty around whether the requirement for offset is formally attached to the approved mining right and EMPr, what are the implications of denying the proposed amendment activities on the grounds of a fatal flaw stemming from the activities affecting irreplaceable biodiversity that cannot be avoided, mitigated, rehabilitated or offset (assuming CBA1 cannot be offset as stated in the offset guidelines)? If, according to the current guidelines, offset of CBA1 is not a viable option and the amendment is denied on these grounds, the understanding of the situation is that the approved mining right and EMPr will still permit mining to proceed which will result in loss of CBA1 habitat within the footprint of approved activities, potentially without offset. Due to the complexity of this issue, it is strongly advised that the applicant approach the relevant competent authority as soon as possible and prior to environmental authorisation submission to obtain their opinion on the situation and recommendations on the best way forwards before proceeding. The MRA encompasses an area of Springbokvlakte Thornveld (Vulnerable, Poorly Protected) and overlaps with a focus area for protected area expansion. If this vegetation type could be brought into a biodiversity offset, in addition to an area of Central Sandy Bushveld vegetation, it could represent both a like-for-like and like-for-better offset for potential residual impact while also potentially securing a portion of a protected area expansion focus area. Though offset of CBA1 may not be endorsed in principle according to the guidelines, allowing it to

be considered in this specific situation may be of value in retaining ecological infrastructure in the landscape and potentially contributing towards achieving other important environmental spatial planning targets.

Therefore, in summary, the ecological, socio-economic, financial, and administrative viability of applying a biodiversity offset will need to be determined in conjunction with the competent authority before it can be established whether a residual impact remains after mitigation⁵. If a residual impact does remain (in the situation where an offset is not viable), then it is unlikely that the management objective⁶ for affected CBA1 areas can be achieved, which may constitute a fatal flaw to the project.

8.1.2 Habitat Degradation and Reduced Ecosystem Functioning

The deterioration of habitat quality can occur due to air and noise pollution emanating from construction and operation areas, a decrease in water quality through inputs of dirty water from the disposal of waste, water containing waste, stormwater, and any water extracted from the opencast pits during construction and operation. One of the most prevalent impacts on vegetation in areas bordering mining activities is persistent dust settling on vegetation. Any activity which causes a change in the abiotic features of a habitat will have a negative impact on those floral and faunal species which utilize the habitat if the change causes the habitat to become unsuitable for use by those species, either through habitat quality deterioration or reduced size and connectivity.

Ingress of water into the opencast pits from both the Nyl River (if this is not effectively prevented) and the surrounding ground water reserve has the potential to influence the surrounding habitats, as it could lead to changes in the landscape hydrology, and therefore the level of wetness of both wetland and terrestrial habitats in the surrounding landscape. This would lead to both deterioration in habitat quality and possibly a complete alteration of the habitat characteristics. The potential for this impact to occur is supported by the findings detailed in the wetland ecology report (WCS, 2022), which indicates that, based on the findings of the Geohydrological study undertaken by GPT (2022) and the Nyl River Hydrological Analysis undertaken by eScience Associates (2015), increased loss of flood waters in the Nyl floodplain to groundwater⁷ (which could result in a small, but potentially significant reduction in MAR) can be expected to result in decreased duration and extent of flooding

⁵ The recently published National Biodiversity Offset Guideline (DFFE, 2023) should be consulted for guidance in formulating an appropriate offset strategy.

⁶ The management objective for CBAs is stated as being to maintain an area in a good ecological condition (natural or near-natural state) to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. Maintaining an area in a natural state can include biodiversity-compatible land uses and resource uses. The management objectives for both CBA1 and CBA2 are the same (LEDET, 2016; SANBI, 2020).

⁷ As a result of the increased groundwater drawdown and transmission losses.

within the wetland, with potential knock-on impacts to wetland biodiversity and vegetation in particular. Further detail regarding the potential impacts of the proposed mining on the wetland habitat and flooding regime can be found in the wetland ecology report (WCS, 2022).

Mitigation Measures

The wetland ecology report (WCS, 2022) states that there is little opportunity to mitigate the groundwater drawdown and associated increased transmission losses if mining proceeds as currently proposed within the North Pit. The 50m wetland buffer proposed (in the wetland ecology report) will serve little purpose in protecting the Floodplain from flow related impacts resulting from groundwater drawdown, should such impacts materialize.

No development or disturbance should occur within the 1:100 year flood line in accordance with the National Water Act (no. 36 of 1998). From an ecological perspective it is strongly recommended that no mining or related activities should occur within the wetland habitat associated with the Nyl River. However, if, in disregard of this recommendation, permission is given for development within the 1:100 year flood line, any such activities or structures within the 1:100 year floodline or within wetland areas should be carefully controlled and regularly monitored to prevent pollution, erosion or changes in the natural hydrology. All avoidance, mitigation and management measures proposed by the wetland ecologist to limit the risk of impact to wetland habitats must be implemented in full.

No vehicle or equipment storage or maintenance areas should be located within wetland areas, within the 1:100 year floodline, outside of fenced construction areas within areas of natural vegetation or within any ecological buffer areas specified by the faunal, floral or wetland specialist.

Dust should be controlled throughout the project life through means that do not impact on the quantity or quality of water entering the adjacent natural areas, and which are non-toxic to plant and animal life.

No polluted or dirty water should be discharged into the environment. Dirty water should either be treated on site to acceptable environmental quality standards or stored and then removed by qualified and licensed waste management contractors to be treated off-site. Any clean water discharged into the environment should be handled in such a way that its discharge does not cause erosion or alter the natural hydrology within wetlands and rivers. All demolition areas should be fenced, and demolition activities should be limited to within the fenced areas.

Any mining activity or mining-related activity which leads to, or has any risk of leading to, an alteration in the natural hydrology of the Nyl River and important Nylsvley Floodplain should be reconsidered

if hydrological changes cannot be completely mitigated and/or the natural hydrology within the landscape cannot be successfully and completely reinstated at the end of the mine's life.

To protect terrestrial vegetation from indirect effects, e.g., dust, it is important to vigorously implement dust control measures, protect undeveloped areas from any access, including being used as a dumping or storage ground for material and equipment, and to avoid putting linear infrastructure, such as pipelines, roads, and power lines, across undeveloped areas. Long-term monitoring is required to evaluate compliance and to monitor habitat quality over time. Long-term monitoring requires annual monitoring, including during pre-construction, of monitoring sites in areas planned to remain undeveloped, as well as more distant sites with current similar qualities, for comparative purposes.

A biodiversity management plan must be developed and implemented for the entire MRA, and funding, and all other required resources, must be allocated for effective implementation of the biodiversity management plan.

The management of alien invasive species (both faunal and floral invasives) should include the following:

- An Alien Invasive Management Plan must be compiled and implemented. This should divide the area of control into logical management units, have clear objectives for detection and control, and include regular monitoring throughout the life of the project. Non-compliance should result in real and enforceable significant consequences. The management of alien species should extend to both floral and faunal invasives that may negatively affect local, indigenous biodiversity.
- Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove.
- Means of control for alien invasives (plants and animals) should be carefully considered to limit the potential for indirect impact to local, indigenous biodiversity. Only control measures that have a very low risk of toxicity or harm to non-target species should be considered.
- An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

8.1.3 Direct Disturbance of Fauna

Increased activity on site, blasting and the use of heavy machinery will lead to increased noise and vibration which could disturb the local fauna, leading to changes in their behaviour and activity patterns and may cause them to migrate out of the area leading to further biodiversity losses. Blasting

within the northern pit, in close proximity to the floodplain and habitat known to be utilised by several SCC's could negatively affect individuals of these species and reduce habitat suitability.

Illumination of the mining area at night could affect the activity patterns of nocturnal species and may lead to certain species avoiding use of habitat adjacent to the mine, lead to collisions of birds in flight with infrastructure (such as overhead power-lines) if the lighting causes disorientation, or could alter patterns of predation. As the north pit and flood protection berm lie adjacent to the floodplain, where faunal activity is expected to be high due to its anticipated importance as a forage and water resource, its use as a migration corridor and the association of a large portion of the wildlife likely to occur with aquatic habitats, illumination of this area could lead to significant changes in habitat usage and predator/prey interactions by nocturnal species.

Mitigation Measures

- Unnecessary noise should be kept to a minimum.
- Precautions should be put in place to minimise vibrations and noise during construction.
- All demolition and blasting areas should be fenced and demolition and blasting activities should be limited to within the fenced areas.
- As the majority of fauna are most active at dusk, dawn and at night, it is recommended that any blasting be carried out outside of these times to limit disturbance to fauna when they are most active.
- Illumination of the mine area at night should be limited as far as possible, particularly surrounding the north ore pit which lies along the edges of the floodplain.
- To minimise the likelihood of disorientated birds colliding with infrastructure, it is recommended that overhead infrastructures such as power lines not cross the floodplain and wherever possible existing power lines to the east of the floodplain should be used.

8.1.4 Mortality of Individuals or Populations of Species of Conservation Concern

During construction, operation and decommissioning the activities associated with these phases, and the machinery required, may lead to the accidental death of SCC's on site.

Attempts by fauna to cross construction roads and other linear infrastructure could lead to accidental fatalities.

Mitigation Measures

- Infrastructure within habitats found to support or able to support SCC's must be limited as far as possible.
- Unnecessary impacts on surrounding natural vegetation must be avoided. Impacts must be contained to the footprint of proposed infrastructure.
- Speed restrictions, especially on roads within 400 m of the High SEI areas, must be enforced.
- All mitigation measures proposed by the various faunal and floral specialists to limit this impact should be adhered to.

8.1.5 Harvesting/Collection for Food/Trade

Human presence within the proposed mine footprint and the surrounding area is expected to increase, which may lead to greater utilisation of the fauna and flora through poaching and/or plant harvesting. This could have a detrimental effect on certain species populations, especially rare and endangered species, or those under threat of over-utilization. Ignorance on the part of those involved in accidental wildlife encounters could also lead to unnecessary animal fatalities.

Mitigation Measures

- All personnel working at the mine must be educated regarding the local fauna, dangerous animals, and SCC's and discouraged from poaching and/or harvesting.
- Penalties should be established, enforced and communicated to all staff to discourage poaching and/or harvesting.
- Regular monitoring by a qualified ecologist/wildlife ranger or similar should be conducted to identify and manage any poaching activities in the area.
- The mine area should be fenced to prevent personnel from accessing the surrounding landscape.
- All mitigation measures proposed by the various faunal and floral specialists to limit this impact should be adhered to.

8.1.6 Impact Assessment Table

The findings of the quantitative impact assessment for terrestrial biodiversity are detailed in Table 11.

The most significant impacts anticipated are destruction and fragmentation of habitat within the development footprint and habitat degradation and reduced ecosystem functioning in areas immediately adjacent to the development footprint. Destruction of habitat within the development footprint cannot be mitigated without shifting the layout. As has been detailed above, in response to specialist advice, the layout of the northern pit has been adjusted to remain outside of the Nyl River floodplain wetland habitat and a 50m buffer thereof, and therefore the rating post-mitigation has been reduced to Medium⁸, as this mitigation measure has been applied in the design of the project. The significance rating for habitat degradation is Medium with the application of appropriate mitigation as proposed and **assuming indirect hydrological impacts to the wetland can be fully avoided or mitigated with certainty**. All other anticipated impacts are reduced to Low significance with the application of the mitigation measures proposed. There are no expected differences in the impacts between the construction, operational and decommissioning phases, except that the decommissioning phase is not expected to include any activities that will cause further habitat destruction.

Table 11: Environmental impact assessment for potential impacts related to terrestrial biodiversity.

No.	Environmental Component	Potential Impact	Rating (prior to mitigation)									Proposed Mitigation Measures	Rating (post-mitigation)				
			Status	Magnitude	Extent	Duration	Probability	Significance	Reversibility	Irreplaceable loss of resources	Potential of impacts to be mitigated		Magnitude	Extent	Duration	Probability	Significance
CONSTRUCTION PHASE																	
1	Terrestrial Biodiversity	Destruction and fragmentation of habitat (Including CBA's and ESA's)	-	10	1	5	5	80	3	3	2	See Terrestrial Biodiversity Report text for mitigation measures	6	1	5	5	60
2	Terrestrial Biodiversity	Habitat degradation and reduced ecosystem functioning	-	8	2	5	5	75	2	2	2		6	2	4	5	60

⁸ Assuming all avoidance, minimization and rehabilitation measures are achievable.

