APPENDIX E: SPECIALIST STUDIES

- Biodiversity Study (inclusive of Plant and Animal Compliance Statements)
- Aquatic Biodiversity Compliance Statement
- HIA
- Desktop PIA
- Soils and Land Capability Compliance Statement
- Landscape/Visual SSVR
- Financial Provision

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BIODIVERSITY ASSESSMENT AS PART OF THE BASIC ASSESSMENT PROCESS FOR THE PROPOSED EXTENSION OF THE RAILWAY INFRASTRUCTURE AT THE WESSELS MINE, NORTHERN CAPE PROVINCE

Prepared for

SLR Consulting (South Africa) (Pty) Ltd

July 2021

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Report reference: STS 210054

EXECUTIVE SUMMARY

STS was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a biodiversity assessment as part of the Basic Assessment (BA) process for the proposed extension of the railway infrastructure at Wessels Mine in the Northern Cape. The project included the assessment of the proposed railway loop supplied by the mine.

During the field assessment, three habitat units were identified, namely the *Senegalia melifera* Thicket, the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland and the Transformed habitat. The majority of the proposed railway loop is located within the Transformed habitat, which is characterised by the transformation of the indigenous vegetation to that of the current mining area as well as the associated roads. The southern portion is associated with the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland whilst the eastern portion is associated with the *Senegalia melifera* Thicket.

Four floral Species of Conservation Concern (SCC) (*Vachellia erioloba* & *V. haematoxylon, Harpagophytum procumbens* and *Boophone disticha*) were observed during the site assessment, whilst there is potential that six additional species may occur. No faunal SCC were observed, though there remains the possibility that four may utilise the railway footprint area, most likely whilst foraging. Overall, the habitat units, due to their proximity to the mine and past grazing impacts, have been degraded, with many areas becoming encroached. Given the aforementioned and taking into consideration the data from the field assessment, the two natural habitat units have been assigned an intermediate sensitivity, whist the transformed areas are considered to be of low sensitivity.

Following the ecological assessment of the biodiversity within the proposed railway loop, the impacts associated with the proposed development activities were determined. The impacts on the floral and faunal habitat, diversity and SCC are considered to range from medium to very low significance prior to the implementation of mitigation measures. With mitigation fully implemented the impacts can be reduced to low and very-low significance impacts. No significant impacts on the biodiversity associated with the proposed railway loop are however anticipated.

The National Web based Environmental Screening Tool returned a Low Sensitivity for the Animals and Plants theme and a Very High Sensitivity for the Terrestrial Biodiversity theme. Following the site assessment, and as presented within this report, the proposed railway loop aligns more with a higher sensitivity than that of the low sensitivity indicated in the screening tool. Such deviation was largely due to the relatively intact nature of the non-transformed areas as well as the presence of several floral SCC.

This report and the data contained herein fulfils the requirements for both the Plants and Animals Compliance Statements as well as the baseline data reporting requirements for the Basic Assessment (BA) process.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the proposed railway loop will be made in support of the principle of sustainable development.

DOCUMENT GUIDE

The table below provides a guide to the reporting of biodiversity impacts as they relate to 1) Government Notice No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Biodiversity** as published in Government Gazette 43110 dated 20 March 2020, and 2) Government Notice No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on **Terrestrial Plant and Animal Species** as published in Government Gazette 43855 dated 30 October 2020.

Theme-Specific Requirements as per Government Notice No. 320 Terrestrial Biodiversity Theme – Very High Sensitivity Rating as per Screening Tool Output		
No.	**SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS**	**Section in report/Notes**
2	**Terrestrial Biodiversity Specialist Assessment**	
2.1	The assessment must be prepared by a specialist registered with the South African Council for Natural Scientific Professionals (SACNASP) with expertise in the field of terrestrial biodiversity.	Appendix I
2.2	The assessment must be undertaken on the preferred site and within the proposed development footprint.	Section 1
2.3	**The assessment must provide a baseline description of the site which includes, as a minimum, the following aspects:**	
2.3.1	A description of the ecological drivers or processes of the system and how the proposed development will impact these;	Section 4
2.3.2	Ecological functioning and ecological processes (e.g., fire, migration, pollination, etc.) that operate within the preferred site;	Section 4
2.3.3	The ecological corridors that the proposed development would impede including migration and movement of flora and fauna;	Section 4
2.3.4	The description of any significant terrestrial landscape features (including rare or important flora-faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Area (FEPA) sub catchments;	Section 4
2.3.5	A description of terrestrial biodiversity and ecosystems on the preferred site, including: a) main vegetation types; b) threatened ecosystems, including listed ecosystems as well as locally important habitat types identified; c) ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and d) species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified;	Section 3 (desktop analysis)
2.3.6	The assessment must identify any alternative development footprints within the preferred site which would be of a "low" sensitivity as identified by the screening tool and verified through the site sensitivity verification; and	Not Applicable.
2.3.7	**The assessment must be based on the results of a site inspection undertaken on the preferred site and must identify:**	
2.3.7.1	Terrestrial Critical Biodiversity Areas (CBAs), including: *a) the reasons why an area has been identified as a CBA;* *b) an indication of whether or not the proposed development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *c) the impact on species composition and structure of vegetation with an indication of the extent of clearing activities in proportion to the remaining extent of the ecosystem type(s);* *d) the impact on ecosystem threat status;* *e) the impact on explicit subtypes in the vegetation;* *f) the impact on overall species and ecosystem diversity of the site; and* g) *the impact on any changes to threat status of populations of species of conservation concern in the CBA;*	Section 3 (desktop analysis) and 4
2.3.7.2	Terrestrial Ecological Support Areas (ESAs), including:	

	a) *the impact on the ecological processes that operate within or across the site;* b) *the extent the proposed development will impact on the functionality of the ESA; and* c) *loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridors or introducing barriers that impede migration and movement of flora and fauna;*	
2.3.7.3	Protected areas as defined by the National Environmental Management: Protected Areas Act, 2004 including- a) *an opinion on whether the proposed development aligns with the objectives or purpose of the protected area and the zoning as per the protected area management plan;*	Section 3 (desktop analysis)
2.3.7.4	Priority areas for protected area expansion, including- a) *the way in which in which the proposed development will compromise or contribute to the expansion of the protected area network;*	Section 3 (desktop analysis)
2.3.7.5	SWSAs including: a) *the impact(s) on the terrestrial habitat of a SWSA; and* b) *the impacts of the proposed development on the SWSA water quality and quantity (e.g., describing potential increased runoff leading to increased sediment load in water courses);*	Section 3 (desktop analysis)
2.3.7.6	FEPA sub catchments, including- a) *the impacts of the proposed development on habitat condition and species in the FEPA sub catchment;*	Not Applicable
2.3.7.7	Indigenous forests, including: a) *impact on the ecological integrity of the forest; and* b) *percentage of natural or near natural indigenous forest area lost and a statement on the implications in relation to the remaining areas.*	Not Applicable
2.4	**The findings of the assessment must be written up in a Terrestrial Biodiversity Specialist Assessment Report.**	
	Results of the **Floral Assessment** as well as conclusions on Terrestrial Biodiversity as it relates to vegetation communities and the results of the **Faunal Assessment** as well as conclusions on Terrestrial Biodiversity as it relates to faunal communities are in **Sections 4 – 6.**	
3	**Terrestrial Biodiversity Specialist Assessment Report**	
3.1	**The Terrestrial Biodiversity Specialist Assessment Report must contain, as a minimum, the following information:**	
3.1.1	Contact details of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae;	Appendix I
3.1.2	A signed statement of independence by the specialist;	Appendix I
3.1.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 1.3
3.1.4	A description of the methodology used to undertake the site verification and impact assessment and site inspection, including equipment and modelling used, where relevant;	Section 2 Appendices B, C & D
3.1.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.1.6	A location of the areas not suitable for development, which are to be avoided during construction and operation (where relevant);	Section 5 & 6
	Impact Assessment Requirements 3.1.7 Additional environmental impacts expected from the proposed development; 3.1.8 Any direct, indirect and cumulative impacts of the proposed development; 3.1.9 The degree to which impacts and risks can be mitigated; 3.1.10 The degree to which the impacts and risks can be reversed; 3.1.11 The degree to which the impacts and risks can cause loss of irreplaceable resources;	Section 6

	3.1.12 Proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the Environmental Management Programme (EMPr);	
3.1.13	A motivation must be provided if there were development footprints identified as per paragraph 2.3.6 above that were identified as having a "low" terrestrial biodiversity sensitivity and that were not considered appropriate;	**Not Applicable to this report**
3.1.14	A substantiated statement, based on the findings of the specialist assessment, regarding the acceptability, or not, of the proposed development, if it should receive approval or not; and	Executive summary & Section 7
3.1.15	Any conditions to which this statement is subjected.	Section 5 & 6
3.2	The findings of the Terrestrial Biodiversity Specialist Assessment must be incorporated into the Basic Assessment Report or the Environmental Impact Assessment Report, including the mitigation and monitoring measures as identified, which must be incorporated into the EMPr where relevant.	**Not Applicable to this report**
3.3	A signed copy of the assessment must be appended to the Basic Assessment Report or Environmental Impact Assessment Report.	**Not Applicable to this report**

