

APPENDIX E: BIODIVERSITY STUDIES

**FAUNAL, FLORAL, WETLAND AND AQUATIC
ASSESSMENT AS PART OF THE ENVIRONMENTAL
ASSESSMENT AND AUTHORISATION PROCESS FOR THE
PROPOSED THARISA MINE DEVELOPMENT PROJECT,
NORTH WEST PROVINCE**

Prepared for

SLR Consulting (Africa) (Pty) Ltd.

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a faunal, floral, wetland and aquatic ecological assessment as part of the environmental assessment and authorisation process for the proposed mine expansions related to the Tharisa Mine, hereafter referred to as the “subject property”. The subject property is situated immediately to the north of the N4 roadway within the North West Province. The town of Marikana is situated approximately 3km to the north, and the towns of Lapologang, Tsilong Village and Silver City (formerly Mmaditlhokwa Village) are located approximately 3km to the west, while Rustenburg is located 30km to the northwest. Existing infrastructure within the Mining Rights Area (MRA) include three open pit areas, various waste rock dumps, a ore processing plant and office area, return and raw water dams, a storm water dam, a sewage treatment plant (STP) and a Run-of-Mine (ROM) pad, whilst the proposed development, which forms the focus of this study, includes the expansion of open pit and waste rock dump areas.

The subject property is surrounded by properties in which agricultural and mining activities, as well as rural development dominate, leaving the surrounding areas largely transformed. The ecological assessment was therefore confined to the subject property and its immediate surrounds and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area as well as the searches undertaken on national and provincial databases.

FLORAL ASSESSMENT

- The assessment site falls within the Savanna Biome, the Central Bushveld Bioregion and within the Marikana Thornveld, Moot Plains Bushveld and Gold Reef Mountain Bushveld vegetation types (Mucina & Rutherford, 2006).
- Four habitat units were identified during the assessment namely the Transformed Habitat Unit, the Scattered Bushveld Habitat Unit, the Rocky Outcrop Habitat Unit, the Wetland Habitat Unit.
- The Transformed Habitat Unit covers the majority of the study area and includes areas where the vegetation has been significantly impacted by mining activities, infrastructure and housing development, as well as through historical and current agricultural activities.
- The Scattered Bushveld Habitat Unit includes patches of less transformed bushveld throughout the study area which has been less impacted by development activities. These areas have not previously been cultivated and have not been significantly impacted by mining activities.
- The Wetland Habitat Unit is located in the northeast, northwest, southwest and southeast areas of the subject property and is associated with a number of non-perennial tributaries. The perennial Sterkstroom River traversing the centre of the subject property and flowing in a northern direction, is also included within the Wetland Habitat Unit and discussed accordingly.
- The Rocky Outcrop Habitat Unit comprises two rocky outcrops, with largely intact vegetation, a high diversity of floral species and an increased diversity and abundance of faunal species. The vegetation occurring within these areas are notably different from that of the surrounding transformed bushveld and comprise vegetation typical of rocky areas within the region.
- The various habitat units obtained the following Vegetation Index Scores (VIS) which define the integrity of the vegetation in each habitat unit:

Habitat unit	Score	Class	Motivation
Transformed Bushveld Habitat Unit	5	E – The loss of natural habitat extensive	These areas have been disturbed extensively due to mining and agricultural activities and have been impacted significantly by infrastructure development.
Rocky Outcrop Habitat Unit	19	B – Largely Natural with few modification	These areas have intact habitat and low levels of alien floral species. Edge effects from adjacent anthropogenic activities have impacted upon these areas and loss of ecological corridors between rocky outcrops is evident.
Wetland Habitat Unit	15	C – Moderately modified	This habitat is of high importance in terms of habitat provision for a number of floral and faunal species. Moderate to high levels of alien species invasion was noted.
Scattered Bushveld Habitat Unit	18	C – Moderately modified	Vegetation structure is intact and increased species diversity is present, however fragmentation due to agricultural activities has taken place and edge effects of mining and development activities have impacted on this



Habitat unit	Score	Class	Motivation
			habitat unit.

- Four Red Data Listed (RDL) floral species are known to occur in the Quarter Degree Squares (QDS) 2527CB and 2527CA. None of these RDL floral species were noted during the site assessment and it is considered unlikely that these species occur within the subject property. Although not listed for the QDSs, two floral species, namely *Hypoxis hemerocallidae* and *Crinum macowanii*, have been encountered in the subject property, are listed by the IUCN (2013) as being 'Declining'.
- Several individuals of the floral species which is protected under the National Forests Act (Act 84 of 1998), namely *Sclerocarya birrea* subsp. *caffra* (Marula) were encountered within the Rocky Outcrop and Scattered Open Bushveld Habitat Units. In terms of this act, protected tree species may not be cut, disturbed, damaged or destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold - except under licence granted by the Department of Water Affairs (DWA). Applications for such activities should be made to the responsible official in each province.
- Floral species protected under the Transvaal Nature Conservation Ordinance (No 12 of 1983) include *Crinum macowanii*, *Eulophia streptopetala*, *Cussonia paniculata*, and *Pallaea calomelanos* and *Cheilanthes viridis*. These species occur within the Rocky Outcrop Habitat Unit and within the Scattered Open Bushveld Habitat Unit. In addition, *Gladiolus* spp, *Boophane disticha*, although not noted during the filed assessment, have a high probability of occurring within the subject property. The North West Province Biodiversity Conservation Bill, which was published for comment under Notice Nr. 394, Provincial Gazette 6719, dated 23 December 2009, incorporates the old Transvaal Nature Conservation Ordinance of 1983, but the status of this Bill is also currently unclear. It is therefore recommended that the relevant competent authorities provide clarity on this issue in the Record of Decision (ROD).
- A moderate abundance and a high diversity of alien species occur within the subject property, with the majority of alien plant species being present within the Transformed and Wetland Habitat Units, with a number of these species being Category 1 invaders.

Impact assessment:

Based on the floral impact assessment it is evident that there are three possible impacts on the floral ecology within the subject property. The table below summarises the findings indicating the significance of the impact before management takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs. From the table it is evident that prior to management measures being put in place, all of the impacts are high and medium-high level impacts. If effective management takes place, all impacts will be reduced to medium-low level impacts.

Summary of potential floral impacts

Impact	Unmanaged	Managed
1: Impact on habitat for floral species	High	Medium-Low
2: Impact on floral diversity	High	Medium-Low
3: Impact on important species	Medium-High	Medium-Low

FAUNAL ASSESSMENT

Faunal habitat:

- High levels of anthropogenic activity as well as agricultural and mining activity within the subject property and surrounding area have led to high levels of transformation of natural faunal habitat throughout the majority of the subject property. The Rocky Outcrop and Wetland Habitat Units provide improved faunal habitat and food resources for a wide variety of faunal species and is considered to be of high importance for faunal migration. In this regard specific mention is made of the Sterkstroom River and associated riparian zone.
- Only commonly occurring faunal species were observed within the subject property.
- The proposed development may pose a threat to faunal conservation in the region, should sensitive habitats such as rocky outcrops and wetland areas be further impacted by mining or other anthropogenic activity.



RDL Faunal assessment:

- No RDL mammals were observed during the site survey. In terms of conservation, the likelihood that any threatened RDL mammal species will be encountered within the subject property is considered low.
- No threatened RDL avifaunal species were identified during the site survey. However, threatened species with a greater than 60% Probability of Occurrence (POC) of utilising the subject property, predominantly for foraging purposes, are *Tyto capensis* (African Grass Owl), *Falco peregrinus* (Peregrine Falcon), *Polemaetus bellicosus* (Martial Eagle), *Sagittarius serpentarius* (Secretary bird) and *Gyps coprotheres* (Cape Vulture).
- No RDL amphibian species were identified during the site survey and the probability of such species occurring is low, with the exception of *Pyxicephalus adspersus* (Giant Bullfrog), which has an increased likelihood of being present. POC of this species is however below 60%.
- No RDL listed reptiles species were identified during the site assessment, there is however a probability that *Python natalensis* (South African Python) may be present in the vicinity of the Rocky Outcrop Habitat Unit. This species is considered regionally threatened.
- No RDL invertebrate species were encountered on the subject property. The proposed development within the subject property is deemed unlikely to pose a significant conservation threat on invertebrate species due to the majority of habitat having been impacted and mining activities in the area.
- No threatened spider species were identified within the subject property. Two protected scorpion species are however known to occur within the subject property, namely *Opisththalmus glabrifrons* and *Hadogenes gracilis* (NSS, 2008). These species are likely to inhabit the Rocky Outcrop Habitat Unit.

RDSIS assessment:

- Six RDL species calculated a POC greater than 60% namely *Python natalensis* (African Rock Python), *Gyps coprotheres* (Cape Vulture), *Tyto capensis* (African Grass Owl), *Falco peregrinus* (Peregrine Falcon), *Polemaetus bellicosus* (Martial Eagle) and *Sagittarius serpentarius* (Secretary bird).
- The greater than 60% POC likelihood of these RDL faunal species is largely due to them utilising the subject property for foraging purposes, while *Python natalensis* may permanently utilise the subject property for habitation within the Rocky Outcrop Habitat Unit.
- The RDSIS assessment of the subject property calculated a low score of 37%, indicating a low importance to RDL faunal species conservation within the subject property in terms of conservation.

Impact assessment:

Based on the faunal impact assessment it is evident that there are three possible impacts on the faunal ecology within the subject property. The table below summarises the findings, indicating the significance of each impact before management takes place and the likely significance of the impacts if management and mitigation takes place. From the table it is evident that if effective management takes place, all potential faunal impacts may be reduced with impact on faunal habitat being reduced from a high level impact to a medium high level impact, impact on faunal biodiversity decreasing from a medium high level to a low level impact and the potential loss of RDL floral species being reduced from a medium low level impact to a low level impact.

Summary of potential faunal impacts

Impact	Unmanaged	Managed
1: Impact on faunal habitat and ecological structure	High	Medium-High
2: Impact on faunal diversity and ecological integrity	Medium-High	Medium-Low
3: Impact on potential RDL faunal species	Medium-Low	Low

WETLAND ASSESSMENT

Eight wetland areas were identified within the subject property. These wetlands were grouped into five groups, namely the north-eastern wetlands, the north-western wetlands, the south-western wetland and artificial wetland, the south-eastern wetlands and the Sterkstroom River.