3	Terrestrial Biodiversity	Mortality of individuals or populations of SCC	-	8	1	4	4	52	2	2	2		4	1	4	3	27
4	Terrestrial Biodiversity	Direct disturbance or displacement of fauna	-	6	2	4	4	48	1	1	2		4	2	4	3	30
5	Terrestrial Biodiversity	Introduction and encroachment of exotic or invasive species	-	6	2	5	4	52	1	1	1		4	2	4	3	30
6	Terrestrial Biodiversity	Harvesting/Collection for Food/Trade	-	6	2	4	3	36	2	2	1		4	2	4	2	20
OPERATIONAL PHASE																	
1	Terrestrial Biodiversity	Destruction and fragmentation of habitat (Including CBA's and ESA's)	-	10	1	5	5	80	3	3	2		6	1	5	5	60
2	Terrestrial Biodiversity	Habitat degradation and reduced ecosystem functioning	-	8	2	5	5	75	2	2	2		6	2	4	5	60
3	Terrestrial Biodiversity	Mortality of individuals or populations of SCC	-	8	1	4	4	52	2	2	2		4	1	4	3	27
4	Terrestrial Biodiversity	Direct disturbance or displacement of fauna	-	6	2	4	4	48	1	1	2		4	2	4	3	30
5	Terrestrial Biodiversity	Introduction and encroachment of exotic or invasive species	-	6	2	5	4	52	1	1	1		4	2	4	3	30
6	Terrestrial Biodiversity	Harvesting/Collection for Food/Trade	-	6	2	4	3	36	2	2	1		4	2	4	2	20
DECOMMISSIONING PHASE																	
1	Terrestrial Biodiversity	Destruction and fragmentation of habitat (Including CBA's and ESA's)	-	8	2	5	5	75	2	2	2		4	2	4	5	50
2	Terrestrial Biodiversity	Mortality of individuals or populations of SCC	-	8	1	4	4	52	2	2	2		4	1	4	3	27
3	Terrestrial Biodiversity	Direct disturbance or displacement of fauna	-	6	2	4	4	48	1	1	2		4	2	4	3	30
4	Terrestrial Biodiversity	Introduction and encroachment of exotic or invasive species	-	6	2	5	4	52	1	1	1		4	2	4	3	30
5	Terrestrial Biodiversity	Harvesting/Collection for Food/Trade	-	6	2	4	3	36	2	2	1		4	2	4	2	20

8.2 Plant Species Theme

There are various potential impacts associated with development of the proposed mine, which are discussed in some detail below.

8.2.1 Loss of Populations of Plant Species of Concern

Plant species are especially vulnerable to infrastructure development because they cannot move out of the path of the construction activities but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered, or vulnerable. For any other species a loss of individuals or localized populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

- fragmentation of populations of affected species;
- reduction in area of occupancy of affected species; and
- loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

This assessment specifically addresses impacts on plant species of concern that occur within terrestrial ecosystems, including *Justicia minima* (Rare), *Elaeodendron transvaalense* (Near threatened), and *Cucumis humifructus* (Vulnerable), as well as others that are less likely to occur on site. In all three cases, they all occur in other parts of the country beyond Nylsvlei, and outside of South Africa. In terms of population processes, the magnitude of any impacts will therefore be low, and of limited extent.

Mitigation Measures

- ***Habitats found to support or able to support threatened species must not be affected by the proposed mine and associated infrastructure.***
- A permit must be obtained for any protected trees that will be affected by the proposed activities. This will require a comprehensive walk-through survey of all proposed infrastructure areas, once these have been finalised, to identify and locate all individuals of such species. Protected tree species seen on site include *Boscia albitrunca* and *Vachellia erioloba*, but could also include *Combretum imberbe*, *Curtisia dentata*, *Elaeodendron transvaalensis*, *Erythrophysa transvaalensis*, *Philenoptera violacea*, *Pittosporum viridiflorum*, *Sclerocarya birrea*, *Securidaca longipedunculata*, and possibly *Warburgia salutaris*.
- Unnecessary impacts on surrounding natural vegetation must be avoided. Impacts must be contained to the footprint of proposed infrastructure.

8.2.2 Hydrological Impacts Leading to Wetland Habitat Degradation, Leading to Loss of Habitat Supporting Populations of Plant Species of Concern

Construction will possibly lead to indirect loss of or damage to seasonal wetlands or drainage lines or impacts that affect the catchment of these wetlands. This may lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

- increased loss of soil;
- loss of or disturbance to indigenous wetland vegetation;
- loss of sensitive wetland habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
- fragmentation of sensitive habitats;
- impairment of wetland function;
- change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
- reduction in water quality in wetlands downstream of road.

The site contains a large wetland system that is part of the larger Nylsvlei system. The species richness and variability of habitats within this system is relatively high. A variety of species with restricted distribution occur within this system. The wetland habitat on site is considered to have high sensitivity and conservation value. The two plant species of concern that are specifically being addressed here are *Elytrophorus globularis* (Vulnerable) and *Oryza longistaminata* (Vulnerable), both of which are dependent on hydrological function for survival and both of which only occur in the Nylsvlei system in South Africa. Any impacts on either of these two species therefore potentially have a very high magnitude in terms of population processes on these two species, and a regional effect, in the sense that the two species occur nowhere else in South Africa, although both occur widely outside South Africa. Hydrological changes are potentially permanent and, on the basis of the proposed activity, have a moderate chance of occurring.

Mitigation Measures

- Wetland habitat must not be affected by the proposed mine and associated infrastructure. A suitable buffer should be maintained from the edge of the temporary wetland zone as per the recommendations of the wetland specialist. This proposed mitigation measure has been adopted and integrated into the mine layout design, with the north pit remaining outside of both the Nyl floodplain and a 50m buffer.
- The two plant species of concern that probably occur within the Nyl wetland ecosystem on site, or nearby, are dependent on the proper functioning of this wetland ecosystem. This means that development of the mine should not impact on the structure or function of this ecosystem.
- Impacts that cause a change in the hydrology of the wetland system must be prevented, as per specialist studies that specifically address this issue. The outcome must be that levels of inundation, and seasonality thereof, should not be altered.
- For any impact on wetlands, there is a legal obligation to apply for a Water Use Licence for any wetlands that may be affected, since they are classified in the National Water Act as a water resource.
- Stormwater and runoff water must be controlled for all infrastructure and managed to avoid siltation and surface hydrological impacts on wetlands.
- Pollution impacts must be controlled by preventing pollutants from entering the wetland system.

8.2.3 Invasion by Alien Invasive Plant Species

Major factors contributing to invasion by alien invader plants includes high disturbance. Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al.* 2003). Consequences of this may include:

- loss of indigenous vegetation;
- change in vegetation structure leading to change in various habitat characteristics;
- change in plant species composition;
- change in soil chemical properties;
- loss of sensitive habitats;
- loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
- fragmentation of sensitive habitats;
- change in flammability of vegetation, depending on alien species;

- hydrological impacts due to increased transpiration and runoff; and
- impairment of wetland function.

Alien invasive species previously recorded in the area in which the site is located indicate that the following species are likely to invade the site, given the right conditions: *Acacia mearnsii*, *Ricinus communis*, *Eucalyptus camaldulensis*, *Eucalyptus grandis*, *Salix babylonica*, *Nicotiana glauca*, *Populus canescens*, *Jacaranda mimosifolia*, *Melia azeradach*, *Populus deltoides*, *Solanum mauritianum*, *Sesbania punicea*, *Lantana camara*, *Opuntia ficus-indica* and *Morus alba* (WCS, 2012). The potential therefore exists for extensive and diverse invasion of the site. The habitats most likely to be affected are watercourses and wetlands.

Mitigation Measures

- Disturbance of indigenous vegetation must be kept to a minimum.
- Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible.
- Soil stockpiles should not be translocated from areas with alien plants into the site and within the site alien plants on stockpiles must be controlled so as to avoid the development of a soil seed bank of alien plants within the stock-piled soil.
- An Alien Invasive Management Plan must be compiled and implemented. This should divide the area of control into logical management units, have clear objectives for detection and control, and include regular monitoring throughout the life of the project. Non-compliance should result in real and enforceable significant consequences.
- Any alien plants must be immediately controlled to avoid establishment of a soil seed bank that would take decades to remove.
- An ongoing monitoring programme should be implemented to detect and quantify any aliens that may become established and provide information for the management of aliens.

8.2.4 Impact Assessment Tables

The findings of the quantitative impact assessment for the plant theme are detailed in Table 12.

The most significant impact anticipated is the loss of vegetation and wetland habitat that supports SCC's. In order to mitigate this potential impact to some degree, the mine layout has been adjusted to remain outside the Nyl floodplain wetland and a 50m buffer of the wetland. This will avoid direct impact to the wetland habitat, though it may not avoid indirect impacts that affect the hydrology

supporting the wetland. With this mitigation measure applied, the post mitigation impact rating is Low. The remaining potential impacts are of Low significance with the application of the proposed mitigation measures.

Table 12: Environmental impact assessment for potential impacts related to plant SCC's.

No.	Environmental Component	Potential Impact	Rating (prior to mitigation)									Proposed Mitigation Measures	Rating (post-mitigation)				
			Status	Magnitude	Extent	Duration	Probability	Significance	Reversibility	Irreplaceable loss of resources	Potential of impacts to be mitigated		Magnitude	Extent	Duration	Probability	Significance
CONSTRUCTION PHASE																	
1	Plant SCC	Loss of populations of SCC	-	4	2	4	3	30	2	2	2	See Section 8.2 of the Terrestrial Biodiversity Report for mitigation measures	2	1	1	2	8
2	Plant SCC	Hydrological degradation leading to loss of SCC	-	10	3	5	5	90	3	3	3		4	1	5	3	30
OPERATIONAL PHASE																	
1	Habitat for SCC	Invasion by alien invasive plant species	-	8	2	5	4	60	3	2	1	See Section 8.2 of the Terrestrial Biodiversity Report for mitigation measures	4	1	4	3	27

8.3 Cumulative Impacts

The above listed, discussed and rated potential impacts relate specifically to the proposed mining activities which are the focus of this environmental impact assessment. However, this project cannot, and should not, be assessed in isolation without comment on the possible cumulative impacts to which the proposed Volspruit Mine would contribute, in conjunction with other existing and possible future activities along the Nyl River and within its catchment. Considering mines alone, other mining operations proposed along the Nyl River floodplain may individually cause acceptably limited disturbances to the environment, but when considered together, have a significantly negative effect on the environment's ability to support those, including people, that depend on it for food, clean water

and shelter. Incremental destruction and fragmentation of sensitive habitats or CBA's, changes in the hydrology driving this important wetland system, and deterioration of water quality are all serious impacts expected in association with increased human utilisation of this area. A strategic and holistic assessment of proposed future development (both mining and other developments) needs to be undertaken as a first step to provide a more realistic picture of the anticipated future dynamics of this system as a consequence of development. This would help decision makers in setting limits on acceptable or appropriate development within and adjacent to the Nyl River Floodplain. However, the classification of large areas lying within the proposed mining footprint as CBA1 suggests that strategic provincial planning has already highlighted this area as incompatible with a mining landuse.

Currently the environment within and surrounding the study area is characterised by very low population density, and limited disturbance, primarily associated with linear infrastructures and agriculture. Other than agriculture, large tracts of land are given over to protected nature reserves with limited human disturbance. Establishment of a mining operation within this environment has the potential to not only have direct impact on the environment, but also encourage greater migration of people into the area to support the labour needs of the mine. This will increase utilisation and pressure on local resources, such as the water resource, a knock-on effect that may not cease at mine closure if communities become established in and around the mine. Habitat degradation associated with mining and related activities could in turn make the surrounding area less suitable for use as private nature reserves and impact on ecotourism utilisation of the area, encouraging a move away from these low impact land use activities to more intensive farming activities that impact the terrestrial biodiversity more significantly and do not align as well with achieving the conservation targets established for the area. This is a long-term and potentially cumulative impact that is difficult to quantify but needs to be considered in terms of the long-term sustainability of the natural resources in general, and specifically, the significant natural feature of the Nyl River floodplain.

9. CONCLUSION

The Volspruit Mining Company (Pty) Ltd (Volspruit MC) has an approved mining right and EMPr for the Volspruit MRA site. The mining right (MR) area covers 1335,28 ha. The minerals approved for mining relates to Platinum Group Metals (platinum (Pt), palladium (Pd), rhodium (Rh), ruthenium (Ru), osmium (Os) and iridium (Ir)), gold (Au) nickel (Ni), chrome (Cr) and Copper (Cu) and came into effect on the 4th of October 2017 (being the date on which the Environmental Management Programme (EMPr) was approved in terms of Section 39(4) of the Minerals and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002). The MR was awarded for a period of 30 years ending on the 3rd of October 2047 and is subject to conditions set out in the MR that was

issued by the Regional Manager of the Limpopo region of the Department of Mineral Resources (DMR), now the Department of Mineral Resources and Energy.