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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al*. (2011), Hui and Richardson (2017) and Wilson *et al*. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species Regulations, 2020].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biological diversity or Biodiversity (as per the definition in NEM:BA)	The variability among living organisms from all sources including, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate, and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEM:BA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
Critical Biodiversity Area (CBA)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation, and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g., southern Africa), national (South Africa), provincial, regional, or even within a particular mountain range.
Ecological Support Area (ESA)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Ground-truth	Ground truth is a term used in various fields to refer to information provided by direct observation (i.e., empirical evidence) as opposed to information provided by inference.
Habitat (as per the definition in NEM:BA)	A place where a species or ecological community naturally occurs.
Important Bird and Biodiversity Area (IBA)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.
Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species Regulations, 2020.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have

	expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g., species are still native if they increase their range as a result of watered gardens but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
Red Data listed (RDL) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
Species of Conservation Concern (SCC)	The term SCC in the context of this report refers to all RDL and IUCN listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS

AIP	Alien Invasive Plant
BA	Basic Assessment
BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resource Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
DFFE	Department of Forestry, Fisheries and the Environment
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
E-GIS	Environmental Geographical Information Systems
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
GWC	Griqualand West Centre
Ha	Hectares
IBA	Important Bird Area
IEM	Integrated Environmental Management
IUCN	International Union for the Conservation of Nature
MAMSL	Meter Above Mean Sea Level
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
MRA	Mining Right Area
NBA	National Biodiversity Assessment
NCDENC	Northern Cape Department of Environment and Nature Conservation
NCNCA	Northern Cape Nature Conservation Act,
NCPSDF	Northern Cape Provincial Spatial Development Framework
NEMA	National Environmental Management, 1998 Act (Act No. 107 of 1998)
NEM:BA	National Environmental Management: Biodiversity Act, 1998 (Act No. 10 of 2004)
NFA	National Forest Act, 1998 [Act No. 84 of 1998]
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
NTBA	Not Yet Been Assessed
ONA	Other Natural Areas
PES	Present Ecological State
POC	Probability of Occurrence
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data List
SABAP 2	Southern African Bird Atlas 2

SACAD	South Africa Conservation Areas Database
SACNASP	Professional member of the South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SanParks	South African National Parks
SAPAD	South Africa Protected Area Database
SCC	Species of Conservation Concern
SLR	SLR Consulting (Africa) (Pty) Ltd
STS	Scientific Terrestrial Services CC
SWSA	Strategic Water Source Area
TOPS	Threatened or Protected Species
TSP	Threatened Species Programme
VEGMAP	National Vegetation Map Project
VU	Vulnerable
WAS	Water Source Area

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a biodiversity assessment as part of the Basic Assessment process for the proposed extension of the railway infrastructure at the Wessels Mine, which is operated by South32 Limited (South32), within the Northern Cape. The proposed extension of the railway infrastructure comprises of a single proposed railway loop, hereafter collectively referred to as the “proposed railway loop” (Figures 1 and 2). For the purpose of this assessment a 20 m assessment corridor on either side of the proposed railway loop was investigated during the field assessment and will hereafter be referred to as the “assessment zone”.

The proposed railway loop is located within the John Toalo Gaetsewe District Municipality and magisterial District Municipality within the Joe Morolong Local Municipality in the Northern Cape Province. The Wessels Mine is located approximately 1.5 km north-east of Blackrock Mine and is an operational underground manganese mine operating at a depth of approximately 350 m below surface. The Wessels Mine is located approximately 18 km north east of the town of Hotazel, with the R380 roadway situated directly west of the proposed railway loop. The Ga-Mogara River is located approximately 6,4 km east of the proposed railway loop. The majority of the proposed railway loop is situated within the mining area with limited native vegetation remaining.

This report, after consideration of the description of the ecological integrity of the proposed railway loop, must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from a biodiversity resource management perspective.

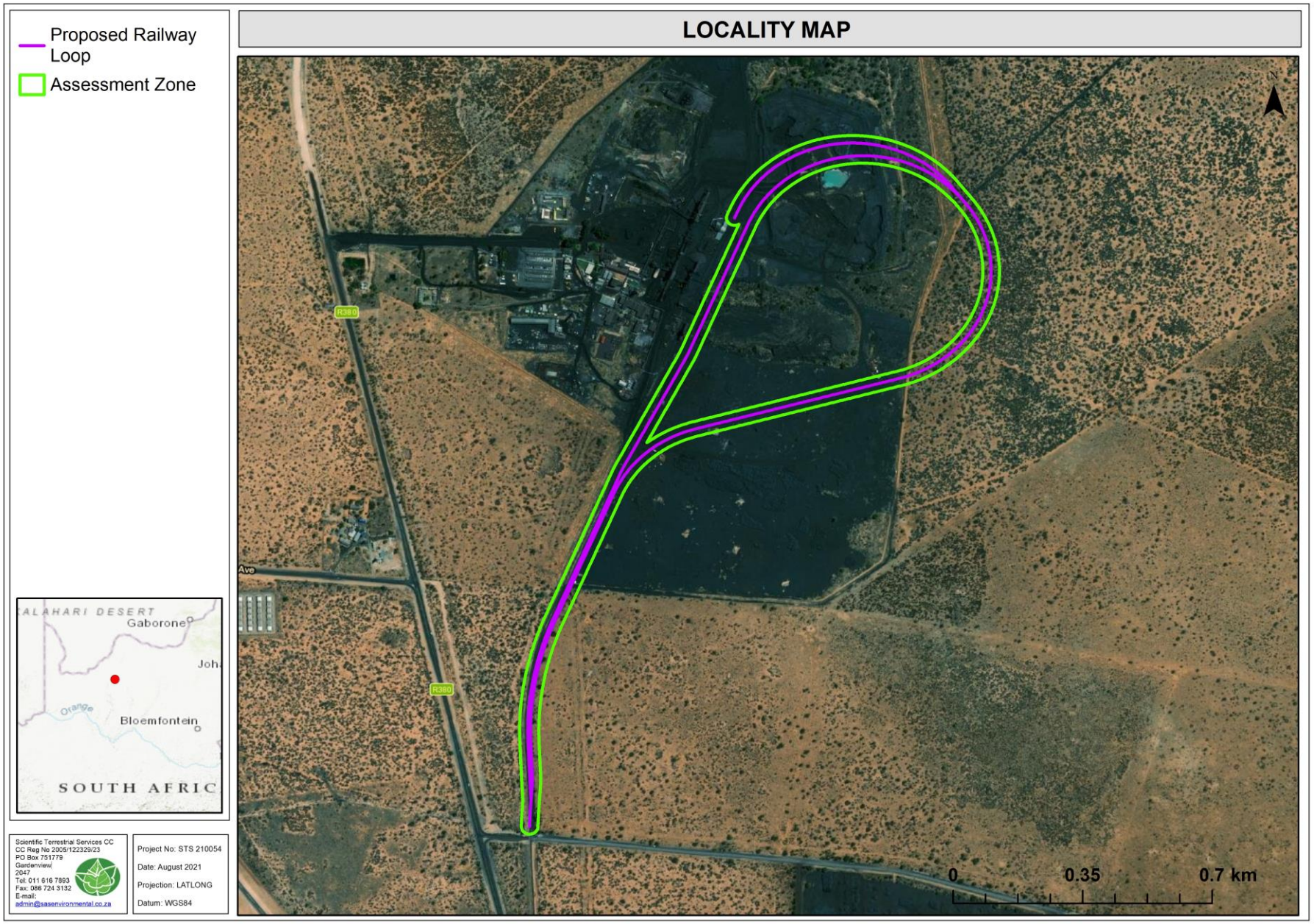


Figure 1: Satellite image depicting the location of the proposed railway loop and associated assessment zone in relation to surrounding area.