During the assessment wetlands were delineated according to the DWAF 2005 guideline method which considers several wetland indicators such as terrain units, soil indicators, soil moisture and vegetation types.

Wetland ecology key observations:

- The subject property falls within the Bushveld Basin Aquatic Ecoregion and is located within the A21K quaternary catchment.
- The South African National Biodiversity Institute (SANBI) Wetland Inventory (2006) and National Freshwater Ecosystem Priority Areas (NFEPA) (2011) databases were consulted to define the aquatic ecology of the wetland or river systems close to or within the subject property that may be of ecological importance. Aspects applicable to the subject property and surroundings are discussed below:
 - The subject property falls within the Crocodile (West) and Marico Water Management Area (WMA) and within the Upper Crocodile sub-WMA.
 - The subWMA is not regarded important in terms of fish sanctuaries, rehabilitation or corridors.
 - The subWMA is not considered important in terms of translocation and relocation zones for fish.
 - The subWMA is not listed as a fish Freshwater Ecosystem Priority Areas (FEPA).
 - The Sterkstroom River is a perennial river classified as a Class C (Moderately Sensitive System) river. It is not free flowing and is not classified as a flagship river or as a FEPA river.
 - Wetlands within the study area and are indicated as valley floor, plain and slope wetlands.
- The wetland features within the subject property were classified as channelled and unchannelled valley bottom wetland during the field assessment.
- The north-eastern tributaries have been affected by mining activities and the addition of a waste rock dump as well as by a dirt road, with subsequent loss of the wetland and loss of wetland connectivity being evident.
- The north-western tributaries have been affected by recent mining activity. The Ecological Importance and Sensitivity (EIS) of these wetlands have been calculated as a Class D (low/marginal) and the level of ecoservices provision was calculated as moderately low.
- The VEGRAI and the EIS of the south-western tributary and artificial wetland feature was calculated as a Class C. The EIS of the south-western tributaries was calculated as a Class D, while the ecoservices level was calculated as moderately low.
- For the Sterkstroom River, the wetland Index of Habitat Integrity was assessed and was calculated as falling within Category C (Moderately modified). The VEGRAI was also calculated as a Class C, while the EIS falls within Class C (Moderate).
- All results obtained from the National Wetland Classification System (NWCS) that was used in the determination of the appropriate Ecological Management Class (EMC) were considered. The results obtained from the wetland assessment indicate moderate to high levels of transformation on all levels of ecology and functionality. Therefore, the EMC class deemed appropriate to enhance and maintain currently ecology as well as functionality is Class C (Moderately modified) for all the wetland features. Mitigation measures and recommendations stipulated in this report, if followed, are deemed adequate to reach this goal. On a localised scale however, the catchment wide impacts on the drainage system may limit the ability to reach this EMC objective.
- A summary of the results obtained from the various assessments applied to each wetland feature (including drainage lines and the Sterkstroom River) are presented below.

Feature	Function Assessment	WET-Health Assessment	VEGRAI Assessment	IHI Assessment	EIS Assessment	REC
North-western drainage lines	Moderately low	C / D	N/A	N/A	C	C
South-western Artificial wetland	N/A	N/A	N/A	N/A	N/A	C
South-western drainage line	N/A	N/A	C	N/A	C	C
South-eastern drainage lines	Moderately low	C	N/A	N/A	C	C
Sterkstroom	Moderately high	N/A	C	C	C	C



Feature	Function Assessment	WET-Health Assessment	VEGRAI Assessment	IHI Assessment	EIS Assessment	REC
River						

Impact assessment:

The impact assessment was divided into three sections where impacts were determined for:

- Mining activities of the north-western area of the subject property;
- Mining activities of the south-eastern portion of the subject property;
- Mining activities of the central portion of the subject property including the Sterkstroom River;

The drainage line and the artificial wetland in the southwest portion of the subject property were not assessed as there is currently no new infrastructure planned for that portion of the subject property. It is therefore expected that the current impact significance and EIS will remain the same; however it is important to note that should any future activities are planned in close vicinity to these wetland features a detailed wetland assessments and impact assessment must be performed.

An impact assessment was not carried out on the north-eastern drainage lines, as it was not possible to ascertain the PES or EIS of these features due to the existing mining activities occurring in the vicinity thereof.

Alternative	Colour
Mining of the north-western area of the subject property	
Mining of the southeaster portion of the subject property	
Mining of the central portion of the subject property.	

Based on the wetland assessment it is evident that there are three possible impacts that may affect the wetland and riparian ecology of the subject property. The table below summarises the findings indicating the significance of the impacts before mitigation takes place and the likely impact levels if management and mitigation takes place. In the consideration of mitigation it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs. From the table it is evident that prior to mitigation all of the impacts are high level impacts. If mitigation and effective management takes all impacts will be reduced to a medium low level.

Summary of potential wetland impacts

Impact	Unmanaged	Managed
1: Loss of wetland habitat and ecological structure	High	Medium low
1: Loss of wetland habitat and ecological structure	High	Medium low
1: Loss of wetland habitat and ecological structure	High	Medium low
2: Changes to wetland ecological and sociocultural service provision	High	Medium low
2: Changes to wetland ecological and sociocultural service provision	High	Medium low
2: Changes to wetland ecological and sociocultural service provision	High	Medium low
3: Impacts on wetland hydrological function	High	Medium low
3: Impacts on wetland hydrological function	High	Medium low
3: Impacts on wetland hydrological function	High	Medium low

AQUATIC ASSESSMENT

The aquatic made use of historical aquatic reports which are available for the Tharisa Mine and the Sterkstroom River system traversing the centre of the subject property which included the original aquatic assessment undertaken as part of the initial EIA as well as the results of the aquatic biomonitoring program for the mine. Historical biomonitoring assessment sites were selected based on the position of the mining footprint to monitor any impacts of the current Tharisa mining activities. The sites selected represented upstream and downstream points along the Sterkstroom River and are referred to as A1, B and B1. A1 is located upstream of the mining activities, with B1 located within the centre of the subject property on the Sterkstroom River, while biomonitoring point B is located downstream of mining activities. An addition future biomonitoring point, A2, is recommended for future biomonitoring in order to better define the spatial trends in community integrity in the vicinity of the Tharissa Mine.



Riverine Visual assessment

- Visually the biomonitoring sites throughout the years have shown little variation with regards to the in stream morphology and habitat suitability and diversity for both historical upstream and downstream sites.
- Some general impacts below the upstream site A along the N4 highway may be negatively affecting the Sterkstroom River and it is recommended that an additional biomonitoring site be included in future biomonitoring period until the N4 development has been completed.
- The November 2013 site visit indicated that the downstream site B1 was dry. However, during August 2013 there was sufficient water to conduct biomonitoring (cleanstream 2013).
- Additional visual records indicate that Tharisa mine does not abstract any water from the Sterkstroom River and is managing its water in a closed system between the west open pit and east open pit areas which are respectively situated west and east of the Sterkstroom River.

***In-situ* water quality**

The historical baseline documented results for this study area are to be taken from the NSS 2008 report. Overall, the water quality since then (NSS 2010, NSS 2011 and CS 2013) has improved for the pH and DO values since 2008 according to the TWQR guidelines (DWA 1996 Vol 7) and should not pose a risk to aquatic biota. The EC values however did not improve. Temporally for both upstream and downstream EC values for 2008, 2010, 2011 and 2013 have revealed a marked increase of greater than 15% for each year which is outside the TWQR guidelines in relation to the reference 2008 year. Any additional negative impact on the system resulting in poorer (compared to baseline) water quality conditions, may have significant negative repercussions for the receiving ecosystem. Continued assessments will indicate if such impacts could possibly result from Tharisa mining activities and will allow for proactive mitigation to be implemented

Habitat integrity

- For the 2010, 2011 and 2012 years the IHI site scores and classifications were generally similar with the instream and riparian habitats being classified as being largely modified, with exception for the downstream site during 2010 indicating a moderately modified habitat score.
- The most likely causes of these modifications were flow modifications and water abstraction that resulted from the presence of the Buffelspoort Dam situated upstream from the sites (NSS 2010 and 2011).

Macro invertebrate assessment

The SASS data indicates that the aquatic macro-invertebrate community in this section of the Sterkstroom River has suffered a general loss in integrity throughout the area, when compared to the reference score for a pristine ecoregion system. Depending on the flow (high flow or low flow) biomonitoring periods the macro-invertebrate community MIRAI and SASS scores at the upstream reference site upstream of the Tharisa mining study area can vary considerably. This fluctuation of macro-invertebrates over the different flow periods can be considered to be natural variation, along with the possible altered water flow from the Buffelspoort dam and may impact on the aquatic community in the Sterkstroom River system. When specifically comparing the macro-invertebrate scores between the upstream and the downstream sites along the Sterkstroom River it is evident that no significant change in the classes occurred within the study area. Therefore no impact on the macro-invertebrate community is deemed to be taking place from the current Tharisa mining activities.

Fish Assemblage Results

According to the scores, the fish assemblages were moderately modified at both upstream and downstream sites for 2010, 2011 and for 2013 survey periods. These results were primarily due to the lower number of indigenous species present in comparison to the expected fish species, which were based on fish studies conducted in the Sterkstroom catchment. This indicates that activities relating to Tharisa mine have not impacted on the fish assemblage along the Sterkstroom River. Impacts within this river system can be related to potential future activities that may be affected by the Tharisa mining activities, including any change to the water quality and water flow over time. Close monitoring of fish community integrity should be implemented throughout all phases of the Tharisa mining operations.



Impact assessment:

Based on the aquatic impact assessment it is evident that there are 4 major impacts on the aquatic ecology on the Sterkstroom River system within the Tharisa Mine study area. The table below summarise the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation it is assumed that a high level of mitigation takes place but which does not lead to prohibitive costs.