After the issuing of the MR, and based on various optimisation and environmental studies, Volspruit MC changed the layout and location of the waste rock residue stockpile (WRRS), and the layout of the north pit and the tailings residue stockpile (TRS or TSF) from what was previously approved. It should be noted that mining activities have not commenced in the MR area. This project information and the context provided regarding the environmental authorisations granted to date may have bearing on which aspects of the mine project the conclusions drawn from this study may apply to and the degree to which further recommendations need to be pursued and implemented.

According to several regional and national datasets discussed here, the study site lies within an area highlighted as being of high value from a biodiversity perspective, with particular focus on the Nyl River floodplain. The site survey confirmed the presence of natural habitat on site within high sensitivity areas, such as those classified as CBA1 and ESA2. A threatened ecosystem - Springbokvlakte Thornveld (Vulnerable) – was confirmed in the extreme south of the study area but does not overlap with the current mine infrastructure footprint and is unlikely to be impacted by the mine infrastructure as currently proposed. The remainder of the site is classified as Central Sandy Bushveld, which is neither endemic, nor threatened. Broad vegetation habitats were identified, including savanna, dense woodland, koppies, wetlands and transformed/degraded areas. The extent of transformed or degraded habitat verified within the study area exceeds the extent of areas of the study area identified as “No Natural Remaining” or as ESA’s (LEDET, 2016), and portions of the study area earmarked as CBA1 according to LEDET (2016) are actually transformed or degraded and their classification as CBA1 in these areas should be revised to either ESA or “No Natural Remaining”. Habitats identified and classified outside of transformed/degraded areas remain largely in a natural or near-natural condition and are therefore confirmed as CBA1 or ESA2, as relevant. Of the habitats classified, the wetlands, koppies and dense woodland were evaluated to be of High SEI (Site Ecological Sensitivity) due to factors such as their conservation importance, capacity to support SCC’s, functional integrity and resilience. Five plant SCC’s have a High or Very High potential to occur on site within Nylsvlei floodplain or the Savanna/bushveld habitats on site and could be affected by the proposed mining development.

The document “*Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector*” (Department of Environmental Affairs, *et. al.*, 2013) specifies that “Highest Biodiversity Importance Areas” (which includes certain areas of the study area) pose the highest risk to mining, and that environmental studies forming part of the EIA process should focus on confirming the presence and significance of these biodiversity features. The biodiversity feature within the study area that has triggered the risk to mining according to the Mining and Biodiversity Guideline is the Nyl floodplain

wetland (a National Freshwater Ecosystem Priority Area (NFEPA)) that has been confirmed along the western edge of the MRA. The Nyl River floodplain forms a significant natural feature of the site that is important at a local, regional and national level (WCS, 2022). All proposed mine infrastructures will remain fully outside of the highlighted wetland habitat, and a 50m buffer thereof, and no direct impact to this FEPA wetland is anticipated. The wetland assessment study (WCS, 2022) has however highlighted that the Nyl floodplain wetland may experience indirect negative impacts of low to medium significance as a result of the proposed mine project occurring within its catchment, some of which cannot yet be fully quantified, as well as possible cumulative impacts associated with potential future mining and general development within its catchment. A gap identified in previous environmental studies relating to this project, undertaken between 2010 and 2012, was the degree of uncertainty around the nature and extent of potential indirect impact to the Nyl River floodplain. Despite updated studies having been done, this uncertainty persists. It is uncertain whether further hydrological analyses or geohydrological or wetland assessments would be able to resolve this uncertainty with confidence, and specialists in these fields should be consulted to find clarity.

The proposed mining development will result in the unavoidable and potentially permanent loss and fragmentation of areas of natural habitat, including habitat evaluated as being of High and Medium SEI, and earmarked in the gazetted Waterberg District Bioregional Plan as CBA1 (180ha⁹) (areas with high irreplaceability i.e. areas essential for meeting biodiversity targets, and critical linkages in the provincial biodiversity corridor network where existing conversion of natural landscapes to other uses has severely restricted options for maintaining connectivity in the natural landscape). This impact has been significantly mitigated through adjustment of the mine layout, and assuming implementation of all other avoidance, mitigation and rehabilitation measures, the significance of the impact could be reduced from High to Medium. However, the achievability of rehabilitating all disturbance footprints, including the opencast pits and potentially permanent surface infrastructures (such as the TRS) needs to be determined. If rehabilitation will not be sufficient to return the disturbed areas to a state that reflects the pre-mining biodiversity support capability or ecosystem functionality (as may be the case with one or both of the opencast pits), rehabilitation alone will not be sufficient to address the residual impact, and a biodiversity offset should be considered. the ecological, socio-economic, financial, and administrative viability of applying a biodiversity offset will need to be determined in conjunction with the competent authority before it can be established whether a residual impact remains after mitigation¹⁰. If a residual impact does remain, then it is unlikely that the

⁹ This only reflects the CBA1 areas affected by the proposed amendment activities – the amended flood protection berm, revised north pit footprint, WRRS and TRS.

¹⁰ The recently published National Biodiversity Offset Guideline (DFFE, 2023) should be consulted for guidance in formulating an appropriate offset strategy.

management objective¹¹ for affected CBA1 areas can be achieved, which may constitute a fatal flaw to the project.

Other impacts such as indirect habitat degradation/deterioration and loss of plant SCC's, are of Medium negative significance with full application of the mitigation measures provided. All other impacts are of Low negative impact significance with full application of the mitigation measures provided.

In summary, the outcomes of this study indicate that highly sensitive and important habitat does occur within the areas earmarked for development of the mine, and that the mine will have a potentially significant negative residual impact on the important natural resources that these habitats represent through destruction and fragmentation of habitat that cannot be fully avoided or minimised. In addition, the current set of studies has not completely ruled out the potential for indirect impact to the floodplain and its supporting hydrology, and as a consequence, the important biodiversity that it represents and supports.

Therefore, it is the opinion of the terrestrial ecosystem specialists that, from a biodiversity perspective, given the importance and sensitivity of the habitats on site that will be affected, and the lack of certainty around impact, or the lack thereof, to the wetland habitat, the activities being applied for may not be desirable in this location as currently proposed and based on the information currently available. The following additional investigations or information is required to address knowledge gaps and resolve uncertainties around the residual risk of the project to the environment:

1. The proposed Volspruit mining project should only be considered for authorisation if it can be shown with a high degree of certainty that all aspects of the Ecological Reserve of the Nyl floodplain will be met during all phases of the mining project (WCS, 2022).
2. The feasibility and achievability of rehabilitating all disturbance footprints to a state that reflects the pre-mining biodiversity support capability or ecosystem functionality needs to be established as part of a biodiversity/ecosystem rehabilitation investigation. This study should aim to identify the degree to which the negative impact of the mine to the terrestrial biodiversity can be reversed through rehabilitation.

If rehabilitation will not be sufficient to reduce the residual impact to acceptable levels, then the ecological, socio-economic, financial, and administrative viability of applying a biodiversity offset will need to be determined before it can be established whether a residual impact remains after

¹¹ The management objective for CBAs is stated as being to maintain an area in a good ecological condition (natural or near-natural state) to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. Maintaining an area in a natural state can include biodiversity-compatible land uses and resource uses. The management objectives for both CBA1 and CBA2 are the same (LEDET, 2016; SANBI, 2020).

mitigation (as per the recommendations contained in SANBI (2021)). The recently published National Biodiversity Offset Guideline (DFFE, 2023) should be consulted for guidance in formulating an appropriate offset strategy. However, due to the complexity of this project's history, it is strongly advised that the applicant approach the relevant competent authority as soon as possible and prior to environmental authorisation submission to obtain their opinion on the situation and recommendations on the best way forwards before proceeding with further studies.

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- South African National Biodiversity Institute (SANBI). 2021. Ecosystem Environmental Assessment Guideline: Draft guidelines for the implementation of the Terrestrial and Aquatic Ecosystem Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Draft Version 1.
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- WCS. 2022. Wetland Assessment Report for the Volspruit Mine Project, Limpopo Province.

11. APPENDIX 1: QUALIFICATIONS AND CV'S

SACNASP Professional Certificate



herewith certifies that

Shavaughn Davis

Registration Number: 115025

is a registered scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)

in the following field(s) of practice (Schedule 1 of the Act)

Ecological Science (Professional Natural Scientist)
Zoological Science (Professional Natural Scientist)

Effective 20 July 2016

Expires 31 March 2024



~~ASAP~~

Chairperson

News

Chief Executive Officer



To verify this certificate scan this code

Curriculum Vitae of the Specialist - Shavaughn Davis

Date of Birth:	1982-05-29	Profession:	Wetland Ecologist/Zoologist
Identity Number:	8205290085080	Nationality:	South African
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		Fax:	(012) 349 2993
		Cell:	073 233 6110
		E-mail:	shavaughnd@wetcs.co.za

Academic History:

2006 – M.Sc. Zoology, Nelson Mandela Metropolitan University
2004 – B.Sc. (Hons.) Zoology, Nelson Mandela Metropolitan University
2003 – B.Sc. Zoology and Botany, University of Port Elizabeth (now NMMU)
2000 - Matriculated with a University Exemption from Woodridge College, Port Elizabeth.

Professional Affiliations:

SACNASP: Ecological & Zoological Science (115025)
South African Wetland Society (Reg. number EJGYPMF3)

Additional Training:

2019 - Introduction to WET-Health Version 2 Training Workshop, offered by the Western Cape Wetlands Forum in partnership with the SANBI, DEA, FRC and SAEON.
2019 - Introduction to Environmental Law and Policy, University of North Carolina at Chapel Hill
2018 - Official DWS Section 21 (C) and (I) Water Use Authorisation Course
2017 - Wetland Plant Identification Training Course, Water Research Commission
2014 - Matlabas Mire: stratigraphy and flows: Mire typology (Formed part of the Marakele AllWet Summer School Programme)
2010 - Advanced Wetland Delineation Course, University of Pretoria, South Africa

Employment record:

2010 - Present day: Wetland Ecologist & Zoologist at Wetland Consulting Services (Pty.) Ltd. & WCS Scientific (Pty) Ltd.
2008: Research Assistant at Okavango Buffalo Research Project, Okavango Delta, Botswana
2007 - 2008: Scientific Consultant at Wetland Consulting Services (Pty.) Ltd.

Previous Research Projects:

1. Davis, S. 2006. Endozoochory in the Subtropical Thicket: comparing effects of species with different digestive systems on seed fate. Unpublished MSc dissertation, Nelson Mandela Metropolitan University. Dissertation supervisor: Prof. G. I. H. Kerley
2. Davis, S. 2004. Diet of Elephants in the Nyati Concession Area, Addo Elephant National Park. Unpublished Honours project, Nelson Mandela Metropolitan University. Project supervisors: Prof. G. I. H. Kerley and M. Landman
3. Davis, S. 2003. Potential for saltmarsh rehabilitation in the Swartkops river estuary. Undergraduate research project, Department of Botany, University of Port Elizabeth (now Nelson Mandela Metropolitan University). Project supervisor: Dr. J. Adams

Conference Presentations:

1. Davis, S. & Kerley, G. I. H. 2006. Seed dispersal by elephants: passage rate and seed germination. Paper presented at 2nd Eastern Cape Elephant Conservation and Management Workshop. September 2006, Port Elizabeth, South Africa.
2. Davis, S., Kerley, G. I. H. & Landman, M. 2005. Dietary shifts of elephants in the Addo Elephant National Park. Paper presented at the Zoological Society of South Africa Conference. July 2005, Grahamstown, South Africa.
3. Davis, S., Kerley, G. I. H. & Landman, M. 2004. Dietary shifts of elephants in the Addo Elephant National Park. Paper presented at the Elephant Managers and Owners Association Conference. September 2004, Pilansburg, South Africa.