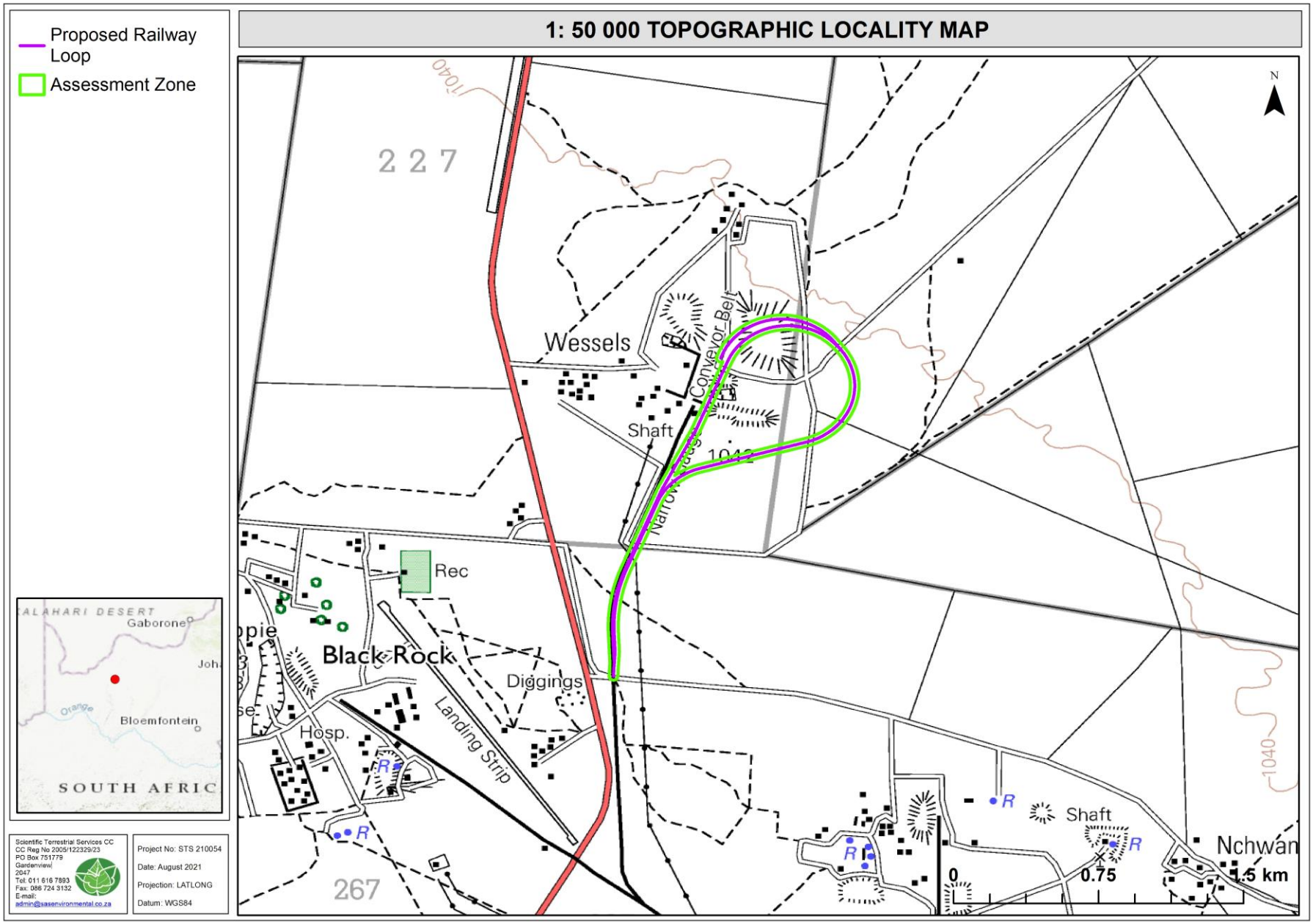


Figure 2: The proposed railway loop and associated assessment zone depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To outline the legislative requirements that were considered for the assessment (Appendix A of this report);
- To define the Present Ecological State (PES) of the biodiversity of the assessment zone;
- To determine and describe habitats, communities and the ecological state of the assessment zone;
- To conduct a faunal and floral Species of Conservation Concern (SCC) assessment, including the potential of suitable habitat to occur within the assessment zone for SCC;
- To identify and consider all sensitive landscapes, including rocky ridges, wetlands and any other ecologically important features, if present;
- Verify the outcomes of the screening tool for the proposed railway loop;
- To determine the environmental impacts that the construction of the proposed development might have on the biodiversity of the surrounding area; and
- To develop mitigation and management measures for all phases of the proposed railway loop.

1.3 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- The biodiversity assessment was confined to the assessment zone and did not include the neighbouring and adjacent properties. These were considered as part of the desktop assessment (Section 3);
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered. Relevant online sources and background information were further accessed to improve on the overall understanding of the assessment zone's ecology;
- Due to most faunal taxa's nature and habits, it is unlikely that all species would have been observed during a field assessment of limited duration. Due to the locality of the proposed railway loop (adjacent current mining activities), the cyclical nature of many species' life stages, as well as the season of the assessment, few faunal species were observed during the site visit. As such, background data (desktop) and literature studies (previous studies undertaken in the immediate area) were used to further infer faunal species composition and sensitivities in relation to the available habitat;

- Due to the season of assessment (winter), many of the geophytes had died back and were not observable or identifiable. Similarly, many of the smaller herbaceous species, without the distinctive flowers, inflorescences or seeds made identification difficult. As such some species were only identifiable to species levels whilst other species that only show in summer were likely missed during this assessment. However, the data presented within this report is deemed suitable and accurate in order to make the necessary decisions pertaining to the project;
- Sampling, by its nature, means that not all individuals are assessed and identified. Some species and taxa associated with the assessment zone may therefore have been missed during the assessment; and
- The data presented in this report are based on one site visit, undertaken on the 10th of June 2020 (winter). A more comprehensive assessment would require that assessments take place in all seasons of the year. However, on-site data were augmented with all available desktop data. Together with project experience in the area, the findings of this assessment are considered an accurate reflection of the ecological characteristics of the assessment zone.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996[1];
- The Conservation of Agricultural Resource Act, 1983 (Act No. 43 of 1983) (CARA);
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- Government Notice (GN) number R.1020: Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020 as it relates to the NEM:BA;
- The National Forest Act, 1998 (Act No. 84 of 1998, amended 2001) (NFA);
- GN 536 List of Protected Tree Species as published in the Government Gazette 41887 dated 7 September 2018 as it relates to the NFA;

[1] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers

- GN No. 320 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity as published in Government Gazette 43110 dated 20 March 2020;
- GN No. 1150 Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Plant and Terrestrial Animal Species as published in Government Gazette 43855 dated 30 October 2020; and
- The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA); and
- The Northern Cape Provincial Spatial Development Framework (NCPSDF) as developed 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act 7 of 1998) and the Municipal Systems Act, 2000 (Act 32 of 2000).

The details of each of the above, as they pertain to this study, are provided in Appendix A of this report.

2. ASSESSMENT APPROACH

2.1 General Approach

Maps and digital satellite images were generated prior to the field assessment to determine broad habitats, vegetation types and potentially sensitive sites. The biodiversity desktop assessment is confined to the and assessment zone and does not include the neighbouring and adjacent properties, although the sensitivity of surrounding areas is included on the respective maps. Relevant databases and documentation that were considered during the assessment of the proposed railway loop include[2]:

- 2010 National Protected Area Expansion Strategy (NPAES) (Government of South Africa. 2010; DEA & SANBI, 2009), including the below-listed vector datasets:
    - NPAES Focus Areas 2010: National Protected Areas Expansion Strategy: Focus areas for protected area expansion (South African National Parks (SanParks), 2010);
    - NPAES Formal: Polygons of formal protected national parks areas in South Africa (SANParks/SANBI, 2013); and

[2] Datasets obtained from:
- SANBI BGIS (2020). The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org; and
- Environmental Geographical Information Systems (E-GIS) website. URL: https://egis.environment.gov.za/

- NPAES Protected Areas – Informal: Informal conservation areas in South Africa (SANParks/SANBI, 2012).

- The South African Conservation Areas Database, Quarter 1 (SACAD, 2021);
- The South African Protected Areas Database, Quarter 1 (SAPAD, 2021);
- The National Vegetation Map Project (VEGMAP), with the below vector dataset used for information on Biomes, Bioregions and Vegetation Type(s):
  - 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland (SANBI, 2018a)
- The National List of Threatened Ecosystems 2011 (SANBI 2011; South Africa, 2011);
- From the National Biodiversity Assessment (NBA, 2018) Terrestrial Assessment project (Skowno et al., 2019):
  - 2018 Terrestrial ecosystem threat status and protection level - remaining extent (SANBI, 2018b); and
  - 2018 Terrestrial ecosystem threat status and protection level layer (SANBI, 2018c).
- The Important Bird and Biodiversity Areas (IBA) Programme and vector dataset (BirdLife South Africa, 2015; Marnewick et al., 2015a and 2015b), in conjunction with the South African Bird Atlas Project 2 (SABAP 2);
- Northern Cape Critical Biodiversity Areas Database (2016);
- The International Union for Conservation of Nature (IUCN);
- The National Web-Based Environmental Screening Tool (accessed 2021) – hereafter referred to as the "screening tool'; and
- From the 2017 Strategic Water Source Areas (SWSA) project:
  - 2017 SWSA Surface water (Water Research Commission, 2017).

The field assessment took place during the winter season (10th of June 2021) to determine the ecological status of the assessment zone and to "ground-truth" the results of the desktop assessment. Results of the field assessment are presented in Section 4.

2.2 Sensitivity Mapping

All the ecological features associated with the assessment zone were considered, and sensitive areas were delineated using a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto satellite imagery.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics associated with the Assessment Zone

The following table contains 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 do not always provide an entirely accurate indication of the assessment zone's actual biodiversity characteristics.

Table 1: Summary of the biodiversity conservation characteristics for the assessment zone [Quarter Degree Squares (QDS) 2722BB].