Summary of potential aquatic impacts

Impact	Unmanaged	Managed
1: Loss of instream flow, aquatic refugia and flow dependent taxa	Medium-High	Medium-Low
2: Impacts on water quality affecting aquatic ecology	Medium-High	Medium-Low
3: Loss of Aquatic habitat	Medium-High	Medium-Low
4: Loss of Aquatic Biodiversity and sensitive taxa	Medium-High	Medium-Low

SENSITIVITY MAPPING:

A sensitivity map was compiled for the subject property by making use of the results of the ecological assessments. Areas of increased ecological sensitivity are indicated in Figure 1 below. All areas not highlighted or indicated to be of increased ecological sensitivity, are considered to be of low ecological sensitivity.

From the assessment, it is evident that the Transformed Habitat Unit has low ecological sensitivity as a result of current and historic anthropogenic activity in the form of mining and agricultural activities having impacted on the ecological integrity of these areas. The Rocky Outcrop Habitat Unit, with intact habitat structure and high levels of ecological functioning is also considered to be of high ecological sensitivity.

The Scattered Bushveld Habitat Unit has been exposed to fewer disturbances than the surrounding Transformed Habitat Unit and still hosts a reasonably high biodiversity and suitable habitat for a number of faunal and floral species, including protected *Sclerocarya birrea* subsp *caffra* trees. These areas are however fragmented and have been impacted by edge effects from adjacent mining and agricultural areas.

All wetland areas, including the Sterkstroom River, as included within the Wetland Habitat Unit, are regarded as being of increased ecological sensitivity due to the contribution of the various wetland features to faunal migratory connectivity, wetland eco-services provision and the unique habitat provided for faunal and floral species. Taking into account the findings from the wetland assessment (Section D), and considering the results obtained in calculating the function and ecoservices assessment, WET-Health, the Riparian Vegetation Response Assessment Index (VEGRAI), Wetland Index of Habitat Integrity (IHI) and Ecological Importance and Sensitivity (EIS), it was determined that the Sterkstroom River is of high ecological sensitivity, the North-eastern wetland, the South-western wetland and North-western wetlands are of moderate ecological sensitivity, while the artificial wetland feature in the southwest and the two South-eastern wetlands are of low ecological sensitivity.

A 100m buffer zone is indicated around all wetland features as advocated by Regulation GN 704 of the National Water Act, 1998.



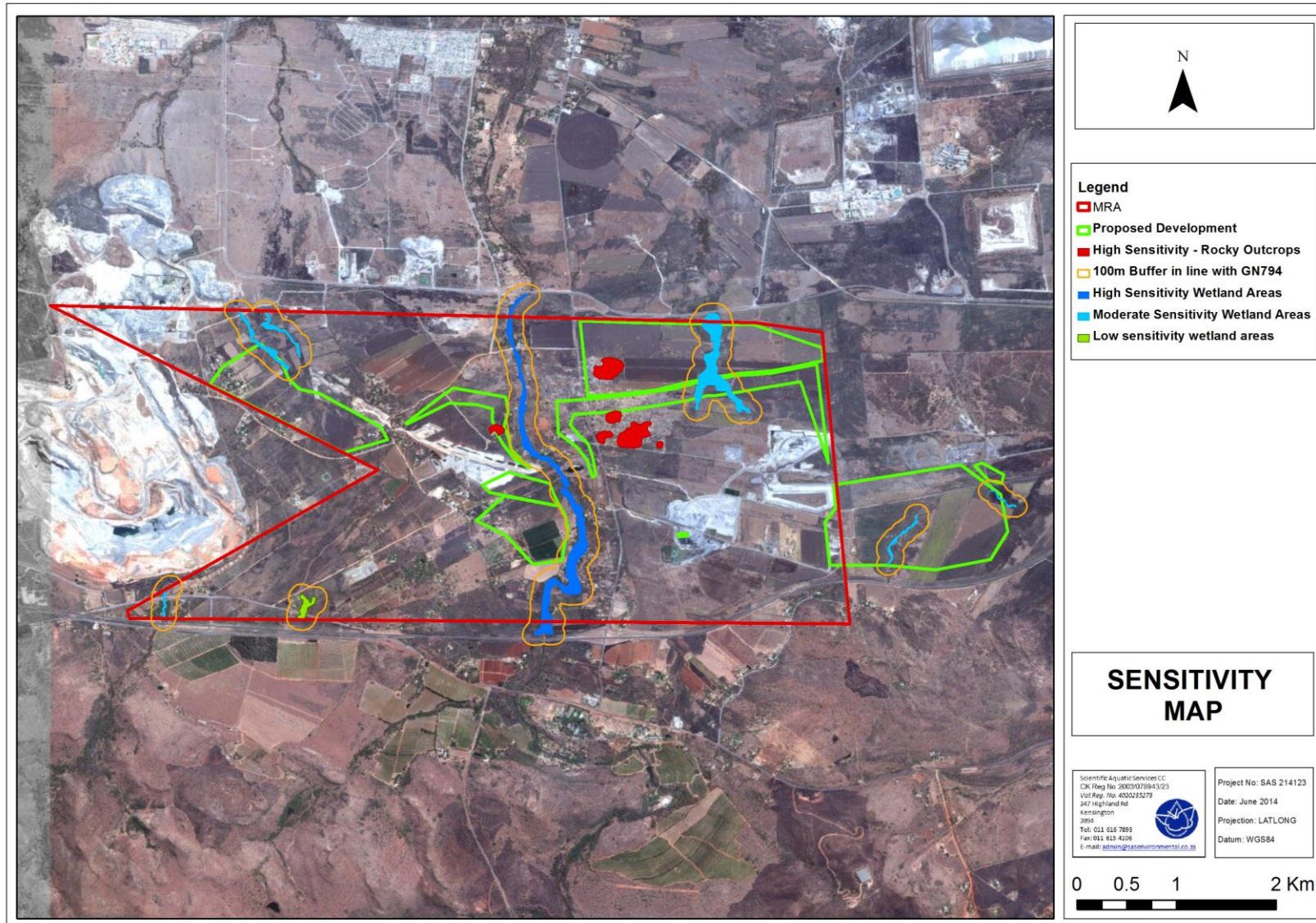


Figure 1: Sensitivity Map for the subject property.



**FAUNAL, FLORAL, WETLAND AND AQUATIC
ASSESSMENT AS PART OF THE ENVIRONMENTAL
ASSESSMENT AND AUTHORISATION PROCESS FOR THE
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NORTH WEST PROVINCE**

Prepared for

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**SECTION A – Background Information And
Methods Of Assessment**

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Glossary of Terms & Acronyms

°C – Degrees Celsius.

Alien vegetation – Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.

ASPT – Average Score per Taxon

BGIS – Biodiversity Geographic Information Systems

Biome – A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.

Bush encroachment – A state where undesirable woody elements gain dominance within grassland, leading to depletion of the grass component. Typically due to disturbances and transformations as a consequence of veldt mismanagement (overgrazing, incorrect burning, etc.).

CARA – Conservation of Agricultural Resources Act (Act 43 of 1983)

CBA – Critical Biodiversity Area

CS – Clean Stream

DEAT – Department of Environmental Affairs and Tourism

Decreaser grass – Grass abundant in veldt in good condition, which decreases when veldt is under- or over-utilized.

DEEEP – Direct Estimation of Ecological Effect Potential

DEMC – Desired Ecological Management Class

DWA – Department of Water Affairs (previously known as DWAF)

DWAF – Department of Water Affairs and Forestry (currently known as DWA)

EAP – Environmental Assessment Practitioner

EC – Electrical conductivity

Ecoregion – An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".

EIA – Environmental Impact Assessment

EIS – Ecological Importance and Sensitivity

EMC – Ecological Management Class

EMP – Environmental Management Programme

Endangered – Organisms in danger of extinction if causal factors continue to operate.

Endemic species – Species that are only found within a pre-defined area and endemism can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.

ESA – Ecological Support Areas



EVC – the Extent of Vegetation Cover (used in VIS calculations)

FAI – Fish Assemblage Integrity Index

FEPA – Freshwater Ecosystem Priority Areas

FRAI – Fish Response Assessment Index

GIS – Geographic Information System

GPS – Global Positioning System

ha – Hectares

HGM – Hydrogeomorphic

IBA – Important Bird Areas

HF – High Flow

HGM – Hydrogeomorphic

IHAS – Invertebrate Habitat Assessment System

IHI – Wetland Index of Habitat Integrity

IHIA – Intermediate Habitat Integrity Assessment

Increaser 1 grass – Grass species that increase in density when veld is under-utilized.

Increaser 2 grass – Grass species that increase in density in over-utilized, trampled or disturbed veld.

Increaser 3 grass – Grass species that increase in density in over and under-utilized veld.

Indigenous vegetation – Vegetation occurring naturally within a defined area.

IUCN – International Union for the Conservation of Nature

LF – Low Flow

m – Metres

MAMSL – Metres Above Mean Sea Level

MAP – Mean Annual Precipitation

MAPE – Mean Annual Potential for evaporation

MASMS – Mean Annual Soil Moisture Stress

MAT – Mean Annual Temperature

MIRAI – Macroinvertebrate Response Assessment Index

mm – Millimetre

MPRDA – Mineral and Petroleum Resources Development Act (Act 28 of 2002)

MRA – Mining Rights Area

NBA – National Biodiversity Assessment

NEMA – National Environmental Management Act (Act 107 of 1998)

NEMBA – National Environmental Management: Biodiversity Act (Act 10 of 2004)

NFEPA – National Freshwater Ecosystem Priority Areas

NPAES – National Protected Areas Expansion Strategy (2008)

NSS – Natural Scientific Services CC.



NW SoER – North West Province State of the Environment Report (2002)

NWA – National Water Act (Act 36 of 1998)

Orange Listed – Species that are not Red Data Listed, but are under threat and at risk of becoming RDL in the near future. Usually allocated to species with conservation status of Near Threatened (NT), Least Concern (LC), Rare and Data Deficient (DD).

PEMC – Proposed Ecological Management Class

PES – Present Ecological State

Pioneer species – A plant species that is stimulated to grow after a disturbance has taken place. This is the first step in natural veld succession after a disturbance has taken place.

POC – Probability of Occurrence.

PRECIS – Pretoria Computer Information Systems

PVC – Percentage Vegetation Cover of indigenous species (used in VIS calculations)

QDS – Quarter Degree Square (1:50,000 topographical mapping references)

RAMSAR – The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.

Rare – Organisms with small populations at present.