Select Consulting Project Experience between 2007 and 2021:

- Assessment of wetlands, water quality, radiation risk (including Radon) and potential wetland impacts for the proposed development of Strubenvale Extension 4 Township.
- Baseline wetland assessment for the proposed Golden Valley Mining Project, Gauteng Province.
- Conceptual rehabilitation plan for the Daveyton Outfall Sewer Pipeline, Daveyton, Gauteng.
- Contributed towards the Wetland Mitigation Strategy for New Largo Opencast Coal Mine, Mpumalanga Province
- Desktop assessment and rehabilitation planning of selected wetlands within the Ekurhuleni Metropolitan Municipality as part of the development of a wetland rehabilitation strategy for the municipality, Gauteng Province.
- **Desktop Biodiversity Assessment for a proposed pipeline development in Kwa-Zulu Natal Province.**
- Detailed wetland delineation and assessment studies for various Sasol Collieries in the Secunda and Sasolburg areas.
- Development of a wetland mitigation/offset strategy for the proposed Vlakfontein extension project, Mpumalanga Province.
- Development of a wetland mitigation/offset strategy for the proposed Khutala Life Extension Project.
- **Faunal baseline survey of mammals, avifauna and herpetofauna for the proposed Lustoff opencast mine in the Chrissiesmeer area, Mpumalanga Province.**
- Offsite wetland offset strategy within the South32 Mine Closure Areas, Mpumalanga Province.
- Present ecological state (PES) assessment of pan wetlands as part of the wetland reserve determination within the Arnot Mining Rights Area for Exxaro Mpumalanga Coal.
- Riparian delineation and assessment on Erf 174 Morningside Ext 13, Morningside, Johannesburg.
- **Small mammal survey as part of a wetland assessment along the proposed Gauteng Road (P1894), East Rand, Gauteng Province.**
- **Small mammal survey as part of a wetland assessment for the proposed development of Dunnottar Ext. 2.**
- **Small mammal survey as part of a wetland assessment on Kriel Ext. 6.**
- **Small mammal survey as part of a wetland assessment on part of Portion 23 of the Farm Breaunanda 184 IQ.**
- **Small mammal survey as part of a wetland assessment on Portion 154 of the Farm Zandfontein (Kirkney Ext. 36).**
- **Specialist faunal assessment and environmental impact assessment for the proposed ATCOM Dragline Relocation Project Specialist Assessment, Mpumalanga Province.**
- **Specialist faunal assessment as part of the EIA/EMP for a proposed mine located on the banks of the Nyl River floodplain near Mokopane, Limpopo Province.**
- Specialist wetland delineation and assessment of identified EWR sites as part of the Wetland Reserve Study for the Extension of the Boschmanskrans Section of the Wolwekrans Colliery, Mpumalanga Province.
- **Terrestrial fauna assessment for the Sasol Middelbult (Block 8) Shondoni Shaft.**
- Update of the national wetland map – summer rainfall mesic & arid regions – Providing specialist wetland input, training of interns, and evaluation of the updated wetland map.
- Wetland and riparian assessment and impact assessment for the proposed Eskom Burgersfort 2km 132kv kingbird power line in Burgersfort, Limpopo Province.
- Wetland and river baseline and impact assessment study for the proposed Burgersfort Road Upgrade, Limpopo Province.
- **Wetland assessment and faunal survey on remainder of Portion 222 of the Farm Witpoortjie 245-IQ: Mindalore Ext. 7.**
- Wetland baseline monitoring as part of the Exxaro's Belfast Implementation Project, Mpumalanga Province.
- Wetland delineation and assessment for a proposed development within the Botshabelo Game Reserve On the Farm Toevlugt 320 JS, Middelburg, Mpumalanga.
- Wetland delineation and assessment for surface infrastructure associated with the New Denmark Colliery, Mpumalanga Province.
- Wetland delineation and assessment for the Anglo American Thermal Coal Setlabotsha Project near Standerton, Mpumalanga Province.
- Wetland delineation and assessment of pans and upper catchment wetlands as part of the Elders-Viskuile Wetland Reserve Determination.
- Wetland delineation and ecological assessment of specific wetland systems along the Saaibwaterspruit for Anglo American Thermal Coal as part of the Proposed New Largo Mining Project, Mpumalanga Province.
- Wetland delineation and ecological assessment of the property Portion 85 of the Farm Rietvlei 101 IR, Johannesburg, Gauteng Province.
- Wetland delineation and impact assessment for a proposed urban development in Calvinia, Northern Cape.
- Wetland delineation and impact assessment for a site within the Stuart East Colliery.
- Wetland delineation and impact assessment for Anglo American Thermal Coal as part of the proposed New Vaal Colliery Life Extension Project, Free State Province.
- Wetland delineation and impact assessment for the Algoa Basin Crude Oil Production Project in the Eastern Cape.
- Wetland delineation of wetlands surrounding proposed drilling locations for Exxaro's Matla Colliery Mine 1, Mpumalanga Province.
- Wetland delineation, assessment and application of the DWS risk assessment for activities proposed at the Goedehoop Colliery.
- Wetland delineation, assessment and conceptual rehabilitation plan to address the requirements of a Non-compliance notice issued for a property in Kyalami, Gauteng Province.

- Wetland delineation, assessment and impact assessment for the proposed development of Fochville Extension 13, North West Province.
- Wetland delineation, baseline assessment and impact assessment for proposed underground mining and surface infrastructure in the Metsimaholo Municipality, Free State Province.
- Wetland delineation, ecological assessment and impact assessment for the proposed Copperleaf Residential Estate, Gauteng Province.
- Wetland delineation, functional assessment and impact assessment for the proposed development of portion of the Remainder of Portion 14 and portion of Portion 31 of the Farm Kleinfontein 467-IR: (Part of The Stewards Ext 9), Dunswart, Boksburg.
- Wetland delineation, impact assessment and compilation of a conceptual wetland rehabilitation plan for the proposed upgrading of roads and stormwater systems in a residential area of Mamelodi, Gauteng Province.
- Wetland mitigation strategy for Glencore's Impunzi Mine, Mpumalanga Province.
- Wetland mitigation strategy for the proposed Mafube Life Extension Project, Mpumalanga Province.
- Wetland monitoring as part of the Eerstelingsfontein Bio-Monitoring Programme, Mpumalanga Province.
- Wetland monitoring as part of the Glisa Bio-Monitoring Programme, Mpumalanga Province.
- Wetland study as part of a Critical Habitat Biodiversity Assessment of the Nhangonzo Coastal Stream, Mozambique.
- Wetland vegetation monitoring and vegetation rehabilitation and management plan as part of the KPSX Wetland Rehabilitation Project Environmental Baseline Monitoring, Mpumalanga Province.
- **Wits Rural Facility specialist baseline faunal assessment and environmental impact assessment for a proposed facilities expansion north of Acornhoek, Limpopo Province.**
- Wits Rural Facility specialist baseline wetland and riparian assessment and impact assessment for a proposed facilities expansion, Limpopo Province.

SACNASP Professional Certificate



Curriculum Vitae of the Specialist - Dr. David Barry Hoare

B.Sc. (Hons), M.Sc., Ph.D., Pr.Nat.Sci. (Ecology, Botany)

Contact details

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Personal information

Date of birth: 04 November 1966, Grahamstown, South Africa

Citizenship: Republic of South Africa

ID no.: 661104 5024 088

Education

- Matric - Graeme College, Grahamstown, 1984
- B.Sc (majors: Botany, Zoology) - Rhodes University, 1991-1993
- B.Sc (Hons) (Botany) - Rhodes University, 1994 with distinction
- M.Sc (Botany) - University of Pretoria, 1995-1997 with distinction
- PhD (Botany) – Nelson Mandela Metropolitan University, Port Elizabeth

Main areas of specialisation

- Vegetation ecology, primarily in grasslands, thicket, coastal systems, wetlands.
- Plant biodiversity and threatened plant species specialist.
- Alien plant identification and control / management plans.
- Remote sensing, analysis and mapping of vegetation.
- Specialist consultant for environmental management projects.

Membership

- Professional Natural Scientist, South African Council for Natural Scientific Professions, 16 August 2005 – present. Reg. no. 400221/05 (Ecology, Botany)
- Member, International Association of Vegetation Scientists (IAVS)
- Member, Ecological Society of America (ESA)
- Member, International Association for Impact Assessment (IAIA)

- Member, Herpetological Association of Africa (HAA)

Employment history

- 1 December 2004 – present, Director, David Hoare Consulting (Pty) Ltd. Consultant, specialist consultant contracted to various companies and organisations.
- 1 January 2009 – 30 June 2009, Lecturer, University of Pretoria, Botany Dept.
- 1 January 2013 – 30 June 2013, Lecturer, University of Pretoria, Botany Dept.
- 1 February 1998 – 30 November 2004, Researcher, Agricultural Research Council, Range and Forage Institute, Private Bag X05, Lynn East, 0039. Duties: project management, general vegetation ecology, remote sensing image processing.

Experience as consultant

Ecological consultant since 1995. Author of over 380 specialist ecological consulting reports. Wide experience in ecological studies within grassland, savanna and fynbos, as well as riparian, coastal and wetland vegetation.

Publication record:

Refereed scientific articles (in chronological order):

Journal articles:

- HOARE, D.B. & BREDENKAMP, G.J.** 1999. Grassland communities of the Amatola / Winterberg mountain region of the Eastern Cape, South Africa. *South African Journal of Botany* 64: 44-61.
- HOARE, D.B., VICTOR, J.E., LUBKE, R.A. & MUCINA, L.**, 2000. Vegetation of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 87-96.
- VICTOR, J.E., HOARE, D.B. & LUBKE, R.A.**, 2000. Checklist of plant species of the coastal fynbos and rocky headlands south of George, South Africa. *Bothalia* 30: 97-101.
- MUCINA, L., BREDENKAMP, G.J., HOARE, D.B. & MCDONALD, D.J.** 2000. A National Vegetation Database for South Africa *South African Journal of Science* 96: 1-2.
- HOARE, D.B. & BREDENKAMP, G.J.** 2001. Syntaxonomy and environmental gradients of the grasslands of the Stormberg / Drakensberg mountain region of the Eastern Cape, South Africa.. *South African Journal of Botany* 67: 595 – 608.
- LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R.** 2003. The vegetation of the habitat of the Brenton blue butterfly, *Orachrysops niobe* (Trimen), in the Western Cape, South Africa. *South African Journal of Science* 99: 201–206.
- HOARE, D.B. & FROST, P.** 2004. Phenological classification of natural vegetation in southern Africa using AVHRR vegetation index data. *Applied Vegetation Science* 7: 19-28.
- FOX, S.C., HOFFMANN, M.T. and HOARE, D.** 2005. The phenological pattern of vegetation in Namaqualand, South Africa and its climatic correlates using NOAA-AVHRR NDVI data. *South African Geographic Journal*, 87: 85–94.
- PFAB, M.F., COMPAN, P.C., WHITTINGTON-JONES, C.A., ENGELBRECHT, I., DUMALISILE, L., MILLS, L., WEST, S.D., MULLER, P., MASTERSON, G.P.R., NEVHUTALU, L.S., HOLNESS, S.D., HOARE, D.B.** 2017. The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province. *Bothalia*, Vol. 47:1. a2182. <https://doi.org/10.4102/abc.v47i1.2182>.