DETAILS OF THE ASSESSMENT ZONE IN TERMS OF MUCINA & RUTHERFORD (SANBI, 2018c)	
Biome	The assessment zone is situated within the **Savanna Biome.**
Bioregion	The assessment zone is situated within the **Eastern Kalahari Bushveld Bioregion**.
Vegetation Type	The assessment zone falls within the **Kathu Bushveld** (SVk 12) vegetation type.
CONSERVATION DETAILS PERTAINING TO THE ASSESSMENT ZONE (VARIOUS DATABASES)	
National Threatened Ecosystems (2011)	According to the National Threatened Ecosystem Dataset, the entire assessment zone is located within an ecosystem that is considered **Least Threatened.** For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations 2014, as amended, published under the NEMA. The data contained in NBA 2018 represents an update of the assessment of threat status for terrestrial ecosystems, but the National List of Threatened Terrestrial Ecosystems has not yet been revised.
National Biodiversity Assessment (2018) (Figure 3)	The assessment zone is located within the remaining extent of the **Kathu Bushveld** (**Least Concern**), which is currently **poorly protected**. Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected" and "well protected" based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type. The ecosystem protection level status is assigned using the following criteria: i. If an ecosystem type has more than 100% of its biodiversity target protected in a formal protected area either A or B, it is classified as Well Protected; ii. When less than 100% of the biodiversity target is met in formal A or B protected areas it is classified it as Moderately Protected; iii. If less than 50% of the biodiversity target is met, it is classified it as Poorly Protected; and iv. If less than 5% it is Hardly Protected.

DESCRIPTION OF THE KATHU BUSHVELD VEGETATION TYPE RELEVANT TO THE ASSESSMENT ZONE (MUCINA & RUTHERFORD 2006)					
Distribution	North-West and Northern Cape Provinces.				
Climate	Summer and autumn rainfall with very dry winters.				
	MAP (mm)	**MAT (°C)**	**MFD (days)**	**MAPE (mm)**	**MASMS (%)**
	300	18.5	27	2883	85
Altitude (m)	1300 – 1500				
Conservation	**Least threatened.** Target 16%. None conserved in statutory conservation areas. Erosion is very low.				
Geology & Soils	Carbonates and chert of the Vaalian Griqualand West Supergroup and Kalahari sediments form flat, rocky, sandy plains with shallow (0.1–0.6 m) red aeolian sands, stony and underlain by rock. Dominant land types Ae and Fc, with Hutton, Clovelly and Mispah soil forms common.				
Vegetation & landscape features (Dominant Floral Taxa in Appendix E)	Open tree layer characterised by *Vachellia erioloba*, *V. karroo*, *Sersia lancea* and *Ziziphus mucronata*. Shrub layer poorly developed, with *Grewia flava* and *Tarchonanthus camphoratus* and grass layer open, with much bare soil in places. **Biogeographically Important Taxa:** Graminoid: *Anthephora argentea.*				
NATIONAL WEB BASED ENVIRONMENTAL SCREENING TOOL (accessed 2021)					
The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the Environmental Authorisation (EA) process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.					
Terrestrial Sensitivity	The Terrestrial Sensitivity for the assessment zone has a **very high sensitivity,** due to the area being classified as a Freshwater Ecosystem Priority Area (FEPA) Catchment.				
Plant Species	For the Plant Species theme, the assessment zone scored a **low sensitivity**.				
Animal Species	For the Animal Species theme, the assessment zone scored a **low sensitivity**.				
STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)					

<table>
<tr><td>SAPAD (2021, Q1); SACAD (2021, Q1); NPAES (2010)</td><td>According to the NPAES,[3] database, the SAPAD[4] and the SACAD[5] the assessment zone is not located within a protected or conservation area or nature reserve, nor is it situated within 10 km of such areas. The NPAES database, however, indicate that the assessment zone is located approximately 4 km south east of the Eastern Kalahari Bushveld Focus Area.</td><td colspan="2">Surface water SWSAs are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide a complete coverage.</td></tr>
<tr><td rowspan="2">IBA (2015)</td><td rowspan="2">The assessment zone is not located within an IBA, nor is it located within 10 km of an IBA.</td><td>Name and Criteria</td><td>The assessment zone is not within 10 km of a Strategic Water Source Area.</td></tr>
<tr><td colspan="2">NORTHERN CAPE CRITICAL BIODIVERSITY AREAS (2016) (Figure 4)
According to the Northern Cape CBA (2016) database, the assessment zone is located within an area classified as Other Natural Areas (ONA). ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).</td></tr>
<tr><td colspan="4">NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2019) (FIGURE 5 & 6)
The NCPSDF is to function as an innovate strategy that will apply sustainability principles to all forms of land use management throughout the Northern Cape as well as to facilitate practical results, as it relates to the eradication of poverty and inequality and the protection of the integrity of the environment.

The assessment zone is located within the Griqualand West Centre (GWC) of plant endemism (Figure 5). This semi-arid region is broadly described as Savanna, forming part of the Eastern Kalahari Bushveld Bioregion. Studies investigating the endemism of the centre report at least 23 plant species that have restricted distributions (Frisby et al. 2015).

The assessment zone also fall within the Gamagara corridor (Figure 6). The Gamagara Corridor comprises the mining belt of the John Taolo Gaetsewe and Siyanda districts and runs from Lime Acres and Danielskuil to Hotazel in the north. The corridor focuses on the mining of iron and manganese.</td></tr>
</table>

CBA = Critical Biodiversity Area, ESA = Ecological Support Area, IBA = Important Bird and Biodiversity Area, MAP = Mean Annual Precipitation, MAT = Mean Annual Temperature, MFD = Mean Frost Days, MAPE = Mean Annual Potential for Evaporation, MASMS = Mean Annual Soil Moisture Stress, NBA = National Biodiversity Assessment, NPAES = National Protected Areas Expansion Strategy, SACAD = South African Conservation Areas Database, SAPAD = South African Protected Areas Database.

[3] Protected areas are areas of land or sea that are **formally** protected by law and managed mainly for biodiversity conservation. Protected areas recognized in the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) are considered **formal protected areas** in the NPAES. It is important to differentiate protected areas from conservation areas. Conservation areas are areas of land not formally protected by law but informally protected by the current owners and users and managed at least partly for biodiversity conservation. Because there is no long-term security associated with conservation areas, they are not considered a strong form of protection. Conservation areas are not a major focus of the NPAES.

[4] **SAPAD (2021):** The definition of protected areas follows the definition as defined in the National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 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; 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).

[5] **SACAD (2021):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

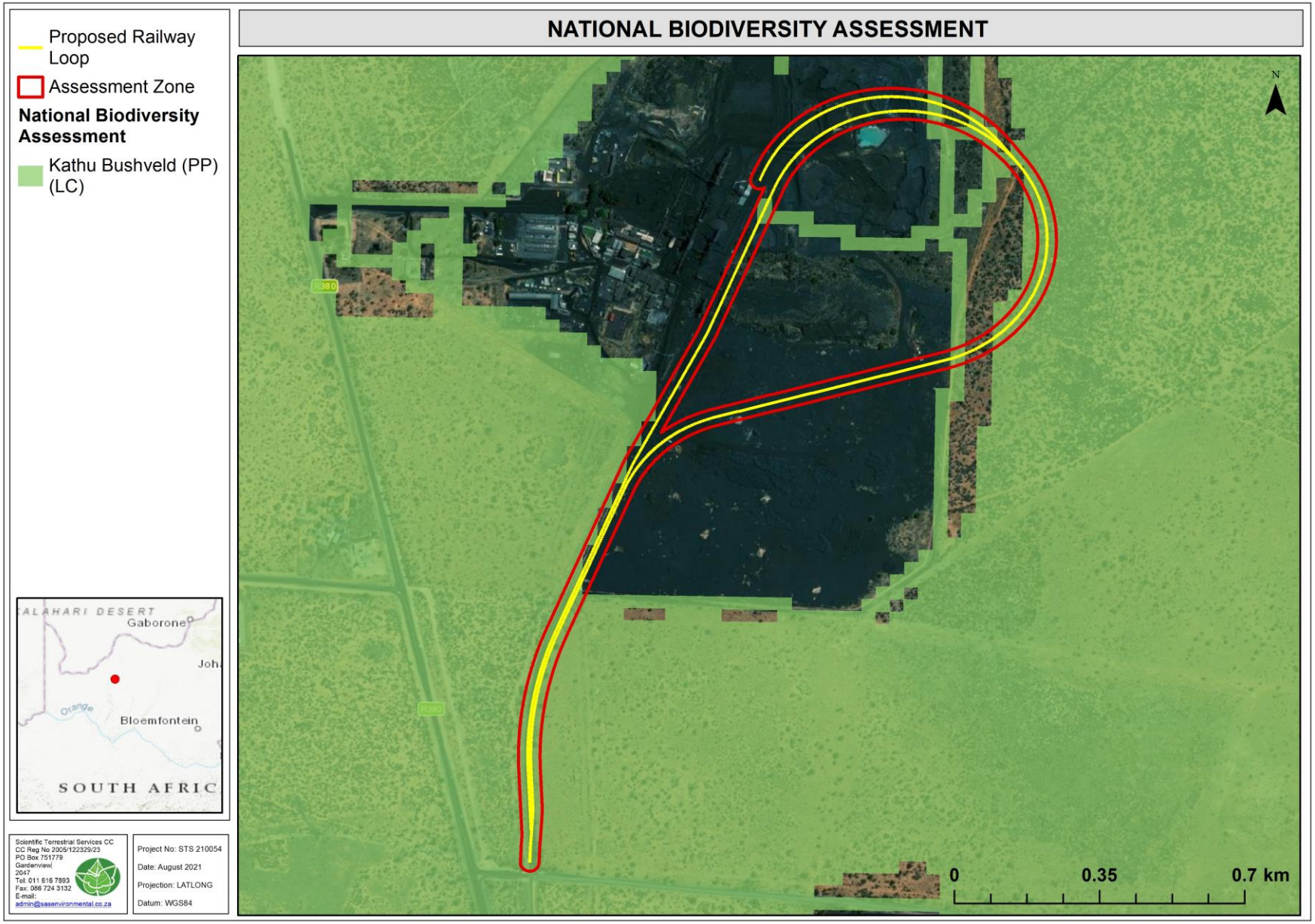


Figure 3: Remaining extent of the Kathu Bushveld vegetation type associated with the assessment zone (NBA 2018).