RDL (Red Data listed) species – Organisms that fall into the *Extinct in the Wild (EW)*, *critically endangered (CR)*, *Endangered (EN)*, *Vulnerable (VU)* categories of ecological status.

RDM – Resource Directed Measures

RDSIS – Red Data Sensitivity Index Score

REC – Recommended Ecological Category

RHP – River Health Programme

Riparian system – Riparian wetlands are recognised as boundaries between the terrestrial and riverine systems.

RIS – Recruitment of Indigenous species (used in VIS calculations)

ROM – Run of Mine

SABAP 2 – Southern African Bird Atlas 2

SANBI – South African National Biodiversity Institute

SAS – Scientific Aquatic Services CC

Secondary vegetation – Vegetation established naturally after a dramatic disturbance (e.g. clearing, agriculture etc.) where secondary species account for more than 70% of the vegetation cover.



SI – Structural Intactness (used in VIS calculations)

STP – Sewage Treatment Plant

subWMA – sub-Water Management Area

TNCO – Transvaal Nature Conservation Ordinance (No 12 of 1983)

TSF – Tailings Storage Facility

TSP – Threatened Species Programme

TSS – Total Species Score (used in RDSIS calculations)

TWQR – Target Water Quality Range

VEGRAI – Riparian Vegetation Response Assessment Index

VIS – Vegetation Index Score

WMA – Water Management Area



1. INTRODUCTION

1.1 *Background*

Scientific Aquatic Services (SAS) was appointed to conduct a faunal, floral, wetland and aquatic ecological assessment as part of the environmental assessment and authorisation process for the proposed mine expansions related to the Tharisa Mine, hereafter referred to as the “subject property” (Section A: Figures 2 & 3). The subject property is situated immediately to the north of the N4 roadway within the North West Province. The town of Marikana is situated approximately 3km to the north, and the towns of Lapologang, Tsilong Village and Silver City (formerly Mmaditlhokwa Village) are located approximately 3km to the west, while Rustenburg is located 30km to the northwest. Existing infrastructure within the Mining Rights Area (MRA) include three open pit areas, various waste rock dumps, a plant and office area, return and raw water dams, a storm water dam, a sewage treatment plant (STP) and a Run-of-Mine (ROM) pad, whilst the proposed development, which forms the focus of this study, includes the expansion of open pit and waste rock dump areas.

The subject property is surrounded by properties in which agricultural and mining activities as well as rural development dominate, leaving the surrounding areas largely transformed. The ecological assessment was therefore confined to the subject property and its immediate surrounds and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area.

This report, after consideration and the description of the ecological integrity of the subject property, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and mining proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.





Figure 2: Digital Satellite image depicting the location of the subject property in relation to surrounding areas.



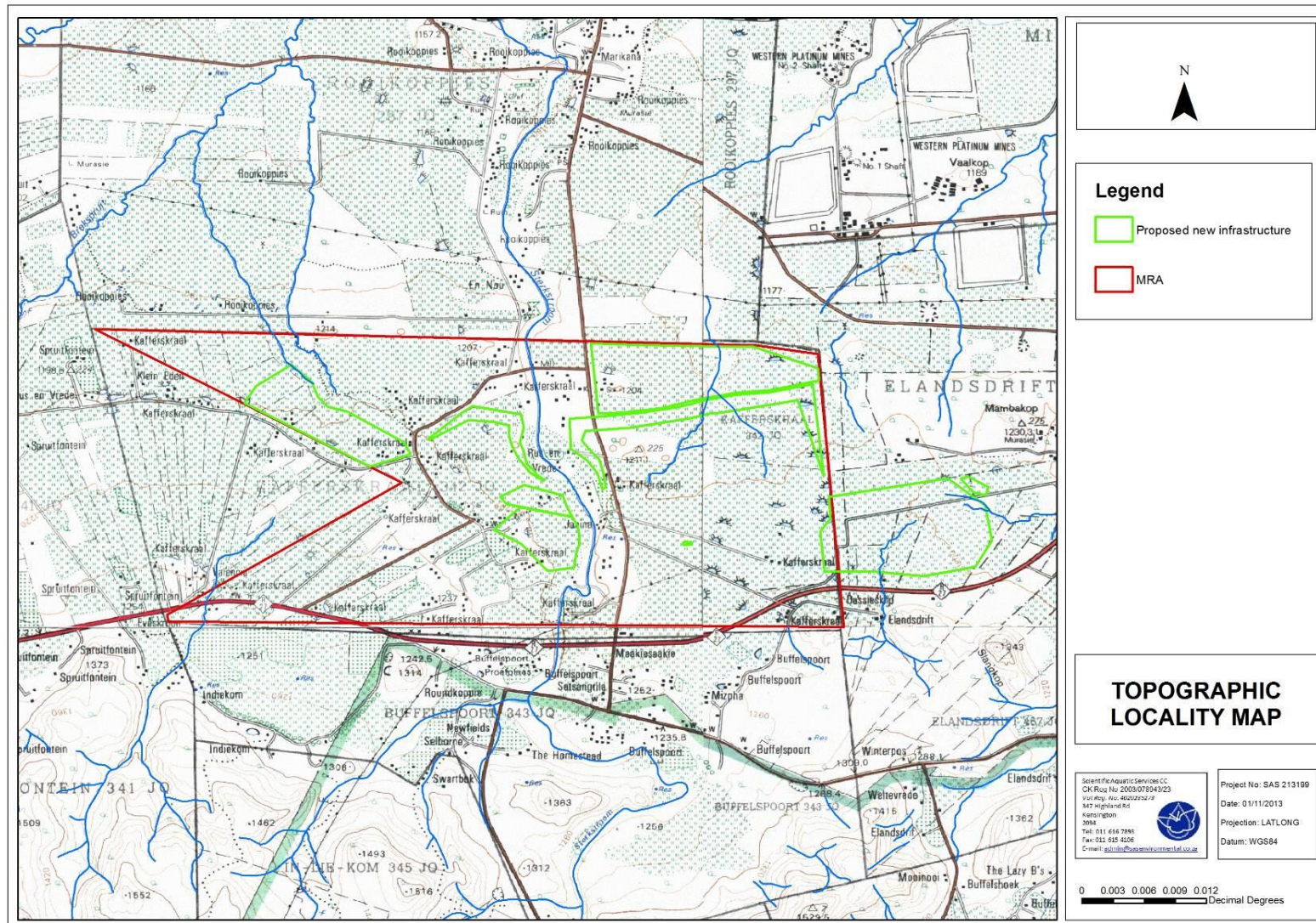


Figure 3: Subject property depicted on a 1:50 000 topographical map in relation to its surrounding area.



1.2 Project Scope

Specific outcomes in terms of this report are outlined below.

Ecological Assessment:

- To conduct a Red Data Listed (RDL) species assessment, including potential for species to occur on the subject property and the implementation of a Red Data Sensitivity Index Score (RDSIS) for the subject property;
- To provide faunal and floral inventories of species as encountered on site;
- To determine and describe habitats, communities and ecological state of the subject property;
- To describe the spatial significance of the subject property with regards to surrounding natural areas; and
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and/or any other special features; and
- To determine the environmental impacts of the proposed mining activity on the terrestrial ecology within the subject property.

Wetland Assessment:

- To define the Present Ecological State (PES) of each wetland system within the subject property;
- To determine the functioning of each system and the environmental and socio-cultural services that the system provide;
- To advocate a Recommended Ecological Category (REC) for each wetland feature;
- To delineate all wetlands or riparian zones occurring within the assessment site and
- To determine the environmental impacts of the proposed mining activity on the wetland areas within the subject property.

Aquatic Assessment:

- To define the Ecological Importance and Sensitivity (EIS) of the receiving environment;
- To define the PES of the riverine resources in the vicinity of the subject property;
- To define the habitat conditions prevalent in the area as well as natural constraints posed to the system along with anthropogenic impacts on these systems;
- To define the impacts envisaged as part of the proposed water management activities on the aquatic resources; and
- To define the required management, mitigation and monitoring measures required in order to minimise the impact of the proposed development on the receiving aquatic environment.



1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the subject property and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa on the subject property may therefore been missed during the assessment.
- Due to current and active mining activity and access restrictions, some areas were inaccessible during the time of assessment.
- The wetland assessment is confined to the subject property as illustrated in Figures 2 & 3, as well as areas of relevance immediately adjacent to the subject property and does not include the neighbouring and adjacent properties. The general surroundings were however considered in the desktop assessment of the subject property.
- The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundary based on the site condition present at the time of the assessment and limitations in the accuracy of the delineation due to disturbances created by grazing, existing development and anthropogenic disturbances are deemed possible.
- Wetland and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within the transition zone some variation of opinion on the wetland boundary may occur, however if the Department of Water Affairs (DWA), 2005 method is followed, all assessors should get largely similar results.

2. ASSESSMENT APPROACH

2.1 General approach

In order to accurately determine the PES of the subject property and capture comprehensive data with respect to wetland, faunal and floral taxa, the following methodology was used:



- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the subject property was made in order to confirm the assumptions made during consultation of the maps.
- Literature review with respect to habitats, vegetation types and species distribution was conducted.
- Relevant data bases considered during the assessment of the subject property included the South African National Biodiversity Institute (SANBI) Threatened species programme (TSP) and Pretoria Computer Information Systems (PRECIS).
- Site visits were undertaken during November 2013 to determine the ecological status of the proposed development sites and the surrounding area. A reconnaissance 'drive around' followed by thorough 'walk through' on foot was undertaken.
- Specific methodologies for the assessment, in terms of field work and data analysis of faunal, floral and wetland ecological assemblages will be presented in the relevant sections along with the methodologies for assessing the integrity and function of wetland systems.

2.2 Ecological Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/ impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/ impacts have been assessed. The method to be used for assessing risks/ impacts is outlined in the sections below.

The first stage of risk/ impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'¹. The interaction of an aspect with the environment may result in an impact.

¹ The definition has been aligned with that used in the ISO 14001 Standard.



- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary².