Book chapters and conference proceedings:

- HOARE, D.B.** 2002. Biodiversity and performance of grassland ecosystems in communal and commercial farming systems in South Africa. Proceedings of the FAO's Biodiversity and Ecosystem Approach in Agriculture, Forestry and Fisheries Event: 12–13 October, 2002. Food and Agriculture Organisation of the United Nations, Viale delle Terme di Caracalla, Rome, Italy. pp. 10 - 27.
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. In: Mittermeier, R.A., Gil, P.R., Hoffmann, M., Pilgrim, J., Brooks, T., Mittermeier, C.G., Lamoreux, J. & Fonseca, G.A.B. da (eds.) *Hotspots revisited*. CEMEX, pp.218–229. ISBN 968-6397-77-9
- STEENKAMP, Y., VAN WYK, A.E., VICTOR, J.E., **HOARE, D.B.**, DOLD, A.P., SMITH, G.F. & COWLING, R.M. 2005. Maputaland-Pondoland-Albany Hotspot. <http://www.biodiversityhotspots.org/xp/hotspots/maputaland/>.
- HOARE, D.B.**, MUCINA, L., RUTHERFORD, M.C., VLOK, J., EUSTON-BROWN, D., PALMER, A.R., POWRIE, L.W., LECHMERE-OERTEL, R.G., PROCHES, S.M., DOLD, T. and WARD, R.A. *Albany Thickets*. In Mucina, L. and Rutherford, M.C. (eds.) 2006. The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19, South African National Biodiversity Institute, Pretoria.
- MUCINA, L., **HOARE, D.B.**, LÖTTER, M.C., DU PREEZ, P.J., RUTHERFORD, M.C., SCOTT-SHAW, C.R., BREDENKAMP, G.J., POWRIE, L.W., SCOTT, L., CAMP, K.G.T., CILLIERS, S.S., BEZUIDENHOUT, H., MOSTERT, T.H., SIEBERT, S.J., WINTER, P.J.D., BURROWS, J.E., DOBSON, L., WARD, R.A., STALMANS, M., OLIVER, E.G.H., SIEBERT, F., SCHMIDT, E., KOBISI, K., KOSE, L. 2006. *Grassland Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- RUTHERFORD, M.C., MUCINA, L., LÖTTER, M.C., BREDENKAMP, G.J., SMIT, J.H.L., SCOTT-SHAW, C.R., **HOARE, D.B.**, GOODMAN, P.S., BEZUIDENHOUT, H., SCOTT, L. & ELLIS, F., POWRIE, L.W., SIEBERT, F., MOSTERT, T.H., HENNING, B.J., VENTER, C.E., CAMP, K.G.T., SIEBERT, S.J., MATTHEWS, W.S., BURROWS, J.E., DOBSON, L., VAN ROOYEN, N., SCHMIDT, E., WINTER, P.J.D., DU PREEZ, P.J., WARD, R.A., WILLIAMSON, S. and HURTER, P.J.H. 2006. *Savanna Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., RUTHERFORD, M.C., PALMER, A.R., MILTON, S.J., SCOTT, L., VAN DER MERWE, B., **HOARE, D.B.**, BEZUIDENHOUT, H., VLOK, J.H.J., EUSTON-BROWN, D.I.W., POWRIE, L.W. & DOLD, A.P. 2006. *Nama-Karoo Biome*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.
- MUCINA, L., SCOTT-SHAW, C.R., RUTHERFORD, M.C., CAMP, K.G.T., MATTHEWS, W.S., POWRIE, L.W. and **HOARE, D.B.** 2006. *Indian Ocean Coastal Belt*. In: Mucina, L. & Rutherford, M.C. (eds.) The vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

Conference Presentations:

- HOARE, D.B. & LUBKE, R.A. *Management effects on diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B., VICTOR, J.E. & LUBKE, R.A. *Description of the coastal fynbos south of George, southern Cape*; Paper presentation, Fynbos Forum, Bienne Donne, July 1994
- HOARE, D.B. & LUBKE, R.A. *Management effects on fynbos diversity at Goukamma Nature Reserve, Southern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995

- HOARE, D.B. & BOTHA, C.E.J. *Anatomy and ecophysiology of the dunegrass Ehrharta villosa var. maxima*; Poster presentation, South African Association of Botanists Annual Congress, Bloemfontein, January 1995
- HOARE, D.B., PALMER, A.R. & BREDENKAMP, G.J. 1996. *Modelling grassland community distributions in the Eastern Cape using annual rainfall and elevation*; Poster presentation, South African Association of Botanists Annual Congress, Stellenbosch, January 1996
- HOARE, D.B. *Modelling vegetation on a past climate as a test for palaeontological hypotheses on vegetation distributions*; Paper presentation, Randse Afrikaanse Universiteit postgraduate symposium, 1997
- HOARE, D.B., VICTOR, J.E. & BREDENKAMP, G.J. *Historical and ecological links between grassy fynbos and afro-montane fynbos in the Eastern Cape*; Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- LUBKE, R.A., HOARE, D.B., VICTOR, J.E. & KETELAAR, R. *The habitat of the Brenton Blue Butterfly*. Paper presentation, South African Association of Botanists Annual Congress, Cape Town, January 1998
- HOARE, D.B. & PANAGOS, M.D. Satellite stratification of vegetation – structure or floristic composition? Poster presentation at the 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999.
- HOARE, D.B. & WESSELS, K. Conservation status and threats to grasslands of the northern regions of South Africa, Poster presentation at the South African Association of Botanists Annual Congress, Potchefstroom, January 2000.
- HOARE, D.B. Phenological dynamics of Eastern Cape vegetation. Oral paper presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B., MUCINA, L., VAN DER MERWE, J.P.H. & PALMER, A.R. Classification and digital mapping of grasslands of the Eastern Cape Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- HOARE, D.B. Deriving phenological variables for Eastern Cape vegetation using satellite data Poster presentation at the South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- MUCINA, L., RUTHERFORD, M.C., HOARE, D.B. & POWRIE, L.W. 2003. VegMap: The new vegetation map of South Africa, Lesotho and Swaziland. In: Pedrotti, F. (ed.) Abstracts: Water Resources and Vegetation, 46th Symposium of the International Association for Vegetation Science, June 8 to 14 – Napoli, Italy.
- HOARE, D.B. 2003. Species diversity patterns in moist temperate grasslands of South Africa. Proceedings of the VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa. African Journal of Range and Forage Science. 20: 84.

Unpublished technical reports:

- PALMER, A.R., HOARE, D.B. & HINTSA, M.D., 1999. Using satellite imagery to map veld condition in Mpumalanga: A preliminary report. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: methodology for mapping the vegetation communities of the South African savanna at a scale of 1:250 000. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.

- HOARE, D.B. 1999. The classification and mapping of the savanna biome of South Africa: size and coverage of field data that exists on the database of vegetation data for South African savanna. Report to the National Department of Agriculture (Directorate Resource Conservation). ARC Range and Forage Institute, Pretoria.
- THOMPSON, M.W., VAN DEN BERG, H.M., NEWBY, T.S. & HOARE, D.B. 2001. Guideline procedures for national land-cover mapping and change monitoring. Report no. ENV/P/C 2001-006 produced for Department of Water Affairs and Forestry, National Department of Agriculture and Department of Environment Affairs and Tourism. Copyright: Council for Scientific and Industrial Research (CSIR) and Agricultural Research Council (ARC).
- HOARE, D.B. 2003. Natural resource survey of node O R Tambo, using remote sensing techniques, Unpublished report and database of field data for ARC Institute for Soil, Climate & Water, ARC Range and Forage Institute, Grahamstown.
- HOARE, D.B. 2003. Short-term changes in vegetation of Suikerbosrand Nature Reserve, South Africa, on the basis of resampled vegetation sites. Gauteng Department of Agriculture, Conservation, Environment and Land Affairs, Conservation Division.
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Consulting reports:

Total of over 380 specialist consulting reports for various environmental projects from 1995 – present.

Workshops / symposia attended:

- International Association for Impact Assessment Annual Congress, Durban, 16 – 19 May 2018. Workshop on remote sensing of rangelands presented by Paul Tueller, University of Nevada Reno, USA,
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- VIIth International Rangeland Congress, 26 July – 1 August 2003, Durban South Africa.
- BioMap workshop, Stellenbosch, March 2002 to develop strategies for studying vegetation dynamics of Namaqualand using remote sensing techniques
- South African Association of Botanists Annual Congress, Grahamstown, January 2002.
- 28th International Symposium on Remote Sensing of Environment, Somerset West, 27-31 March 2000.
- Workshop on Vegetation Structural Characterisation: Tree Cover, Height and Biomass, 28th International Symposium on Remote Sensing of Environment, Strand, 26 March 2000.
- South African Association of Botanists Annual Congress, Potchefstroom, January 2000
- National Botanical Institute Vegmap Workshop, Kirstenbosch, Cape Town, 30 September-1 October 1999.
- Sustainable Land Management – Guidelines for Impact Monitoring, Orientation Workshop: Sharing Impact Monitoring Experience, Zithabiseni, 27-29 September 1999.

- WWF Macro Economic Reforms and Sustainable Development in Southern Africa, Environmental Economic Training Workshop, development Bank, Midrand, 13-14 September 1999.
- 34th Annual Congress of the Grassland Society of South Africa, Warmbaths, 1-4 February 1999
- Expert Workshop on National Indicators of Environmental Sustainable Development, Dept. of
- Environmental Affairs and Tourism, Roodevallei Country Lodge, Roodeplaat Dam, Pretoria, 20-21 October 1998.
- South African Association of Botanists Annual Congress, Cape Town, January 1998
- Randse Afrikaanse Universiteit postgraduate symposium, 1997.
- South African Association of Botanists Annual Congress, Bloemfontein, January 1995.

Referees:

- Prof. Roy Lubke, Associate Professor Emeritus, Botany Department, Rhodes University, Grahamstown. Tel: 0461-318 592. E-mail: r.lubke@ru.ac.za
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12. APPENDIX 2: LIST OF PLANT SPECIES RECORDED ON SITE.

Family	Species
MALVACEAE	<i>Abutilon austro-africanum</i>
RUBIACEAE	<i>Afrocanthium gilfillanii</i>
HYACINTACEAE	<i>Albuca</i> sp
ASTERACEAE	<i>Ambrosia artemisifolia</i> *
COMMELINACEAE	<i>Aneilema hockii</i>
APONOGETONACEAE	<i>Aponogeton junceus</i>
POACEAE	<i>Aristida adscensionis</i>
POACEAE	<i>Aristida congesta</i>
ASPARAGACEAE	<i>Asparagus</i> sp.
ACANTHACEAE	<i>Asystasia mysorensis</i>
ACANTHACEAE	<i>Barleria mackenii</i>
NYCTAGINACEAE	<i>Boerhavia diffusa</i> *
CAPPARACEAE	<i>Boscia albitrunca</i>
POACEAE	<i>Bothriochloa insculpta</i>
CYPERACEAE	<i>Bulbostylis hispidula</i>
POACEAE	<i>Cenchrus ciliaris</i>
APIACEAE	<i>Centella asiatica</i>
PEDALIACEAE	<i>Ceratotheca triloba</i>
FABACEAE	<i>Chamaecrista comosa</i>
VERBENACEAE	<i>Chascanum hederaceum</i>
POACEAE	<i>Chloris virgata</i>
BRASSICACEAE	<i>Cleome angustifolia</i>
BRASSICACEAE	<i>Cleome monophylla</i>
LAMIACEAE	<i>Clerodendrum ternatum</i>
COMBRETACEAE	<i>Combretum apiculatum</i>
COMBRETACEAE	<i>Combretum hereroense</i>
COMBRETACEAE	<i>Combretum molle</i>
COMMELINACEAE	<i>Commelina africana</i>
COMMELINACEAE	<i>Commelina benghalensis</i>
COMMELINACEAE	<i>Commelina erecta</i>
BURSERACEAE	<i>Commiphora mollis</i>
MOLLUGINACEAE	<i>Corbichonia decumbens</i>
MALVACEAE	<i>Corchorus asplenifolius</i>
FABACEAE	<i>Crotalaria lotoides</i>
EUPHORBIACEAE	<i>Croton gratissimus</i>
CUCURBITACEAE	<i>Cucumis zeyheri</i>
POACEAE	<i>Cynodon dactylon</i>
CYPERACEAE	<i>Cyperus decurvatus</i>
CYPERACEAE	<i>Cyperus fastigiatus</i>
CYPERACEAE	<i>Cyperus fulgens</i>
CYPERACEAE	<i>Cyperus margaritaceus</i>
CYPERACEAE	<i>Cyperus sexangularis</i>
VITACEAE	<i>Cyphostemma oleraceum</i>
POACEAE	<i>Dactyloctenium aegyptium</i>
SOLANACEAE	<i>Datura ferox</i> *
PEDALIACEAE	<i>Dicercocaryum senecioides</i>
FABACEAE	<i>Dichrostachys cinerea</i>