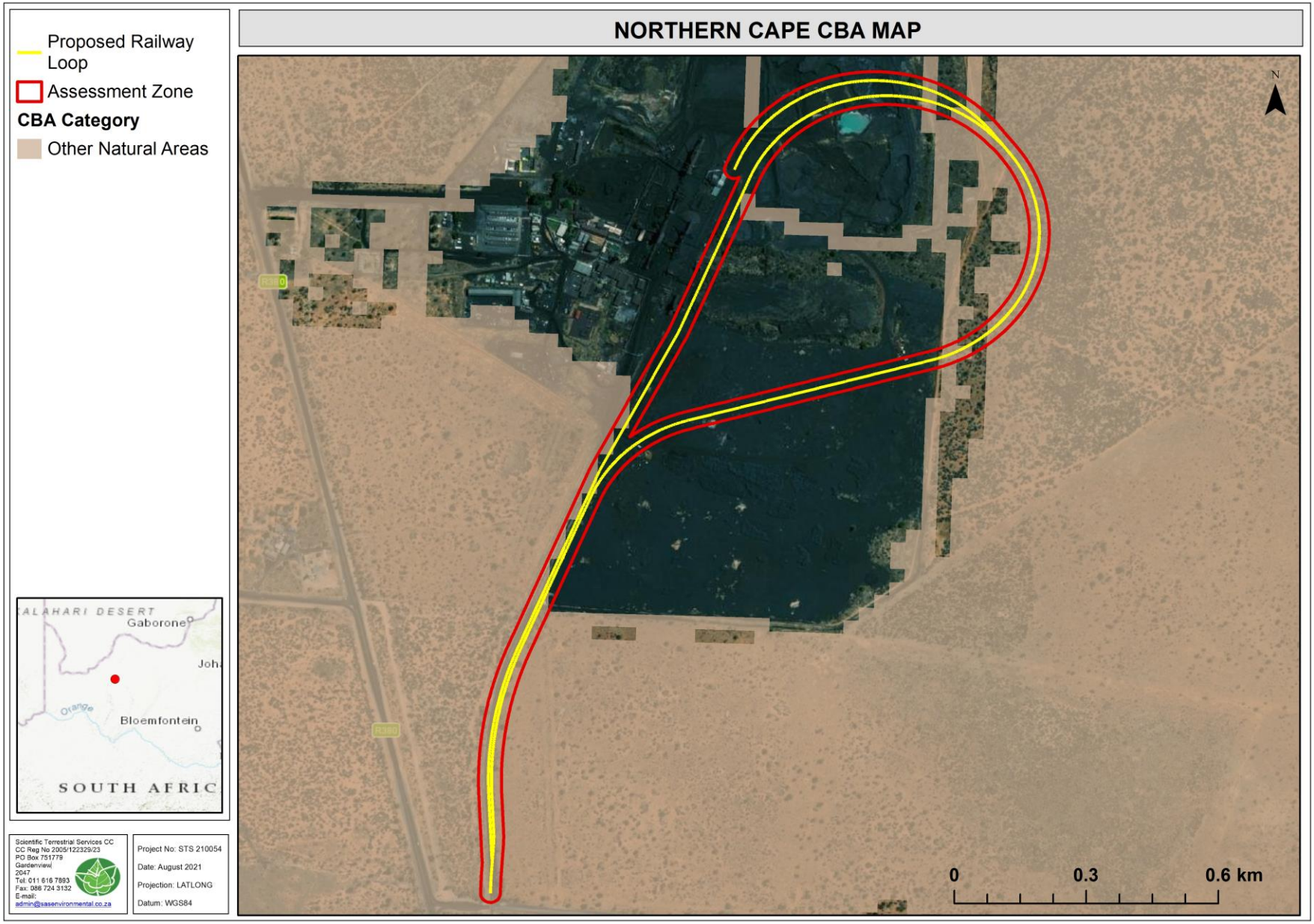


Figure 4: Important biodiversity features relating to the assessment zone according to the Northern Cape CBA Map (2016).

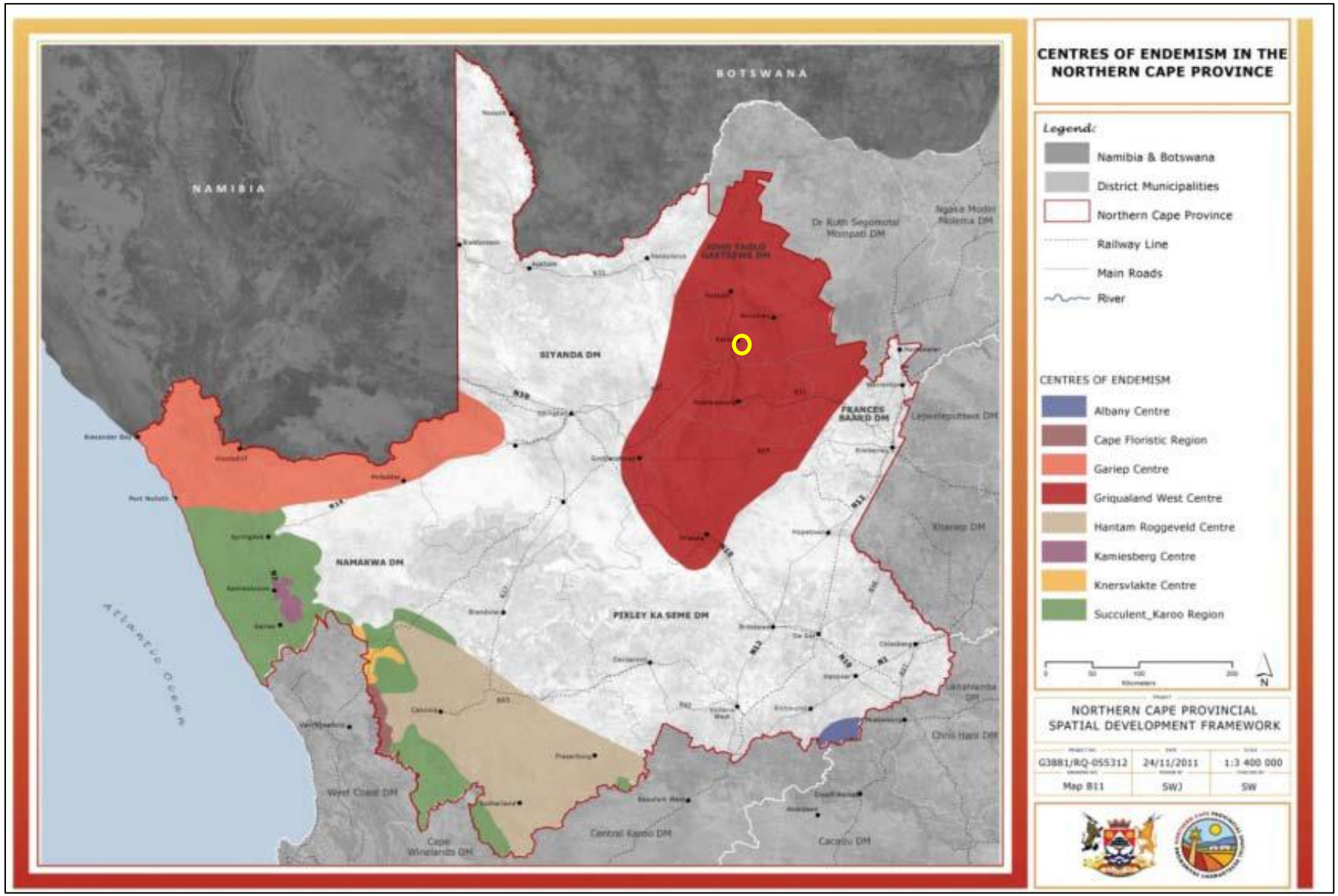


Figure 5: Centres of endemism of the Northern Cape Province: the assessment zone indicated by the yellow circle (NPSDF, 2012).