The assessment of significance is undertaken twice. Initial significance is based only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

² Some risks/impacts that have low significance will however still require mitigation



The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) (NEMA) in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table 1: Criteria for assessing significance of impacts

CONSEQUENCE DESCRIPTORS

Severity of Impact	Rating
Insignificant/non-harmful	1
Small/potential harmful	2
Significant / slightly harmful	3
Great / harmful	4
disastrous / extreme harmful	5
Spatial Scope of Impact	Rating
Activity specific	1
Mine specific (within the mine boundary)	2
Local area (within 5 km of the mine boundary)	3
Regional (Greater Rustenburg area)	4
National	5
Duration of Impact	Rating
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5



LIKELIHOOD DESCRIPTORS

Frequency of Activity / Duration of Aspect	Rating
Annually or less / low	1
6 Monthly / temporary	2
Monthly / infrequent	3
Weekly / life operation / regularly / likely	4
Daily / permanent / high	5
Frequency of Impact	Rating
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

Table 2: Significance rating matrix

		CONSEQUENCE (Severity + Spatial Scope + Duration)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	2	4	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	3	6	9	12	16	20	24	28	32	36	40	44	48	52	56	60
	4	8	12	16	20	25	30	35	40	45	50	55	60	65	70	75
	5	10	15	20	24	30	36	42	48	54	60	66	72	78	84	90
	6	12	18	24	30	36	42	49	56	63	70	77	84	91	98	105
	7	14	21	28	35	42	48	56	64	72	80	88	96	104	112	120
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

Table 3: Positive/Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the project's area of influence encompassing:



- Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/ Impacts were assessed for all stages of the project cycle including:
- Pre-construction;
 - Construction;
 - Operation; and
 - Rehabilitation/ Decommissioning and Closure.
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

2.2.1 Mitigation measure development

According to the Department of Mineral Resources (DMR) (2013) “Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands”.

According to the DMR, (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem’s control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and



-
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. In addition International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DMR, 2013).

The primary environmental objective of the Minerals and Petroleum Resource Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations".

Pressures on biodiversity are numerous and increasing. According to the DMR; (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including³:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

³ North West Province Environment Outlook. A Report on the State of the Environment, 2008. Chapter 4.



Impacts on biodiversity can largely take place in four ways (DMR 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other landuse. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DMR 2013):

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;



-
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
 - **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
 - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
 - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the subject property supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
 - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use; and
 - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
 - **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.



The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.⁴

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts⁵ are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

2.3 Sensitivity Mapping

All the ecological features⁵ of the subject property were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). In addition identified locations of protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map should guide the design and layout of the proposed development.

2.4 Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through construction, operation and closure through to after care and maintenance.

⁴ Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

⁵ Mitigation measures should address both positive and negative impacts



3. LAND USE AND CONSERVATION

CHARACTERISTICS OF THE SUBJECT PROPERTY

The following sections (Sections 3.1 – 3.8) contain data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable, high quality data, the various databases used not always provide an entirely accurate indication of the subject property's actual site characteristics. This information is however considered to be useful as background information to the study. Thus, this data was used as a guideline to inform the assessment and areas where increased conservation importance is indicated were paid attention to.

3.1 National List of Threatened Terrestrial Ecosystems for South Africa (2011)

The National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered, endangered, vulnerable or protected. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value (SANBI, BGIS).

According to the National List of Threatened Terrestrial Ecosystems (2011) the proposed a portion of the remaining extent of the Marikana Thornveld Ecosystem, listed as a 'Vulnerable' ecosystem is present in the central of the subject property, bordering the Sterkstroom (Figure 4). This area was specifically investigated in order to confirm whether representative Marikana Thornveld vegetation was still present, whereby it was found that due to high levels of fragmentation and the majority of this area having been transformed as a result of mining and agricultural activities, little to no Marikana Thornveld vegetation remains.

3.2 NPAES Focus Areas for Protected Area Expansion

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 sets 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. It deals with land-based and marine protected areas across all of South Africa's territory (SANBI BGIS).



According to the NPAES database, the subject property is not affected by areas earmarked as part of the NPAES.



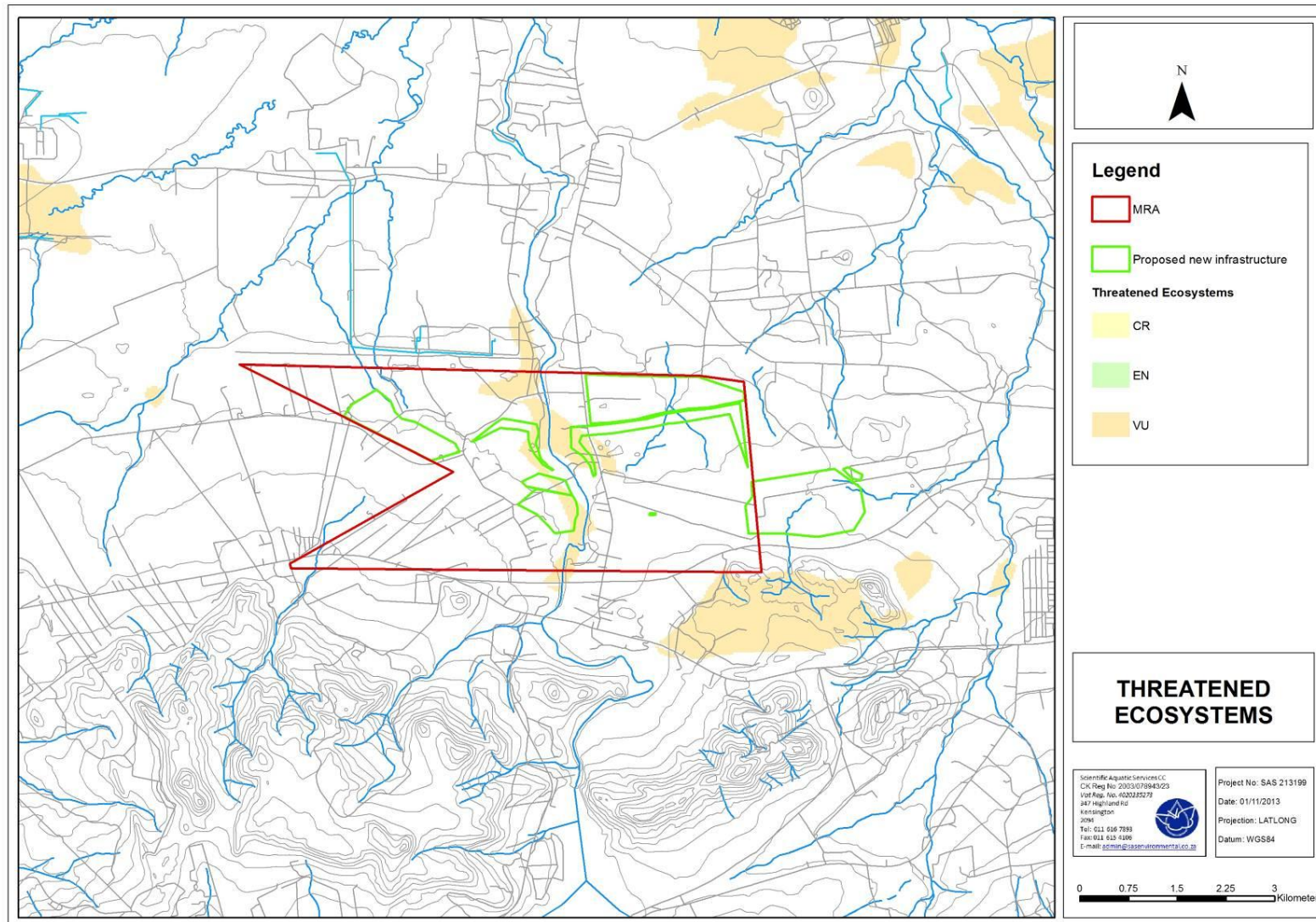


Figure 4: Remaining extent of threatened ecosystems for the subject property (National List of Threatened Terrestrial Ecosystems, 2011).



3.3 Importance According to the Mining and Biodiversity Guideline (2012)

The Mining Biodiversity Guideline (2012) provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining. The Guideline distinguishes between four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining. These categories include: Legally Protected Areas, Highest Biodiversity Importance, High Biodiversity Importance and Moderate Biodiversity Importance.

According to the Mining Biodiversity Guidelines the majority of the subject property falls within areas considered to be of High Biodiversity Importance (Figure 5). High Biodiversity Importance areas include protected area buffer (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 and high water yield areas, amongst others. These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for particular communities or the country as a whole. An environmental impact assessment 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 red flags for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.

Small portions towards the centre of the subject property falls within areas considered to be of Moderate Biodiversity Importance (Figure 5). Moderate Biodiversity Importance areas include Ecological Support Areas (ESAs), vulnerable ecosystems and focus areas for protected area expansion. Areas of Moderate Biodiversity Importance are considered of moderate risk for mining. EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g. threatened species) not included in the existing datasets and on providing site-specific information to guide the application of the mitigation hierarchy. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.



It must be noted that although areas of Highest Biodiversity Importance and Moderate Biodiversity Importance are indicated on the study area, significant habitat transformation has occurred due to current and historical agriculture and mining activities. Thus the site assessment focused on identifying areas on the study area which may still be considered representative of the above categories.

3.4 National Biodiversity Assessment (NBA), 2011

The recently completed NBA (2011) provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA 2011 was led by the South African National Biodiversity Institute (SANBI) in partnership with a range of organisations. It follows on from the National Spatial Biodiversity Assessment 2004, broadening the scope of the assessment to include key thematic issues as well as a spatial assessment. The NBA 2011 includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels (SANBI BGIS).

According to the NBA (2011), the subject property is not located within a formally or informally protected area. The eastern portion of the subject property is however indicated to be located within an area listed as not protected, while the western portion of the subject property is listed as being poorly protected (Figure 6).

3.5 Importance According to the North West Province Biodiversity Conservation Assessment (2009)

Areas within the immediate vicinity of the subject property were assessed using the North West Province Biodiversity Conservation Assessment done in 2009⁶.

The purpose of the North West Province Biodiversity Conservation Assessment was to finalise the Biodiversity Conservation Assessment (Version One) for the North West Province which is to be used to inform the development of the Provincial Biodiversity Sector plans, bioregional plans, and also be used to inform Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and in the Environmental Impact Assessment (EIA) process in the province.

The North West Province Biodiversity Conservation Assessment summarises the results of the biodiversity assessment conducted.