ASTERACEAE	<i>Dicoma galpinii</i>
ASTERACEAE	<i>Dicoma macrocephala</i>
POACEAE	<i>Digitaria</i>
POACEAE	<i>Diheteropogon amplexans</i>
POACEAE	<i>Dinebra retroflexa</i>
APOCYNACEAE	<i>Diplorhynchus condylocarpon</i>
MALVACEAE	<i>Dombeya rotundifolia</i>
POACEAE	<i>Echinochloa pyramidalis</i>
BORAGINACEAE	<i>Ehretia rigida</i>
FABACEAE	<i>Elephantorrhiza burkei</i>
POACEAE	<i>Elionurus muticus</i>
POACEAE	<i>Enneapogon scoparius</i>
POACEAE	<i>Eragrostis lehmanniana</i>
POACEAE	<i>Eragrostis planiculmis</i>
POACEAE	<i>Eragrostis superba</i>
EBENACEAE	<i>Euclea crispa</i>
EBENACEAE	<i>Euclea undulata</i>
POACEAE	<i>Eustachys paspaloides</i>
CONVOLVULACEAE	<i>Evolvulus alsinoides</i>
POACEAE	<i>Fingerhuthia africana</i>
GISEKIAEAE	<i>Gisekia pharnacioides</i>
APOCYNACEAE	<i>Gomphocarpus fruticosus</i>
APOCYNACEAE	<i>Gomphocarpus tomentosus</i>
AMARANTHACEAE	<i>Gomphrena celosioides*</i>
MALVACEAE	<i>Grewia flava</i>
MALVACEAE	<i>Grewia flavescens</i>
MALVACEAE	<i>Grewia monticola</i>
CELASTRACEAE	<i>Gymnosporia buxifolia</i>
MALVACEAE	<i>Hermannia</i> sp.
AMARANTHACEAE	<i>Hermibstaedtia</i> cf. <i>odorata</i>
POACEAE	<i>Heteropogon contortus</i>
MALVACEAE	<i>Hibiscus aethiopicus</i>
MALVACEAE	<i>Hibiscus microcarpus</i>
MALVACEAE	<i>Hibiscus trionum</i>
ASTERACEAE	<i>Hirpicium bechuanense</i>
POACEAE	<i>Hyperthelia dissoluta</i>
FABACEAE	<i>Indigofera filipes</i>
CONVOLVULACEAE	<i>Ipomoea coptica</i>
CONVOLVULACEAE	<i>Ipomoea crassipes</i>
CONVOLVULACEAE	<i>Ipomoea obscura</i>
POACEAE	<i>Ischaemum afrum</i>
EUPHORBIACEAE	<i>Jatropha zeyheri</i>
ACANTHACEAE	<i>Justicia flava</i>
CRASSULACEAE	<i>Kalanchoe thyrsiflora</i>
ASTERACEAE	<i>Kleinia longiflora</i>
RUBIACEAE	<i>Kohautia caespitosa</i> ssp. <i>brachyloba</i>
ANACARDIACEAE	<i>Lannea discolor</i>
VERBENACEAE	<i>Lantana rugosa</i>
HYACINTHACEAE	<i>Ledebouria inquinata</i>
ACANTHACEAE	<i>Lepidagathis scabra</i>
MOLLUGINACEAE	<i>Limeum viscosum</i>
POACEAE	<i>Loudetia simplex</i>

POACEAE	Megathyrsus maximus
MALVACEAE	Melhania prostrata
POACEAE	Melinis repens
POACEAE	Microchloa caffra
CUCURBITACEAE	Momordica balsamina
GERANIACEAE	Monsonia angustifolia
ASTERACEAE	Nidorella hottentotica
RUBIACEAE	Oldenlandia herbacea
APOCYNACEAE	Orbea melanantha
FABACEAE	Otoptera burchellii
POLYGONACEAE	Oxygonum sinuatum
ANACARDIACEAE	Ozoroa paniculosa
POACEAE	Panicum aequinerve
POACEAE	Panicum coloratum
SAPINDACEAE	Pappea capensis
MOLLUGINACEAE	Paramollugo nudicaulis
RUBIACEAE	Pavetta zeyheri
PTERIDACEAE	Pellaea calomelanos
FABACEAE	Peltophorum africanum
APOCYNACEAE	Pentarrhinum insipidum
SOLANACEAE	Physalis angulata
CARYOPHYLLACEAE	Pollichia campestris
PORTULACACEAE	Portulaca kermesina
URTICACEAE	Pouzolzia mixta
PHYLLANTHACEAE	Pseudolachnostylis maprouneifolia
FABACEAE	Rhynchosia sp.
LAMIACEAE	Salvia runcinata
POACEAE	Schizachyrium sanguineum
ASTERACEAE	Schkuhria pinnata
POACEAE	Schmidtia pappophoroides
CYPERACEAE	Schoenoplectus corymbosus
ANACARDIACEAE	Searsia lancea
ANACARDIACEAE	Searsia leptodictya
ANACARDIACEAE	Searsia pyroides
SELAGINELLACEAE	Selaginella dregei
FABACEAE	Senegalia caffra
FABACEAE	Senegalia mellifera
FABACEAE	Senna italica
FABACEAE	Sesbania bispinosa*
POACEAE	Setaria lindenbergiana
POACEAE	Setaria pumila
POACEAE	Setaria verticillata
SOLANACEAE	Solanum campylacanthum
SOLANACEAE	Solanum elaeagnifolium
POACEAE	Sorghum halepense
POACEAE	Sporobolus africanus
POACEAE	Sporobolus festivus
OROBANCHACEAE	Striga bilabiata
LOGANIACEAE	Strychnos madagascariensis
FABACEAE	Tephrosia sp.
POACEAE	Themeda triandra
ACANTHACEAE	Thunbergia atriplicifolia

EUPHORBIACEAE	Tragia rupestris
POACEAE	Tragus berteronianus
ZYGOPHYLLACEAE	Tribulus terrestris
FABACEAE	Tylosema fassoglense
POACEAE	Urochloa panicoides
POACEAE	Urochloa serrata
FABACEAE	Vachellia erioloba
FABACEAE	Vachellia karroo
FABACEAE	Vachellia permixta
FABACEAE	Vachellia robusta
FABACEAE	Vachellia tortilis
VAHLIACEAE	Vahlia capensis
VITACEAE	Vitex pooara
SOLANACEAE	Waltheria indica
OLACACEAE	Ximenia americana
ASTERACEAE	Zinnia peruviana*
RHAMNACEAE	Ziziphus mucronata

13. APPENDIX 3: LIST OF MAMMAL SPECIES PREVIOUSLY RECORDED IN THE QUARTER DEGREE GRID (2428BD).

Family	Scientific name	Common name	Red List Category
Bathyergidae	<i>Cryptomys hottentotus</i>	Southern African Mole-rat	Least Concern (2016)
Bovidae	<i>Aepyceros melampus</i>	Impala	Least Concern
Bovidae	<i>Connochaetes taurinus</i>	Blue Wildebeest	Least Concern (ver 3.1, 2017)
Bovidae	<i>Connochaetes taurinus taurinus</i>		Least Concern (2016)
Bovidae	<i>Damaliscus lunatus lunatus</i>	(Southern African) Tsessebe	Vulnerable (2016)
Bovidae	<i>Hippotragus niger niger</i>		Vulnerable (2016)
Bovidae	<i>Kobus ellipsiprymnus ellipsiprymnus</i>		Least Concern (2016)
Bovidae	<i>Oreotragus oreotragus</i>	Klipspringer	Least Concern (2016)
Bovidae	<i>Raphicerus campestris</i>	Steenbok	Least Concern (2016)
Bovidae	<i>Redunca fulvorufula</i>	Mountain Reedbuck	Least Concern
Bovidae	<i>Sylvicapra grimmia</i>	Bush Duiker	Least Concern (2016)
Bovidae	<i>Tragelaphus angasii</i>	Nyala	Least Concern (2016)
Bovidae	<i>Tragelaphus scriptus</i>	Bushbuck	Least Concern
Bovidae	<i>Tragelaphus strepsiceros</i>	Greater Kudu	Least Concern (2016)
Canidae	<i>Canis mesomelas</i>	Black-backed Jackal	Least Concern (2016)
Equidae	<i>Equus quagga</i>	Plains Zebra	Least Concern (2016)
Felidae	<i>Panthera pardus</i>	Leopard	Vulnerable (2016)
Galagidae	<i>Galago senegalensis</i>	Senegal Bushbaby	
Giraffidae	<i>Giraffa giraffa giraffa</i>	South African Giraffe	Least Concern (2016)
Herpestidae	<i>Helogale parvula</i>	Common Dwarf Mongoose	Least Concern (2016)
Hyaenidae	<i>Hyaena brunnea</i>	Brown Hyena	Near Threatened (2015)
Leporidae	<i>Lepus saxatilis</i>	Scrub Hare	Least Concern
Muridae	<i>Aethomys ineptus</i>	Tete Veld Aethomys	Least Concern (2016)
Muridae	<i>Aethomys namaquensis</i>	Namaqua Rock Mouse	Least Concern
Muridae	<i>Gerbilliscus leucogaster</i>	Bushveld Gerbil	Least Concern (2016)
Muridae	<i>Mastomys coucha</i>	Southern African Mastomys	Least Concern (2016)
Muridae	<i>Mastomys natalensis</i>	Natal Mastomys	Least Concern (2016)
Muridae	<i>Mus (Nannomys) minutoides</i>	Southern African Pygmy Mouse	Least Concern
Muridae	<i>Rattus rattus</i>	Roof Rat	Least Concern
Muridae	<i>Thallomys paedulus</i>	Acacia Thallomys	Least Concern (2016)
Mustelidae	<i>Mellivora capensis</i>	Honey Badger	Least Concern (2016)
Nesomyidae	<i>Saccostomus campestris</i>	Southern African Pouched Mouse	Least Concern (2016)
Orycteropodidae	<i>Orycteropus afer</i>	Aardvark	Least Concern (2016)
Pedetidae	<i>Pedetes capensis</i>	South African Spring Hare	Least Concern (2016)
Rhinolophidae	<i>Rhinolophus smithersi</i>	Smithers' Horseshoe Bat	Near Threatened (2016)
Sciuridae	<i>Paraxerus cepapi</i>	Smith's Bush Squirrel	Least Concern (2016)
Soricidae	<i>Crocidura hirta</i>	Lesser Red Musk Shrew	Least Concern (2016)
Suidae	<i>Phacochoerus africanus</i>	Common Warthog	Least Concern (2016)
Suidae	<i>Potamochoerus porcus</i>	Red River Hog	

Family	Scientific name	Common name	Red List Category
Viverridae	<i>Civettictis civetta</i>	African Civet	Least Concern (2016)

14. APPENDIX 4: LIST OF AVIFAUNAL SPECIES PREVIOUSLY RECORDED IN PENTADS 2415_2855 & 2420_2855.

Ref	Scientific Name		Common Name	
1	<i>Struthio</i>	<i>camelus</i>	Ostrich	Common
4	<i>Podiceps</i>	<i>cristatus</i>	Grebe	Great Crested
6	<i>Tachybaptus</i>	<i>ruficollis</i>	Grebe	Little
47	<i>Phalacrocorax</i>	<i>lucidus</i>	Cormorant	White-breasted
50	<i>Microcarbo</i>	<i>africanus</i>	Cormorant	Reed
52	<i>Anhinga</i>	<i>rufa</i>	Darter	African
54	<i>Ardea</i>	<i>cinerea</i>	Heron	Grey
55	<i>Ardea</i>	<i>melanocephala</i>	Heron	Black-headed
56	<i>Ardea</i>	<i>goliath</i>	Heron	Goliath
57	<i>Ardea</i>	<i>purpurea</i>	Heron	Purple
58	<i>Ardea</i>	<i>alba</i>	Egret	Great
59	<i>Egretta</i>	<i>garzetta</i>	Egret	Little
60	<i>Ardea</i>	<i>intermedia</i>	Egret	Intermediate
61	<i>Bubulcus</i>	<i>ibis</i>	Egret	Western Cattle
62	<i>Ardeola</i>	<i>ralloides</i>	Heron	Squacco
63	<i>Butorides</i>	<i>striata</i>	Heron	Striated
64	<i>Egretta</i>	<i>ardesiaca</i>	Heron	Black
67	<i>Ixobrychus</i>	<i>minutus</i>	Bittern	Little
69	<i>Nycticorax</i>	<i>nycticorax</i>	Heron	Black-crowned Night
72	<i>Scopus</i>	<i>umbretta</i>		Hamerkop
73	<i>Leptoptilos</i>	<i>crumenifer</i>	Stork	Marabou
76	<i>Mycteria</i>	<i>ibis</i>	Stork	Yellow-billed
80	<i>Ciconia</i>	<i>ciconia</i>	Stork	White
81	<i>Threskiornis</i>	<i>aethiopicus</i>	Ibis	African Sacred
83	<i>Plegadis</i>	<i>falcinellus</i>	Ibis	Glossy
84	<i>Bostrychia</i>	<i>hagedash</i>	Ibis	Hadada
85	<i>Platalea</i>	<i>alba</i>	Spoonbill	African
86	<i>Phoenicopterus</i>	<i>roseus</i>	Flamingo	Greater
88	<i>Plectropterus</i>	<i>gambensis</i>	Goose	Spur-winged
89	<i>Alopochen</i>	<i>aegyptiaca</i>	Goose	Egyptian
91	<i>Sarkidiornis</i>	<i>melanotos</i>	Duck	Knob-billed
94	<i>Spatula</i>	<i>smithii</i>	Shoveler	Cape
95	<i>Anas</i>	<i>sparsa</i>	Duck	African Black
96	<i>Anas</i>	<i>undulata</i>	Duck	Yellow-billed
97	<i>Anas</i>	<i>erythrorhyncha</i>	Teal	Red-billed
99	<i>Spatula</i>	<i>hottentota</i>	Teal	Blue-billed
100	<i>Dendrocygna</i>	<i>viduata</i>	Duck	White-faced Whistling
101	<i>Dendrocygna</i>	<i>bicolor</i>	Duck	Fulvous Whistling
102	<i>Netta</i>	<i>erythrophthalma</i>	Pochard	Southern
104	<i>Thalassornis</i>	<i>leuconotus</i>	Duck	White-backed
105	<i>Sagittarius</i>	<i>serpentarius</i>		Secretarybird