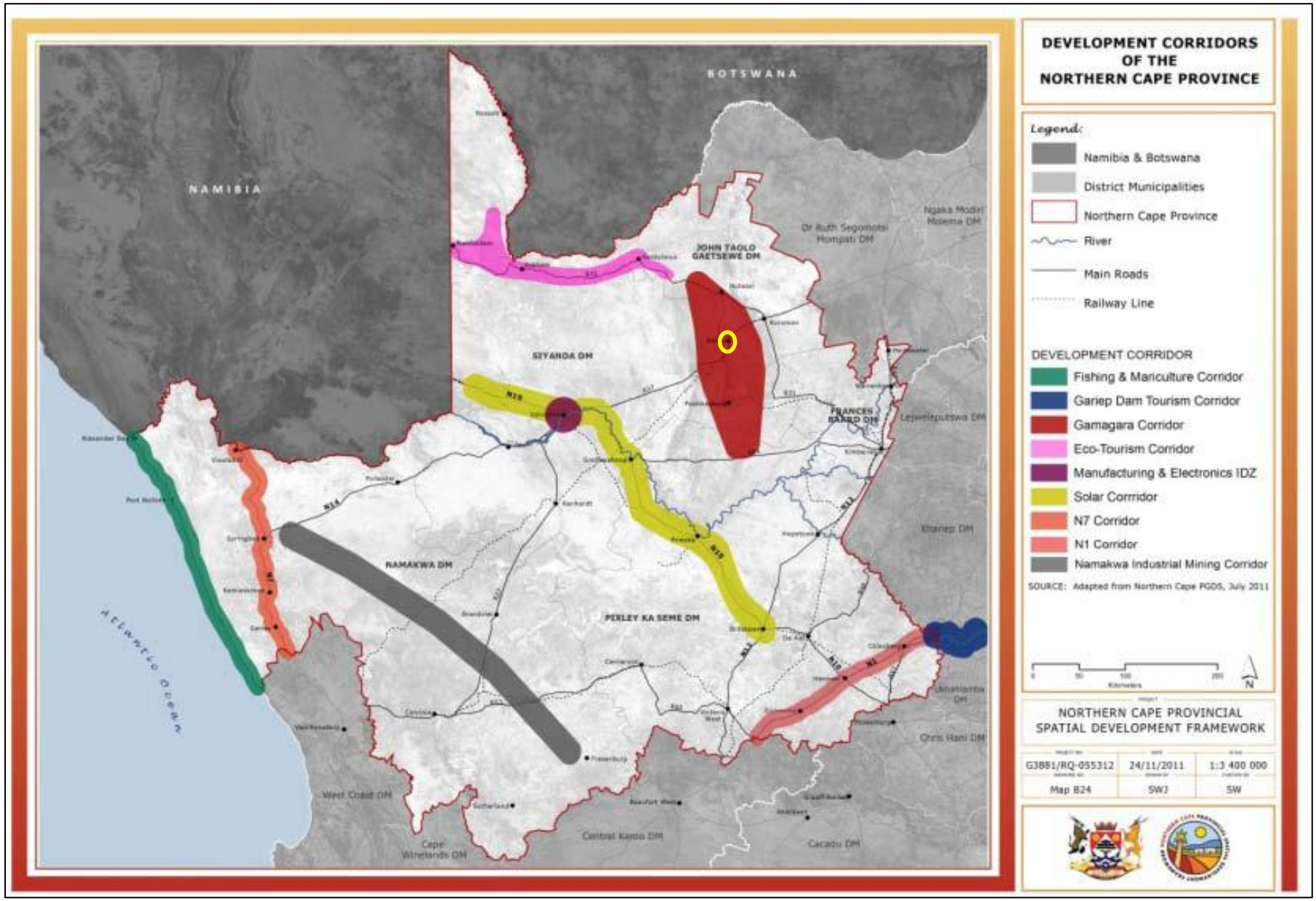


Figure 6: **Development corridors of the Northern Cape Province: the assessment zone is indicated by the yellow circle (NPSDF, 2012).**

4. ASSESSMENT RESULTS

The assessment zone (the 40m buffer around the proposed railway loop) is located within the existing and approved Mining Right Area (MRA), traversing through the active mining area as well as into the adjacent natural habitat to the west of the current Wessels Mine. The assessment zone is located within the Kathu Bushveld vegetation type, which, according to Mucina & Rutherford (2006) comprises of an open tree layer characterised by *Vachellia erioloba*, *V. karroo*, *Searsia lancea* and *Ziziphus mucronata*. The shrub layer is generally poorly developed, with *Grewia flava* and *Tarchonanthus camphoratus* and an open grass layer, with much bare soil in places.

During the field assessment three broad habitat units namely the *Senegalia melifera* Thicket, the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland and the Transformed habitat were identified. The majority of the assessment zone is associated with the Transformed habitat, which is characterised by the transformation of the indigenous vegetation to that of the current mining area as well as the associated roads.

The *Senegalia melifera* Thicket and Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland habitat units are further expanded upon in the dashboard in Section 4.1 below. Due to the level of transformation, the Transformed habitat is briefly described below only, and will not be further discussed in detail as it does not provide suitable floral or faunal habitat.

Transformed Areas

The Transformed areas (Figure 7) include existing gravel roads and the active mining area and comprise of little to no remaining vegetation. This habitat unit is no longer representative of the associated vegetation type and comprises of little to no native vegetation, as such, the habitat is of **low sensitivity**, which aligns with the screening tool's low sensitivity output for animals and plants sensitivity theme.

Figure 7: Road along the current railway line (left) and periphery of the active mining area (right).

The existing impacts on the biodiversity associated with the assessment zone include the below:

- Historic transformation of mining areas, including the road network;
- Edge effects from the mining activities including cutting of shrubs and trees along the permitter fence line, altering the vegetation structure;
- Growth of alien plant species in the disturbed areas, though this does not seem to be proliferate yet; and
- Active mining leading to dust and noise pollution, impacting on the biodiversity in the adjacent areas.

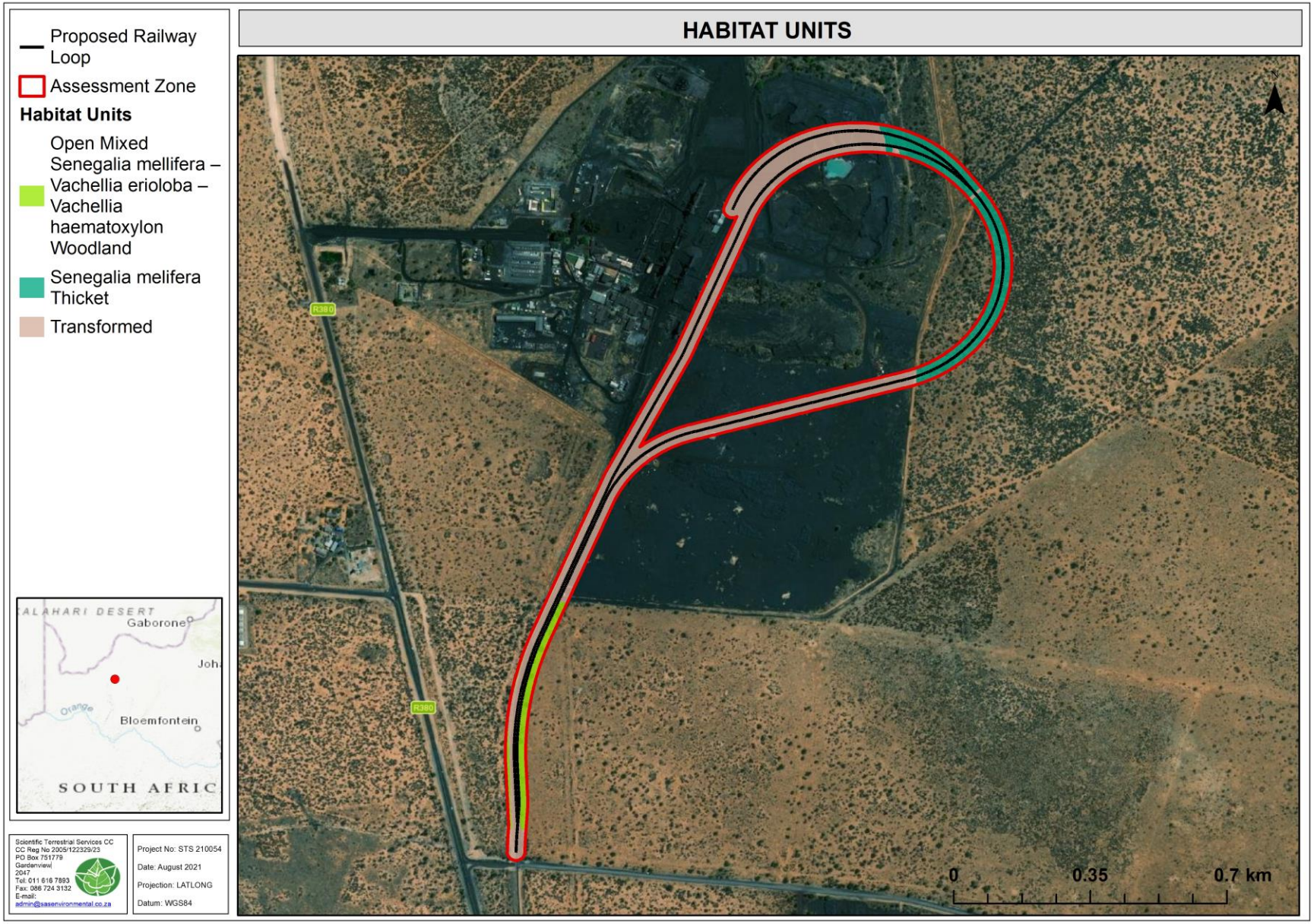


Figure 8: Habitat units associated with the assessment zone.