⁶ Technical report version 1 compiled by the Department of Agriculture, Conservation, Environment and Rural Development.



The North West Province is very rapidly approaching a critical threshold (60% natural habitat remaining) in terms of the state of biodiversity within the province. Lack of capacity, resources and biodiversity information, and significantly under representative protected area network in the province is hampering the province's ability to effectively manage biodiversity in this rapidly changing landscape. This biodiversity assessment through the development of a critical biodiversity area map for the province is aimed at assisting biodiversity and land use managers and decision makers in this demanding task.

The maps below indicate the location of the subject property with reference to each environmental concern or finding as depicted in the Biodiversity Conservation Assessment. No special species of high conservational significance are indicated to occur in close vicinity of the subject property, but small areas considered special habitat, namely 'Bare areas special lithology' seem to occur within the region. Ecosystem status indicated for the subject property surroundings are vulnerable, due to the Marikana Thornveld ecosystem being considered Vulnerable (Figure 8).

The land cover map (Figure 9) indicates large areas of natural vegetation within and adjacent to the subject property with small transformed areas scattered throughout. One critically endangered river, namely the Sterkstroom (Figure 10) is indicated to fall within the subject property.

Critical Biodiversity Areas (CBA's) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity and supporting continued ecosystem functioning and services. The subject property is located within a terrestrial CBA and an aquatic CBA is situated to the south thereof (Figure 11).

It must be noted that although CBA's are indicated on the study area, significant habitat transformation has occurred due to current and historical agriculture and mining activities. Thus the site assessment focused on identifying areas on the study area which may still be considered representative of the above categories.



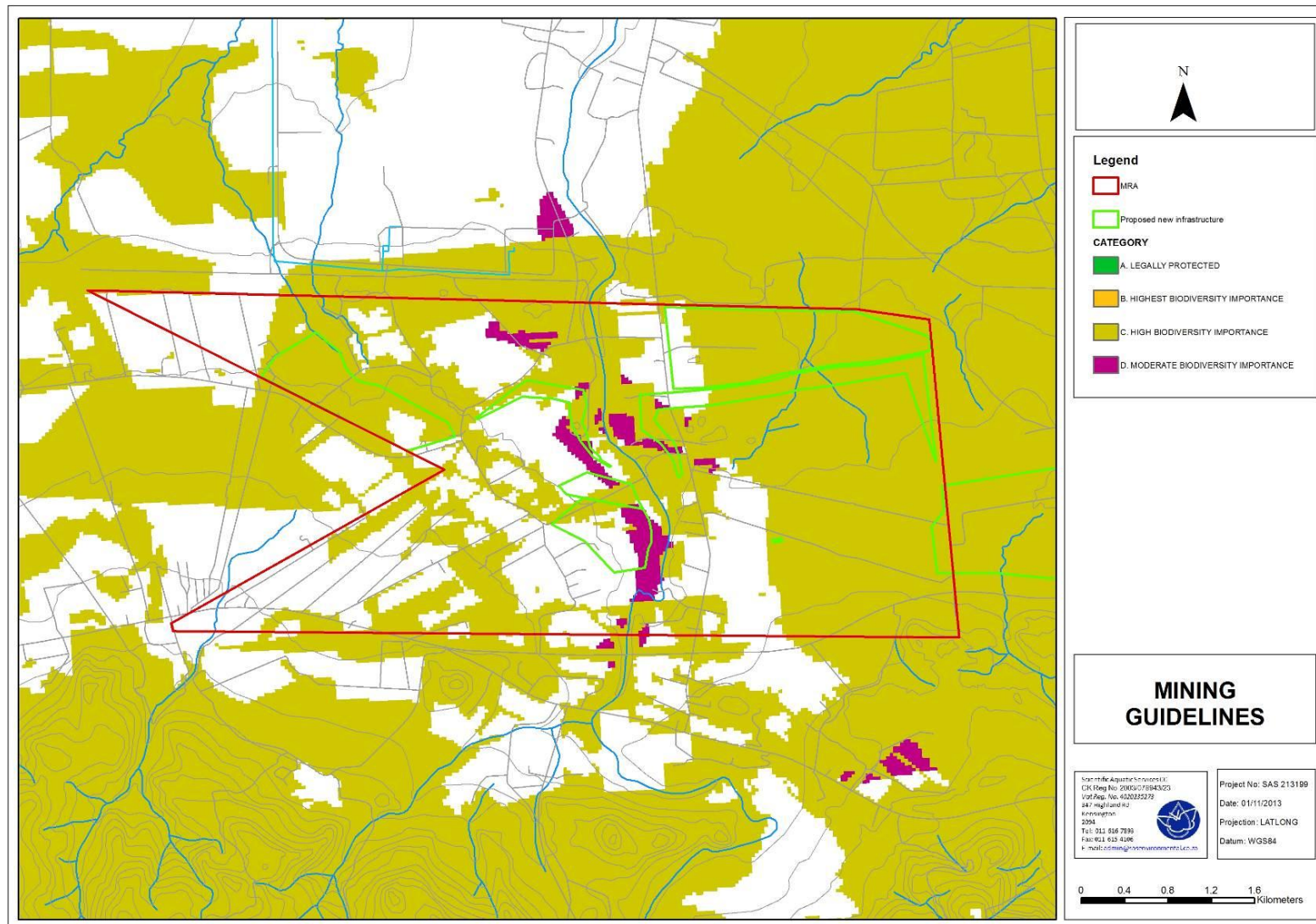


Figure 5: Importance of the subject property according the Mining and Biodiversity Guidelines (2013).



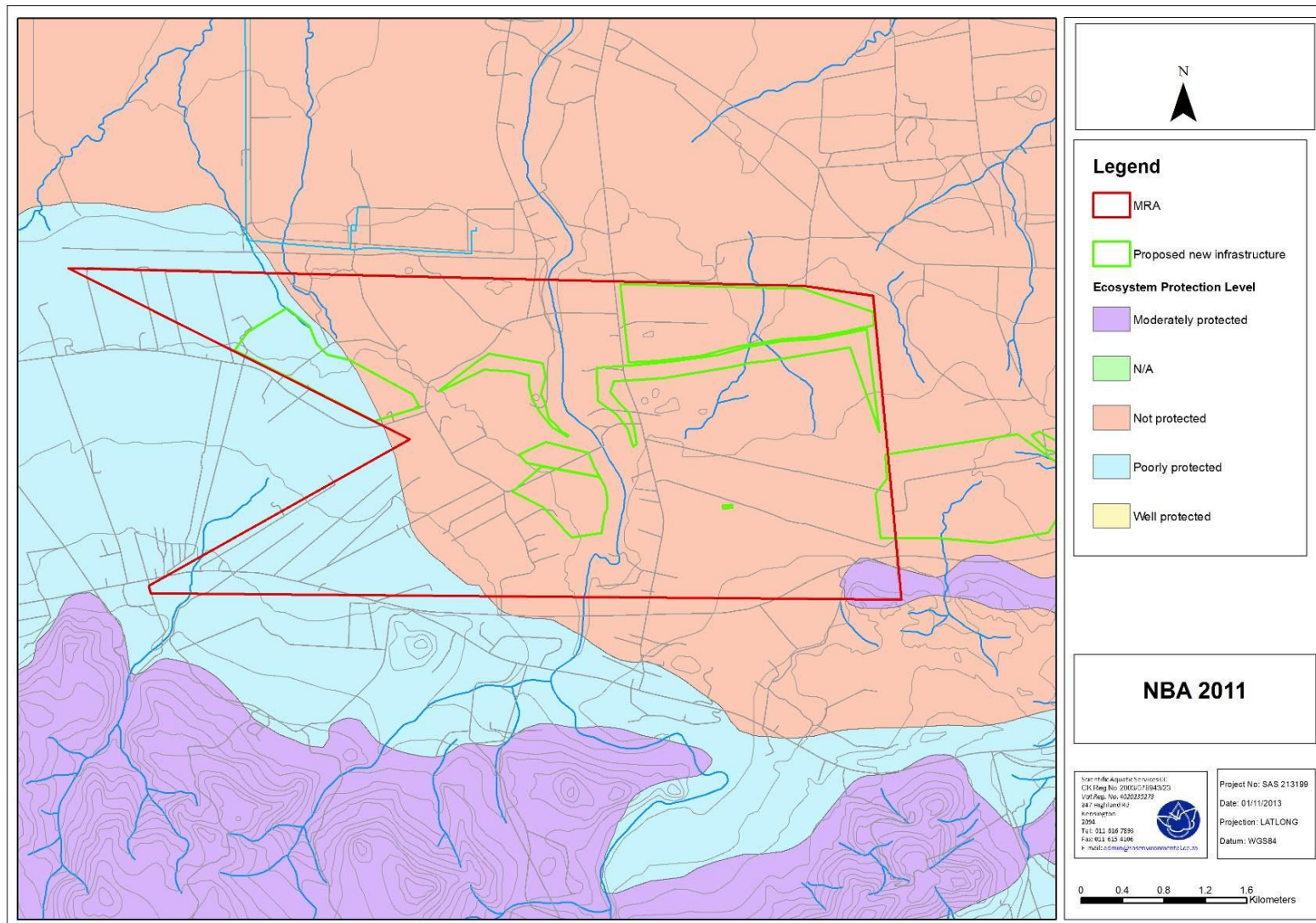


Figure 6: Protection Level of the subject property (NBA, 2011).