Ref	Scientific Name		Common Name	
107	<i>Gyps</i>	<i>africanus</i>	Vulture	White-backed
119	<i>Falco</i>	<i>amurensis</i>	Falcon	Amur
122	<i>Falco</i>	<i>rupicoloides</i>	Kestrel	Greater
123	<i>Falco</i>	<i>rupicolus</i>	Kestrel	Rock
125	<i>Falco</i>	<i>naumanni</i>	Kestrel	Lesser
129	<i>Milvus</i>	<i>aegyptius</i>	Kite	Yellow-billed
130	<i>Elanus</i>	<i>caeruleus</i>	Kite	Black-winged
133	<i>Aquila</i>	<i>verreauxii</i>	Eagle	Verreaux's
134	<i>Aquila</i>	<i>rapax</i>	Eagle	Tawny
137	<i>Hieraaetus</i>	<i>wahlbergi</i>	Eagle	Wahlberg's
138	<i>Lophaetus</i>	<i>occipitalis</i>	Eagle	Long-crested
145	<i>Circaetus</i>	<i>cinereus</i>	Eagle	Brown Snake
146	<i>Circaetus</i>	<i>pectoralis</i>	Eagle	Black-chested Snake
149	<i>Haliaeetus</i>	<i>vocifer</i>	Eagle	African Fish
154	<i>Buteo</i>	<i>buteo</i>	Buzzard	Common
158	<i>Accipiter</i>	<i>minullus</i>	Sparrowhawk	Little
161	<i>Accipiter</i>	<i>badius</i>		Shikra
171	<i>Polyboroides</i>	<i>typus</i>	Harrier-Hawk	African
173	<i>Peliperdix</i>	<i>coqui</i>	Francolin	Coqui
174	<i>Dendroperdix</i>	<i>sephaena</i>	Francolin	Crested
183	<i>Pternistis</i>	<i>natalensis</i>	Spurfowl	Natal
185	<i>Pternistis</i>	<i>swainsonii</i>	Spurfowl	Swainson's
192	<i>Numida</i>	<i>meleagris</i>	Guineafowl	Helmeted
196	<i>Turnix</i>	<i>sylvaticus</i>	Buttonquail	Common
203	<i>Zapornia</i>	<i>flavirostra</i>	Crake	Black
210	<i>Gallinula</i>	<i>chloropus</i>	Moorhen	Common
212	<i>Fulica</i>	<i>cristata</i>	Coot	Red-knobbed
224	<i>Lophotis</i>	<i>ruficrista</i>	Korhaan	Red-crested
228	<i>Actophilornis</i>	<i>africanus</i>	Jacana	African
237	<i>Charadrius</i>	<i>pecuarius</i>	Plover	Kittlitz's
238	<i>Charadrius</i>	<i>tricoloris</i>	Plover	Three-banded
242	<i>Vanellus</i>	<i>coronatus</i>	Lapwing	Crowned
245	<i>Vanellus</i>	<i>armatus</i>	Lapwing	Blacksmith
247	<i>Vanellus</i>	<i>senegallus</i>	Lapwing	African Wattled
253	<i>Calidris</i>	<i>minuta</i>	Stint	Little
256	<i>Calidris</i>	<i>pugnax</i>		Ruff
258	<i>Actitis</i>	<i>hypoleucos</i>	Sandpiper	Common
263	<i>Tringa</i>	<i>nebularia</i>	Greenshank	Common
264	<i>Tringa</i>	<i>glareola</i>	Sandpiper	Wood
269	<i>Recurvirostra</i>	<i>avosetta</i>	Avocet	Pied
270	<i>Himantopus</i>	<i>himantopus</i>	Stilt	Black-winged
275	<i>Burhinus</i>	<i>capensis</i>	Thick-knee	Spotted
277	<i>Cursorius</i>	<i>temminckii</i>	Courser	Temminck's
282	<i>Glareola</i>	<i>nordmanni</i>	Pratincole	Black-winged
304	<i>Chlidonias</i>	<i>leucopterus</i>	Tern	White-winged

Ref	Scientific Name		Common Name	
305	<i>Chlidonias</i>	<i>hybrida</i>	Tern	Whiskered
311	<i>Columba</i>	<i>guinea</i>	Pigeon	Speckled
314	<i>Streptopelia</i>	<i>semitorquata</i>	Dove	Red-eyed
316	<i>Streptopelia</i>	<i>capicola</i>	Dove	Cape Turtle
317	<i>Spilopelia</i>	<i>senegalensis</i>	Dove	Laughing
318	<i>Oena</i>	<i>capensis</i>	Dove	Namaqua
321	<i>Turtur</i>	<i>chalcospilos</i>	Dove	Emerald-spotted Wood
323	<i>Treron</i>	<i>calvus</i>	Pigeon	African Green
339	<i>Crinifer</i>	<i>concolor</i>	Go-away-bird	Grey
343	<i>Cuculus</i>	<i>solitarius</i>	Cuckoo	Red-chested
344	<i>Cuculus</i>	<i>clamosus</i>	Cuckoo	Black
347	<i>Clamator</i>	<i>levaillantii</i>	Cuckoo	Levaillant's
348	<i>Clamator</i>	<i>jacobinus</i>	Cuckoo	Jacobin
351	<i>Chrysococcyx</i>	<i>klaas</i>	Cuckoo	Klaas's
352	<i>Chrysococcyx</i>	<i>caprius</i>	Cuckoo	Diederik
365	<i>Glaucidium</i>	<i>perlatum</i>	Owlet	Pearl-spotted
374	<i>Caprimulgus</i>	<i>tristigma</i>	Nightjar	Freckled
383	<i>Apus</i>	<i>caffer</i>	Swift	White-rumped
385	<i>Apus</i>	<i>affinis</i>	Swift	Little
387	<i>Cypsiurus</i>	<i>parvus</i>	Swift	African Palm
390	<i>Colius</i>	<i>striatus</i>	Mousebird	Speckled
392	<i>Urocolius</i>	<i>indicus</i>	Mousebird	Red-faced
394	<i>Ceryle</i>	<i>rudis</i>	Kingfisher	Pied
395	<i>Megaceryle</i>	<i>maxima</i>	Kingfisher	Giant
397	<i>Corythornis</i>	<i>cristatus</i>	Kingfisher	Malachite
399	<i>Halcyon</i>	<i>senegalensis</i>	Kingfisher	Woodland
402	<i>Halcyon</i>	<i>albiventris</i>	Kingfisher	Brown-hooded
403	<i>Halcyon</i>	<i>chelicuti</i>	Kingfisher	Striped
404	<i>Merops</i>	<i>apiaster</i>	Bee-eater	European
405	<i>Merops</i>	<i>persicus</i>	Bee-eater	Blue-cheeked
409	<i>Merops</i>	<i>bullockoides</i>	Bee-eater	White-fronted
410	<i>Merops</i>	<i>pusillus</i>	Bee-eater	Little
412	<i>Coracias</i>	<i>garrulus</i>	Roller	European
413	<i>Coracias</i>	<i>caudatus</i>	Roller	Lilac-breasted
418	<i>Upupa</i>	<i>africana</i>	Hoopoe	African
419	<i>Phoeniculus</i>	<i>purpureus</i>	Wood Hoopoe	Green
421	<i>Rhinopomastus</i>	<i>cyanomelas</i>	Scimitarbill	Common
424	<i>Lophoceros</i>	<i>nasutus</i>	Hornbill	African Grey
426	<i>Tockus</i>	<i>leucomelas</i>	Hornbill	Southern Yellow-billed
431	<i>Lybius</i>	<i>torquatus</i>	Barbet	Black-collared
432	<i>Tricholaema</i>	<i>leucomelas</i>	Barbet	Acacia Pied
437	<i>Pogoniulus</i>	<i>chrysoconus</i>	Tinkerbird	Yellow-fronted
439	<i>Trachyphonus</i>	<i>vaillantii</i>	Barbet	Crested
440	<i>Indicator</i>	<i>indicator</i>	Honeyguide	Greater
447	<i>Campethera</i>	<i>abingoni</i>	Woodpecker	Golden-tailed

Ref	Scientific Name		Common Name	
450	<i>Dendropicos</i>	<i>fuscescens</i>	Woodpecker	Cardinal
451	<i>Chloropicus</i>	<i>namaquus</i>	Woodpecker	Bearded
458	<i>Mirafra</i>	<i>africana</i>	Lark	Rufous-naped
460	<i>Calendulauda</i>	<i>sabota</i>	Lark	Sabota
484	<i>Eremopterix</i>	<i>leucotis</i>	Sparrow-Lark	Chestnut-backed
493	<i>Hirundo</i>	<i>rustica</i>	Swallow	Barn
495	<i>Hirundo</i>	<i>albigularis</i>	Swallow	White-throated
498	<i>Hirundo</i>	<i>dimidiata</i>	Swallow	Pearl-breasted
501	<i>Cecropis</i>	<i>semirufa</i>	Swallow	Red-breasted
502	<i>Cecropis</i>	<i>cucullata</i>	Swallow	Greater Striped
503	<i>Cecropis</i>	<i>abyssinica</i>	Swallow	Lesser Striped
506	<i>Ptyonoprogne</i>	<i>fuligula</i>	Martin	Rock
509	<i>Riparia</i>	<i>paludicola</i>	Martin	Brown-throated
510	<i>Riparia</i>	<i>cincta</i>	Martin	Banded
513	<i>Campephaga</i>	<i>flava</i>	Cuckooshrike	Black
514	<i>Melaniparus</i>	<i>cinerascens</i>	Tit	Ashy
517	<i>Dicrurus</i>	<i>adsimilis</i>	Drongo	Fork-tailed
521	<i>Oriolus</i>	<i>larvatus</i>	Oriole	Black-headed
522	<i>Corvus</i>	<i>albus</i>	Crow	Pied
527	<i>Melaniparus</i>	<i>niger</i>	Tit	Southern Black
533	<i>Turdoides</i>	<i>jardineii</i>	Babbler	Arrow-marked
545	<i>Pycnonotus</i>	<i>tricolor</i>	Bulbul	Dark-capped
550	<i>Chlorocichla</i>	<i>flaviventris</i>	Greenbul	Yellow-bellied
552	<i>Turdus</i>	<i>libonyana</i>	Thrush	Kurrichane
557	<i>Turdus</i>	<i>litsitsirupa</i>	Thrush	Groundscraper
573	<i>Thamnotlaea</i>	<i>cinnamomeiventris</i>	Chat	Mocking Cliff
576	<i>Saxicola</i>	<i>torquatus</i>	Stonechat	African
581	<i>Cossypha</i>	<i>caffra</i>	Robin-Chat	Cape
582	<i>Cossypha</i>	<i>humeralis</i>	Robin-Chat	White-throated
586	<i>Cercotrichas</i>	<i>paena</i>	Scrub Robin	Kalahari
588	<i>Cercotrichas</i>	<i>leucophrys</i>	Scrub Robin	White-browed
599	<i>Phylloscopus</i>	<i>trochilus</i>	Warbler	Willow
600	<i>Eremomela</i>	<i>icteropygialis</i>	Eremomela	Yellow-bellied
601	<i>Eremomela</i>	<i>usticollis</i>	Eremomela	Burnt-necked
603	<i>Acrocephalus</i>	<i>arundinaceus</i>	Warbler	Great Reed
604	<i>Acrocephalus</i>	<i>gracilirostris</i>	Warbler	Lesser Swamp
609	<i>Bradypterus</i>	<i>baboecala</i>	Warbler	Little Rush
614	<i>Calamonastes</i>	<i>fasciolatus</i>	Wren-Warbler	Barred
621	<i>Sylvietta</i>	<i>rufescens</i>	Crombec	Long-billed
622	<i>Apalis</i>	<i>thoracica</i>	Apalis	Bar-throated
628	<i>Cameroptera</i>	<i>brevicaudata</i>	Cameroptera	Grey-backed
629	<i>Cisticola</i>	<i>juncidis</i>	Cisticola	Zitting
630	<i>Cisticola</i>	<i>aridulus</i>	Cisticola	Desert
637	<i>Cisticola</i>	<i>fulvicapilla</i>		Neddicky
642	<i>Cisticola</i>	<i>chiniana</i>	Cisticola	Rattling