4.1 Floral Assessment

	***Senegalia melifera* Thicket**	**Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland**
Reference photos		
Habitat Overview	Due to the good rains received during the summer months the herbaceous layer has recovered from extended dry periods and grazing, providing suitable ground cover. This habitat unit, although encroached, is still considered representative of the reference vegetation type as described by Mucina and Rutherford (2006). Vegetation structure **Encroached stands of *Senegalia melifera* with relatively homogenous grass swards scattered throughout**.	This habitat unit comprises of a well-established and dense herbaceous layer. The woody component is more open and not encroached. This habitat unit is considered representative of the reference vegetation type as described by Mucina and Rutherford (2006). Vegetation structure **Open woodland structure with well-established yet relatively homogenous herbaceous layer.**
Species Overview	**Dominant Indigenous Vegetation:** - Trees and Shrubs: *Vachellia erioloba, Senegalia mellifera*, *Grewia flava* and *Melolobium candicans*; - Herbs and Forbs: *Aptosimum elongatum, Crotalaria orientalis, Cucumis africanus,* and *Dimorphotheca* sp.*;* and - *Graminoids: Schmidtia kalahariensis* and *Eragrostis lehmanniana.* Refer to **Appendix F** for a complete list of species recorded on site.	**Dominant Indigenous Vegetation:** - Trees and Shrubs: *Vachellia erioloba, Vachellia haematoxylon, Senegalia mellifera, Melolobium candicans* and *Grewia flava*; - Herbs and Forbs: *Crotalaria orientalis* and *Cucumis africanus;* and - Graminoids: *Schmidtia kalahariensis* and *Eragrostis lehmanniana.* Refer to **Appendix F** for a complete list of species recorded on site.
	Dominant Alien Vegetation: None observed during the site assessment. Refer to Section 4.3 for further information pertaining to Alien Invasive Plant (AIP) species.	**Dominant Alien Vegetation:** None observed during the site assessment. Refer to Section 4.3 for further information pertaining to AIPs.

<table>
<tr><th colspan="2">Species of Conservation Concern and Presence of Unique Landscapes (CBAs, ESAs, Protected Areas, Indigenous Forest, etc)</th></tr>
<tr><td>Presence of Unique Landscapes</td><td>Neither of the habitat units are considered unique landscapes, as they are well represented at a regional level. No significant features from a provincial or national database perspective were identified or confirmed for these habitat units.</td></tr>
<tr><td>Species of Conservation Concern</td><td>
The following floral SCC (comprising of species under the NFA, NCNCA and NEM:BA) as per the national and provincial protected species regulations were observed within the assessment zone:

The NFA:
Vachellia erioloba & V. haematoxylon;
The NCNCA:
Schedule 1 – Specially Protected Species: Harpagophytum procumbens; and
Schedule 2 – Protected Species: Boophone disticha (Family Amaryllidaceae);
The NEM:BA Threatened or Protected Species (TOPS):
Harpagophytum procumbens (Protected).


Notes on photographs: Vachellia haematoxylon (left), Vachellia erioloba (middle) and Boophone disticha (right) observed within the railway loop alternatives.

None of the protected species as per the above lists are considered threatened according to the Red List of South African Plants. Additionally, the following floral SCC are considered to have an increased probability of occurring within the assessment zone:

Boscia albitrunca (NCNCA Schedule 2 – Protected and NFA);
Hoodia gordonii (NCNCA Schedule 1 – Specially Protected and TOPS);
Lessertia frutescens subsp. frutescens (NCNCA Schedule 1 – Specially Protected)
Orbea sp. (NCNCA Schedule 2 – Protected Species);
Babiana hypogaea (NCNCA Schedule 2 – Protected Species); and
Nerine laticoma (NCNCA Schedule 2 – Protected Species).

Prior to any ground clearing activities, permits must be obtained from the Department of Forestry, Fisheries and the Environment (DFFE) and the Northern Cape Department of Environment and Nature Conservation (NCDENC) for the removal or destruction of any protected species.

Refer to Appendix G for the list of SCC considered as part of this assessment.
</td></tr>
</table>

Concluding Remarks
The habitat units within the assessment zone are not considered to be unique within the local nor regional setting, however they are considered important from an ecological perspective as they are known to support several floral SCC. Overall, the habitats are still considered to be largely intact, and although encroachment in areas has occurred, this has not yet impacted significantly on the overall floral diversity. **Important considerations:** - The habitat units are considered to be representative of the reference vegetation type, i.e., the Kathu Bushveld; - The habitat units are associated with four known floral SCC, and may provide habitat to several more; - No AIPs were observed at the time of the assessment, however, AIPs are known to occur in the region and flourish in disturbed areas. As such, the areas must be monitored for AIPs and when such are found, they are to be removed / controlled as per an AIP control plan; - According to the Northern Cape CBA (2016) database, the assessment zone is located within an area classified as ONA and is not associated with any CBAs or ESAs; - The Screening Tool output for the area indicated a low sensitivity for the assessment zone, however, given the above data, the site more closely aligns with that of a higher sensitivity; and - From a floral ecological perspective, it is recommended that Alternative 2 of the railway loop alternatives be selected. Alternative 2 will result in the least vegetation clearance and is located closest to the current active mining site.

4.2 Faunal Assessment

Selected examples of fauna species recorded within the Proposed railway loop	
 Left to right: ***Cryptomus hottentosus*** **(Common mole-rat) mound,** ***Raphicerus campestris*** **(Steenbok),** ***Tockus leucomelas*** **(Southern yellow-billed hornbill) and** ***Agama aculeata*** **(Ground agama).**	
Species of Conservation Concern	No faunal SCC or provincially listed / protected species were encountered during the field assessment. The *Senegalia melifera* Thicket habitat may be utilised as part of a larger foraging grounds for SCC. Species which may forage within the assessment zone include, *Ardeotis kori* (Kori Bustard, Near Threatened (NT)), *Orycteropus afer* (Aardvark, Specially Protected NCNCA), *Otocyon megalotis* (Bat-eared Fox, Protected –TOPS and Specially Protected NCNCA), *Opistopthalmus* spp (Protected – TOPS and NCNCA). Of the afore listed species, the only species of particular concern is that of *Opistopthalmus* spp (Burrowing scorpions, Protected – TOPS and NCNCA). These are small borrowing scorpions which may be at risk from earth moving activities as they are less likely to be able to move out the area as vegetation is cleared, particularly during the day when such activities would occur and they would seek refuge underground in their burrows. All other species, should they be in the area at the time, will easily relocate out of the area, ahead of any vegetation clearance and construction activities.
Faunal Habitat Overview	The adjacent anthropogenic activities (active mining) as well as historic grazing in the local area have resulted in a decline of habitats associated with the assessment zone. In particular, overgrazing has led to a decline in more favourable and palatable herbaceous species, impacting on food availability for fauna in the surrounding area. Increased human presence in the area has further led to a decline of larger mammal species due to increased levels of persecution (snaring/hunting) and competition for space. Due to the arid nature of the environment, food and water resources are not as readily available for fauna, which has been further compounded by the degraded state of the habitats. As such, faunal species must range over larger distances to meet their individual energy requirements. The mine, roads and current railway have impacted upon habitat connectivity to the west, whilst connectivity to the east is still largely unhindered by large scale developments. At the time of the assessment invertebrate abundances were low, but this is likely attributable to the winter season. Insects play an integral role in ecosystem maintenance and are also a primary food resource for many species in arid regions, the decline of which places increased stresses on insectivorous species and has a notable knock-on impact for other species. The decline in suitable herbaceous material and the encroachment of woody species in areas has led to a decrease in suitable habitat. Suboptimal habitat conditions as well as anthropogenic activities have led to a cascading effect on faunal species which is evident in the loss of species diversity and abundances adjacent the mine. During the site assessment several faunal species, or the signs thereof were observed. Species observed include: *Cryptomus hottentosus* (Common mole-rat), *Raphicerus campestris* (Steenbok), *Lupulella mesomelas* (Black-backed jackal), *Tragelaphus strepsiceros* (Kudu), *Elephantulus intufi* (Bushveld Sengi), *Lepus capensis* (Cape Hare), *Hystrix africaeaustralis* (Porcupine), *Sigelus silens* (Fiscal Flycatcher), *Calendulauda africanoides* (Fawn-coloured Lark), *Cercotrichas paena* (Kalahari-scrub Robin), *Tchagra senegalus* (Black-crowned Tchagra), *Prinia masulosa* (Karoo Prinia), *Pedioplanis namaquensis* (Namaqua Sand Lizard), *Pedioplanis lineoocellata* (Spotted Sand Lizzard), *Agama aculeata* (Ground agama), *Cynthia cardui* (Painted Lady Butterfly), *Pachylomerus femoralis* (Flattened Giant Dung Beetle), *Sternocera* sp (Giant Jewel Bug) and *Danaus chrysippus* (African Monarch). For a full list of observed species please refer to Appendix F.