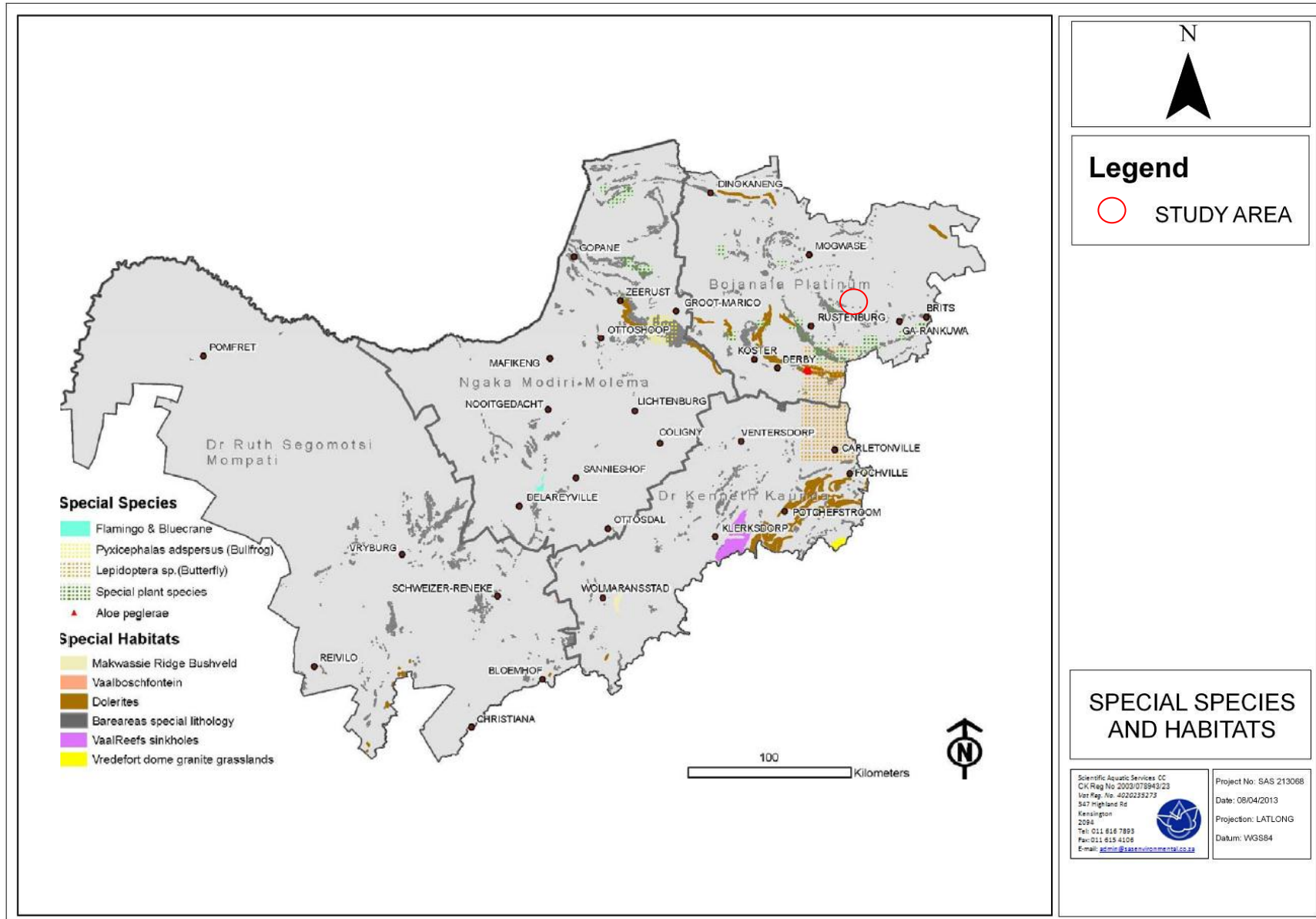


Figure 7: Expert mapped features; location of subject property depicted by a red circle.



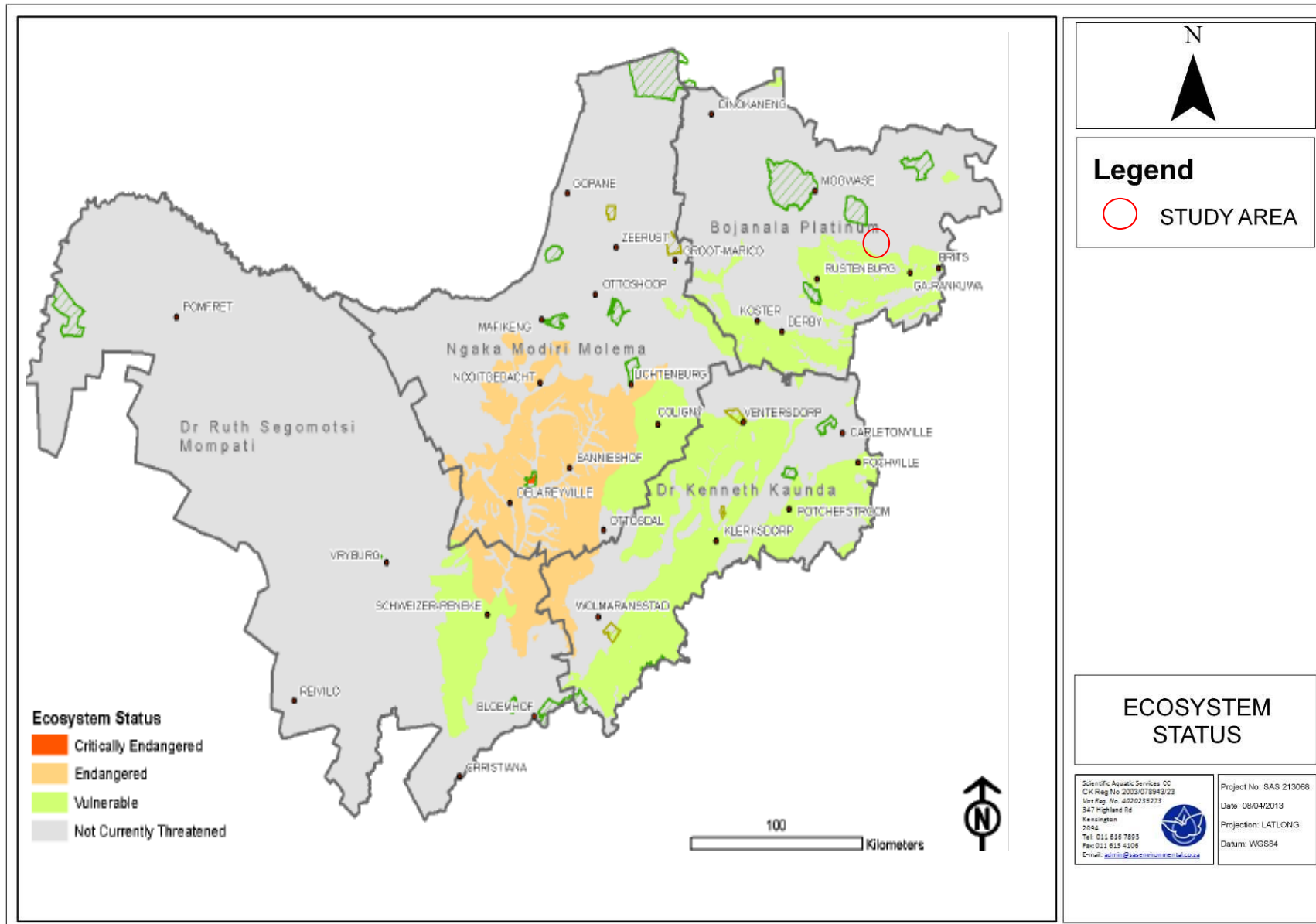


Figure 8: Ecosystem Status; location of subject property depicted by a red circle. Green hatched areas are formally protected areas.



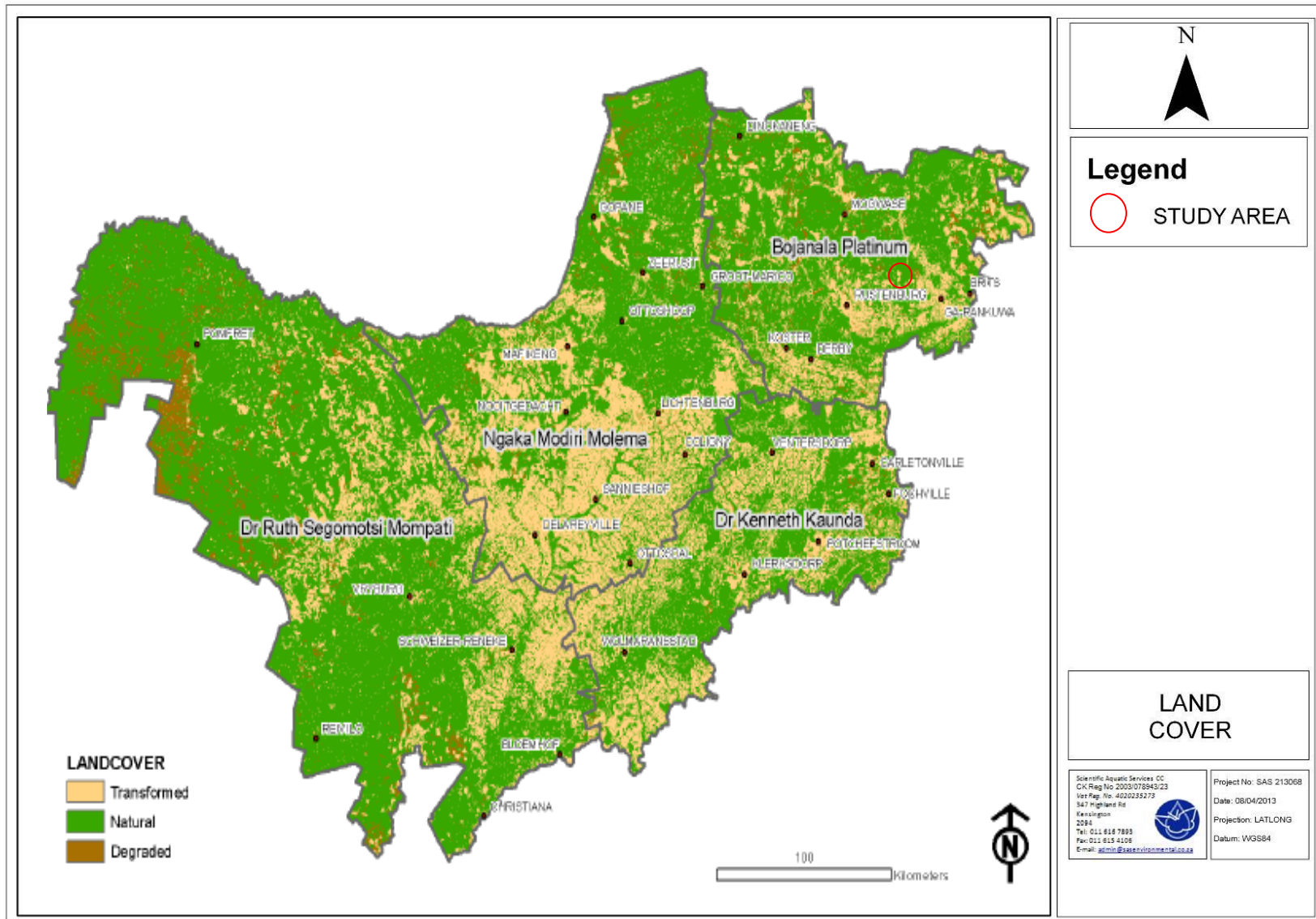


Figure 9: Landcover of the North West province; location of subject property depicted by a red circle.