Ref	Scientific Name		Common Name	
648	<i>Cisticola</i>	<i>aberrans</i>	Cisticola	Lazy
649	<i>Prinia</i>	<i>subflava</i>	Prinia	Tawny-flanked
650	<i>Prinia</i>	<i>flavicans</i>	Prinia	Black-chested
654	<i>Muscicapa</i>	<i>striata</i>	Flycatcher	Spotted
657	<i>Myioparus</i>	<i>plumbeus</i>	Tit-Flycatcher	Grey
658	<i>Curruca</i>	<i>subcoerulea</i>	Warbler	Chestnut-vented
661	<i>Melaenornis</i>	<i>mariquensis</i>	Flycatcher	Marico
664	<i>Melaenornis</i>	<i>pammelaina</i>	Flycatcher	Southern Black
673	<i>Batis</i>	<i>molitor</i>	Batis	Chinspot
682	<i>Terpsiphone</i>	<i>viridis</i>	Flycatcher	African Paradise
685	<i>Motacilla</i>	<i>aguimp</i>	Wagtail	African Pied
686	<i>Motacilla</i>	<i>capensis</i>	Wagtail	Cape
692	<i>Anthus</i>	<i>cinnamomeus</i>	Pipit	African
695	<i>Anthus</i>	<i>vaalensis</i>	Pipit	Buffy
699	<i>Anthus</i>	<i>caffer</i>	Pipit	Bushveld
703	<i>Macronyx</i>	<i>capensis</i>	Longclaw	Cape
706	<i>Lanius</i>	<i>minor</i>	Shrike	Lesser Grey
707	<i>Lanius</i>	<i>collaris</i>	Fiscal	Southern
708	<i>Lanius</i>	<i>collurio</i>	Shrike	Red-backed
709	<i>Laniarius</i>	<i>ferrugineus</i>	Boubou	Southern
711	<i>Laniarius</i>	<i>atrococcineus</i>	Shrike	Crimson-breasted
712	<i>Dryoscopus</i>	<i>cubla</i>	Puffback	Black-backed
714	<i>Tchagra</i>	<i>australis</i>	Tchagra	Brown-crowned
715	<i>Tchagra</i>	<i>senegalus</i>	Tchagra	Black-crowned
719	<i>Chlorophoneus</i>	<i>sulfureopectus</i>	Bushshrike	Orange-breasted
723	<i>Malaconotus</i>	<i>blanchoti</i>	Bushshrike	Grey-headed
724	<i>Urolestes</i>	<i>melanoleucus</i>	Shrike	Magpie
727	<i>Prionops</i>	<i>plumatus</i>	Helmetshrike	White-crested
730	<i>Eurocephalus</i>	<i>anguitimens</i>	Shrike	Southern White-crowned
731	<i>Nilaus</i>	<i>afer</i>		Brubru
734	<i>Acridotheres</i>	<i>tristis</i>	Myna	Common
735	<i>Creatophora</i>	<i>cinerea</i>	Starling	Wattled
736	<i>Cinnyricinclus</i>	<i>leucogaster</i>	Starling	Violet-backed
737	<i>Lamprotornis</i>	<i>nitens</i>	Starling	Cape
743	<i>Lamprotornis</i>	<i>australis</i>	Starling	Burchell's
745	<i>Onychognathus</i>	<i>morio</i>	Starling	Red-winged
748	<i>Buphagus</i>	<i>erythrorynchus</i>	Oxpecker	Red-billed
755	<i>Cinnyris</i>	<i>mariquensis</i>	Sunbird	Marico
763	<i>Cinnyris</i>	<i>talatala</i>	Sunbird	White-bellied
772	<i>Chalcomitra</i>	<i>amethystina</i>	Sunbird	Amethyst
780	<i>Plocepasser</i>	<i>mahali</i>	Sparrow-Weaver	White-browed
784	<i>Passer</i>	<i>domesticus</i>	Sparrow	House
786	<i>Passer</i>	<i>melanurus</i>	Sparrow	Cape
788	<i>Gymnoris</i>	<i>superciliaris</i>	Sparrow	Yellow-throated Bush
789	<i>Sporopipes</i>	<i>squamifrons</i>	Weaver	Scaly-feathered

Ref	Scientific Name		Common Name	
791	<i>Ploceus</i>	<i>ocularis</i>	Weaver	Spectacled
792	<i>Ploceus</i>	<i>intermedius</i>	Masked-weaver	Lesser
797	<i>Ploceus</i>	<i>cucullatus</i>	Weaver	Village
803	<i>Ploceus</i>	<i>velatus</i>	Weaver	Southern Masked
804	<i>Amblyospiza</i>	<i>albifrons</i>	Weaver	Thick-billed
805	<i>Quelea</i>	<i>quelea</i>	Quelea	Red-billed
808	<i>Euplectes</i>	<i>orix</i>	Bishop	Southern Red
812	<i>Euplectes</i>	<i>afer</i>	Bishop	Yellow-crowned
814	<i>Euplectes</i>	<i>albonotatus</i>	Widowbird	White-winged
821	<i>Amadina</i>	<i>fasciata</i>	Finch	Cut-throat
823	<i>Spermestes</i>	<i>cucullata</i>	Mannikin	Bronze
830	<i>Pytilia</i>	<i>melba</i>	Pytilia	Green-winged
835	<i>Lagonosticta</i>	<i>rhodopareia</i>	Firefinch	Jameson's
837	<i>Lagonosticta</i>	<i>senegala</i>	Firefinch	Red-billed
838	<i>Amandava</i>	<i>subflava</i>	Waxbill	Orange-breasted
839	<i>Uraeginthus</i>	<i>angolensis</i>	Waxbill	Blue
840	<i>Granatina</i>	<i>granatina</i>	Waxbill	Violet-eared
841	<i>Brunhilda</i>	<i>erythronotos</i>	Waxbill	Black-faced
843	<i>Estrilda</i>	<i>astrild</i>	Waxbill	Common
844	<i>Ortygospiza</i>	<i>atricollis</i>		Quailfinch
846	<i>Vidua</i>	<i>macroura</i>	Whydah	Pin-tailed
847	<i>Vidua</i>	<i>regia</i>	Whydah	Shaft-tailed
852	<i>Vidua</i>	<i>paradisaea</i>	Whydah	Long-tailed Paradise
859	<i>Crithagra</i>	<i>mozambica</i>	Canary	Yellow-fronted
860	<i>Crithagra</i>	<i>atroregularis</i>	Canary	Black-throated
867	<i>Crithagra</i>	<i>gularis</i>	Seed-eater	Streaky-headed
872	<i>Emberiza</i>	<i>tahapisi</i>	Bunting	Cinnamon-breasted
874	<i>Emberiza</i>	<i>flaviventris</i>	Bunting	Golden-breasted
1016	<i>Anas</i>	<i>platyrhynchos</i>		Mallard
1104	<i>Turdus</i>	<i>smithi</i>	Thrush	Karoo
1172	<i>Zosterops</i>	<i>virens</i>	White-eye	Cape
4129	<i>Tockus</i>	<i>rufirostris</i>	Hornbill	Southern Red-billed
4131	<i>Centropus</i>	<i>burchellii</i>	Coucal	Burchell's
4142	<i>Passer</i>	<i>diffusus</i>	Sparrow	Southern Grey-headed

15. APPENDIX 5: LIST OF HERPETOFAUNA SPECIES PREVIOUSLY RECORDED IN THE QUARTER DEGREE GRID (2428BD).

Family	Scientific name	Common name	Red List Category
Agamidae	<i>Acanthocercus atricollis</i>	Southern Tree Agama	Least Concern (SARCA 2014)
Agamidae	<i>Agama aculeata distanti</i>	Distant's Ground Agama	Least Concern (SARCA 2014)
Chamaeleonidae	<i>Chamaeleo dilepis</i>	Common Flap-neck Chameleon	Least Concern (SARCA 2014)
Colubridae	<i>Crotaphopeltis hotamboeia</i>	Red-lipped Snake	Least Concern (SARCA 2014)
Colubridae	<i>Dispholidus typus viridis</i>	Northern Boomslang	Not evaluated
Colubridae	<i>Telescopus semiannulatus semiannulatus</i>	Eastern Tiger Snake	Least Concern (SARCA 2014)
Cordylidae	<i>Cordylus vittifer</i>	Common Girdled Lizard	Least Concern (SARCA 2014)
Cordylidae	<i>Platysaurus guttatus</i>	Dwarf Flat Lizard	Least Concern (SARCA 2014)
Cordylidae	<i>Smaug breyeri</i>	Waterberg Girdled Lizard	Least Concern (SARCA 2014)
Elapidae	<i>Naja annulifera</i>	Snouted Cobra	Least Concern (SARCA 2014)
Elapidae	<i>Naja mossambica</i>	Mozambique Spitting Cobra	Least Concern (SARCA 2014)
Gekkonidae	<i>Chondrodactylus turneri</i>	Turner's Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Lygodactylus capensis</i>	Common Dwarf Gecko	Least Concern (SARCA 2014)
Gekkonidae	<i>Pachydactylus affinis</i>	Transvaal Gecko	Least Concern (SARCA 2014)
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Ichnotropis capensis</i>	Ornate Rough-scaled Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Meroles squamulosus</i>	Common Rough-scaled Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Nucras holubi</i>	Holub's Sandveld Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis lineoocellata lineoocellata</i>	Spotted Sand Lizard	Least Concern (SARCA 2014)
Lacertidae	<i>Pedioplanis lineoocellata pulchella</i>	Common Sand Lizard	Least Concern (SARCA 2014)
Lamprophiidae	<i>Amblyodipsas polylepis polylepis</i>	Common Purple-glossed Snake	Least Concern (SARCA 2014)
Lamprophiidae	<i>Lycophidion variegatum</i>	Variegated Wolf Snake	Least Concern (SARCA 2014)
Lamprophiidae	<i>Psammophis angolensis</i>	Dwarf Sand Snake	Least Concern (SARCA 2014)

Family	Scientific name	Common name	Red List Category
Lamprophiidae	<i>Psammophis brevirostris</i>	Short-snouted Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	<i>Psammophylax tritaeniatus</i>	Striped Grass Snake	Least Concern (SARCA 2014)
Lamprophiidae	<i>Pseudaspis cana</i>	Mole Snake	Least Concern (SARCA 2014)
Leptotyphlopidae	<i>Leptotyphlops incognitus</i>	Incognito Thread Snake	Least Concern (SARCA 2014)
Pelomedusidae	<i>Pelomedusa galeata</i>	South African Marsh Terrapin	Not evaluated
Pythonidae	<i>Python natalensis</i>	Southern African Python	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis margaritifera</i>	Rainbow Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis punctatissima</i>	Speckled Rock Skink	Least Concern (SARCA 2014)
Scincidae	<i>Trachylepis varia sensu lato</i>	Common Variable Skink Complex	Least Concern (SARCA 2014)
Testudinidae	<i>Kinixys lobatsiana</i>	Lobatse Hinged Tortoise	Least Concern (SARCA 2014)
Typhlopidae	<i>Afrotyphlops schlegelii</i>	Schlegel's Beaked Blind Snake	Least Concern (SARCA 2014)
Bufo	<i>Schismaderma carens</i>	Red Toad	Least Concern
Bufo	<i>Sclerophrys garmani</i>	Olive Toad	Least Concern (IUCN, 2016)
Bufo	<i>Sclerophrys gutturalis</i>	Guttural Toad	Least Concern (IUCN, 2016)
Bufo	<i>Sclerophrys pusilla</i>	Flatbacked Toad	Least Concern (IUCN, 2016)
Hyperoliidae	<i>Hyperolius marmoratus</i>	Painted Reed Frog	Least Concern (IUCN ver 3.1, 2013)
Hyperoliidae	<i>Kassina senegalensis</i>	Bubbling Kassina	Least Concern
Microhylidae	<i>Phrynomantis bifasciatus</i>	Banded Rubber Frog	Least Concern
Phrynobatrachidae	<i>Phrynobatrachus natalensis</i>	Snoring Puddle Frog	Least Concern (IUCN, 2013)
Ptychadenidae	<i>Ptychadena anchietae</i>	Plain Grass Frog	Least Concern
Pyxicephalidae	<i>Cacosternum boettgeri</i>	Common Caco	Least Concern (2013)
Pyxicephalidae	<i>Tomopterna cryptotis</i>	Tremelo Sand Frog	Least Concern
Pyxicephalidae	<i>Tomopterna natalensis</i>	Natal Sand Frog	Least Concern
Rhacophoridae	<i>Chiromantis xerampelina</i>	Southern Foam Nest Frog	Least Concern (2013)