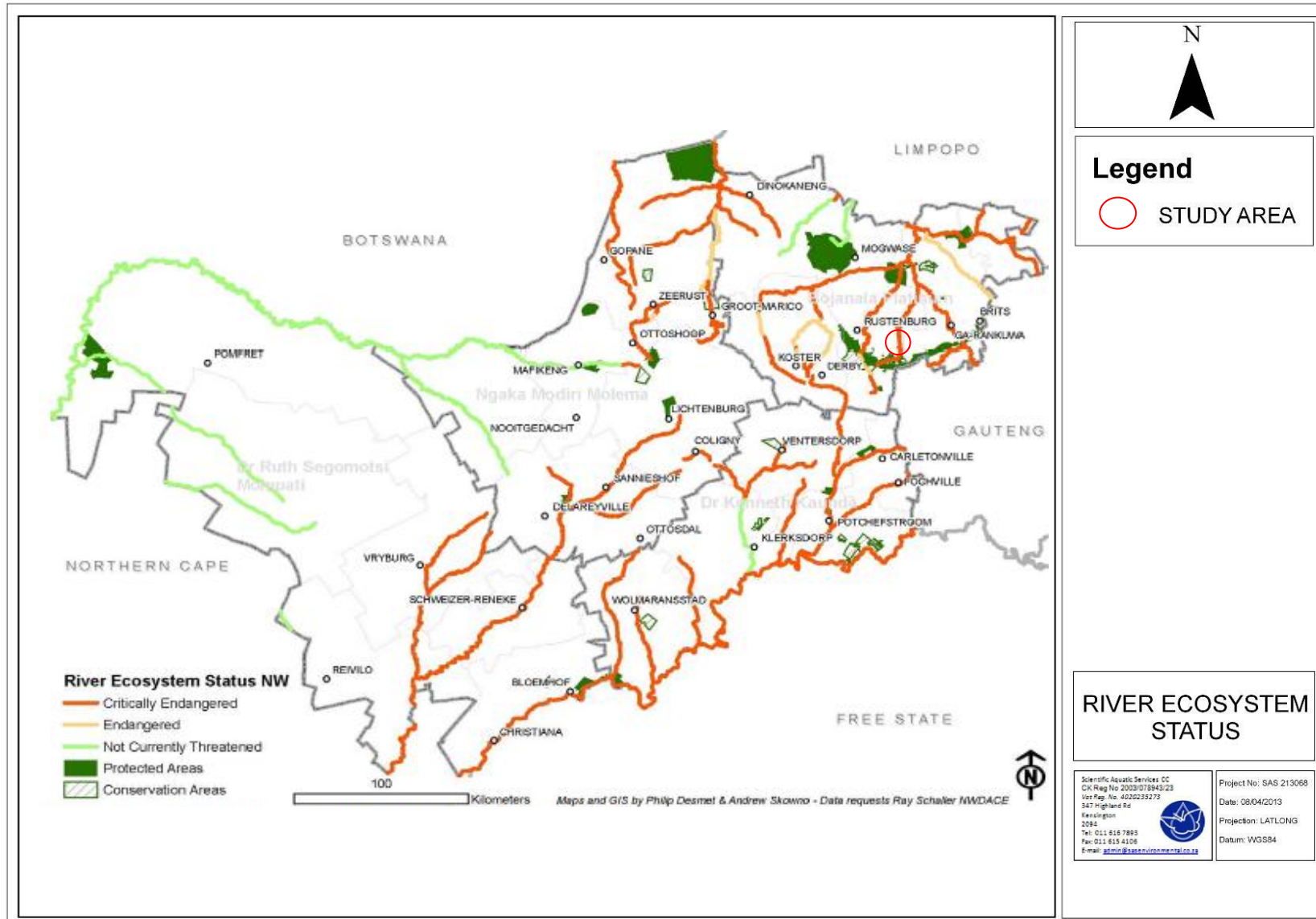


Figure 10: Provincial Ecosystem Status of main-stream rivers; location of subject property depicted by a red circle.



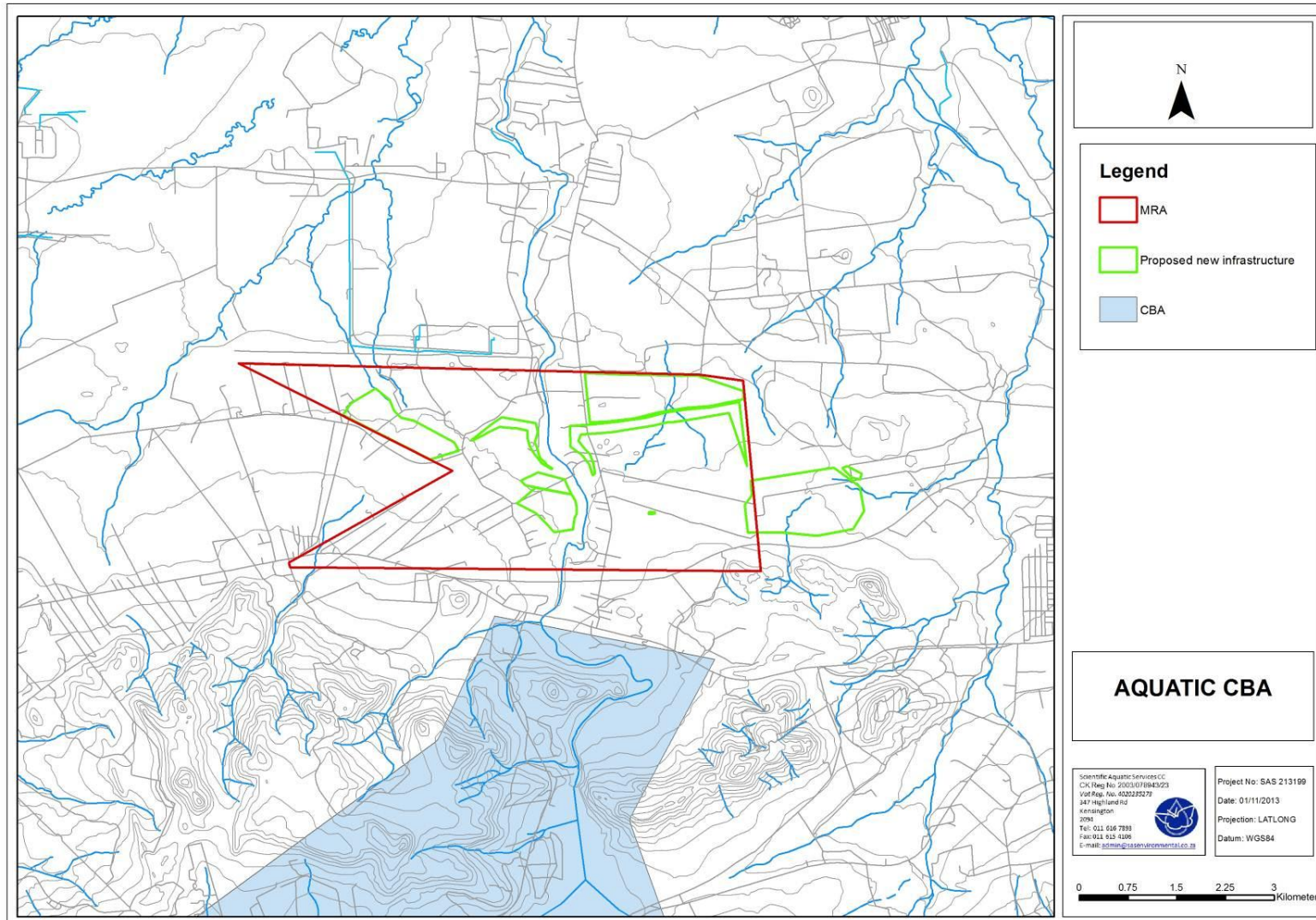


Figure 11: Aquatic CBAs associated with the subject property.



3.6 North West Province State of the Environment Report, 2002 (NW SoER)

The North West Province State of Environment Report (SoER) has been compiled in order to assist the North West Provincial Government and other decision-makers to make informed decisions about the environment. The Biodiversity chapter identifies the current state of, and what is affecting Biodiversity within the province and proposed indicators for future monitoring. This document was utilised to guide the assessment of faunal species considered to be of conservation concern within the province.

4. SURROUNDING PROPERTIES/LAND USES

The subject property is in a rural area characterised by agricultural activities and mining operations. Historically much of the area was utilised for agricultural activities with special mention of maize, sunflower and tobacco production. With the increase in value of platinum group metals significant increases in the amount of mining taking place in the area occurred. With the transformation taking place in the area due to these activities, significant local and fairly regional loss of biodiversity has taken place. In addition there has been a significant increase in the impact on water quality and wetland and aquatic resources in the area. For this reason the need to minimise the impact of proposed development activities on the remaining natural resources in the area is deemed to be of high significance. This report aims to ensure that these aspects are adequately considered during the decision making process for the proposed mining development in question.

5. STRUCTURE OF THE REPORT

Section A of this report served to provide an introduction to the subject property, the general approach to the study as well as the method of impact assessment. Section A also presents the results of general desktop information reviewed as part of the study including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character. The section also indicates that the requirements for mitigation, monitoring and rehabilitation are addressed in each section.

Section B addresses all the issues pertaining to the assessment of the floral ecology of the subject property.



Section C addresses all the issues pertaining to the assessment of the faunal ecology of the subject property.

Section D addresses all the issues pertaining to the assessment of the wetland ecology of the subject property.

Section E addresses all the issues pertaining to the assessment of the aquatic ecology of the subject property.



6. REFERENCES

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