Concluding Remarks
Overall, the assessment zone and the habitat therein will support a moderate diversity of species, dominated by species that are common to the region. The current state of the habitats associated with the assessment zone are unlikely to support key populations of endemic or protected faunal species, and whilst SCC likely occur in the region, they are unlikely to be wholly reliant on the affected habitats. As a result of increased noise, dust and the presence of people, it is likely that many animals will instinctively avoid the areas through which the proposed railway loop are located. The exception to this are those species which have shown a degree of adaptability and are still found in areas of increased activity. Generally, these are smaller nocturnal species, however this is not always the case and larger, albeit secretive and low density species may also be found in these areas. **Important considerations:** - The proposed railway loop will lead to further habitat loss and fragmentation in the areas adjacent the mine, however, these impacts are restricted to a relatively small area to the east of the mine. Given the already existing degree of habitat fragmentation in an east-west format, the railway is unlikely to add to this significantly; - It is important that disturbed areas are rehabilitated and natural vegetation reinstated where possible to limit additional habitat loss through erosive actions and AIP proliferation; - The Screening Tool indicated the site sensitivity as low for animals, however, following the site assessment of the habitat and faunal assemblages, the natural (non-transformed) habitats are considered to be of intermediate / medium sensitivity (albeit not in isolation from the remaining open space habitat to the east of the assessment zone); and - From a faunal ecological perspective, it is recommended that Alternative 2 of the railway loop alternatives be selected. Alternative 2 will result in the least vegetation clearance and is located closest to the current active mining site, thus has more likely be subjected to edge effects that would have already resulted in the displacement of faunal species.

4.3 Alien and Invasive Plant (AIP) Species

South Africa is home to an estimated 759 naturalised or invasive terrestrial plant species (Richardson et al., 2020), with 327 plant species, most of which are invasive, listed in national legislation[6]. Many introduced species are beneficial, e.g., almost all agriculture and forestry production are based on alien species, with alien species also widely used in industries such as horticulture. However, some of these species manage to "escape" from their original locations, spread and become invasive. Although only a small proportion of introduced species become invasive (~0.1–10%), those that do proceed to impact negatively on biodiversity and the services that South Africa's diverse natural ecosystems provide (from ecotourism to harvesting food, cut flowers, and medicinal products) (van Wilgen and Wilson, 2018).

4.3.1 Legal Context

South Africa has released several Acts legislating the control of alien species. Currently, invasive species are controlled by the NEM:BANEM:BA – Alien and Invasive Species Regulations, 2020, in Government Gazette 43735 dated 25 September 2020. AIPs defined in terms of NEM:BA are assigned a category and listed within the NEM:BA List of Alien and Invasive Species (2020) in accordance with Section 70(1)(a) of the NEM:BA:

- **Category 1a** species are those targeted for urgent national eradication;
- **Category 1b** species must be controlled as part of a national management programme, and cannot be traded or otherwise allowed to spread;
- **Category 2** species are the same as category 1b species, except that permits can be issued for their usage (e.g., invasive tree species can still be used in commercial forestry, providing a permit is issued that specifies where they may be grown and that permit holders "*Unless otherwise specified in the Notice, any species listed as a Category 2 Listed Invasive Species that occurs outside the specified area contemplated in sub-regulation (1), must, for purposes of these regulations, be considered to be a Category 1b Listed Invasive Species and must be managed according to Regulation 3*"); and
- **Category 3** are listed invasive species that can be kept without permits, although they may not be traded or further propagated, and must be considered a Category 1b species if they occur in riparian zones.

[6] GN number 1003: Alien and Invasive Species Lists, 2020, in Government Gazette 43726 dated 18 September 2020, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004).

Duty of care related to listed invasive species are referred to in NEM:BA Section 73[7]. The motivation for this duty of care is both environmentally and economically driven. Management of alien species in South Africa is estimated to cost at least ZAR 2 billion (US$142 million) each year - this being the amount currently spent by the national government's DFFE - i.e. the Working for Water programme (van Wilgen, 2020). Managing AIPs early on will reduce clearing costs in the long run.

4.3.2 Site Results

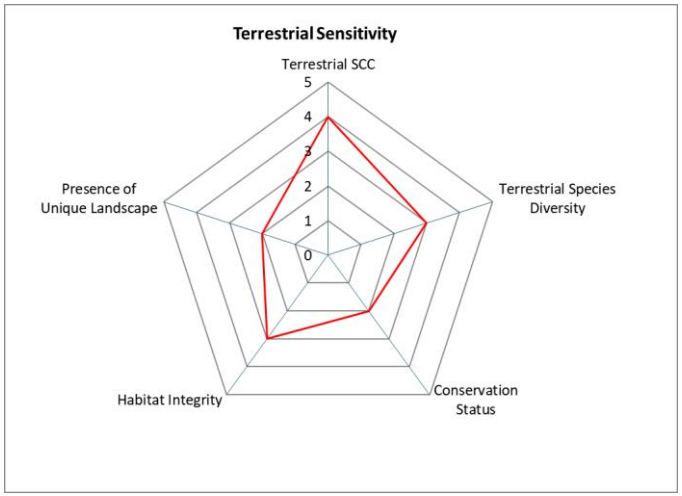
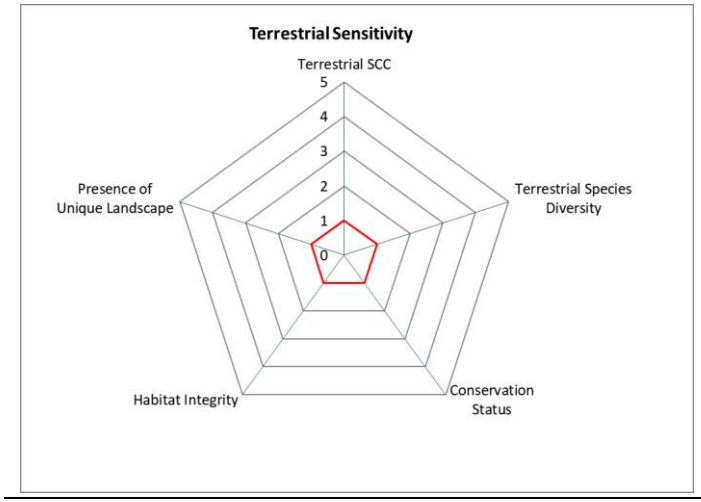
No AIPs were recorded within the railway loop alternatives during the site assessment mainly due to the largely natural habitat associated with the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland and the transformed habitat being devoid of vegetation. Although none were recorded, there still remains the possibility that AIPs could establish in the area in future, notably in any areas that may be disturbed either as part of the construction and operation of the proposed railway loop or as a result of edge effects from the mine. It is important that all AIPs are suitably controlled as per the mines existing AIP Control Plan, and that the railway loop is included into this plan.

5. SENSITIVITY MAPPING

Figure 9 conceptually illustrates areas of ecological sensitivity – depicting the sensitivity for flora and fauna, respectively. The proposed railway loop are depicted according to their sensitivity in terms of the presence or potential for SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. Table 2 (below) presents the sensitivity of each identified habitat unit for i) flora and ii) fauna, along with an associated conservation objective and implications for development.

[7] Section 73(2): A person who is the owner of land on which a listed invasive species occurs must-
a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land;
b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and
c) take all the required steps to prevent or minimise harm to biodiversity.

Table 2: A summary of the floral and faunal sensitivity of each habitat unit and implications for development.

Habitat Sensitivity	Conservation objective	Habitat Unit	Key habitat characteristics
Intermediate 	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.	***Senegalia melifera* Thicket** **Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland**	- Past grazing activities and more recently mining activities have led to a degree of habitat degradation, though the vegetation is overall still considered to be representative of the vegetation type, Kathu Thornveld; - Bush encroachment in some areas has impacted floral and faunal diversity; - Several Floral SCC were noted and expected to occur; - No faunal SCC were observed yet several are likely to forage in these habitats, albeit unlikely in isolation from the adjacent eastern habitat, outside of the assessment zone; and - The habitat unit does not align with the Low Sensitivity for plants and animals as listed in the screening tool.
Low 	Optimise development potential.	**Transformed Areas**	- This habitat has been largely transformed from the reference vegetation type due to the development of the mine and roads; - Little to no native vegetation remains; - No floral or faunal SCC were observed or expected to occur; and - The habitat unit aligns with the Low Sensitivity for plants and animals as listed in the screening tool.

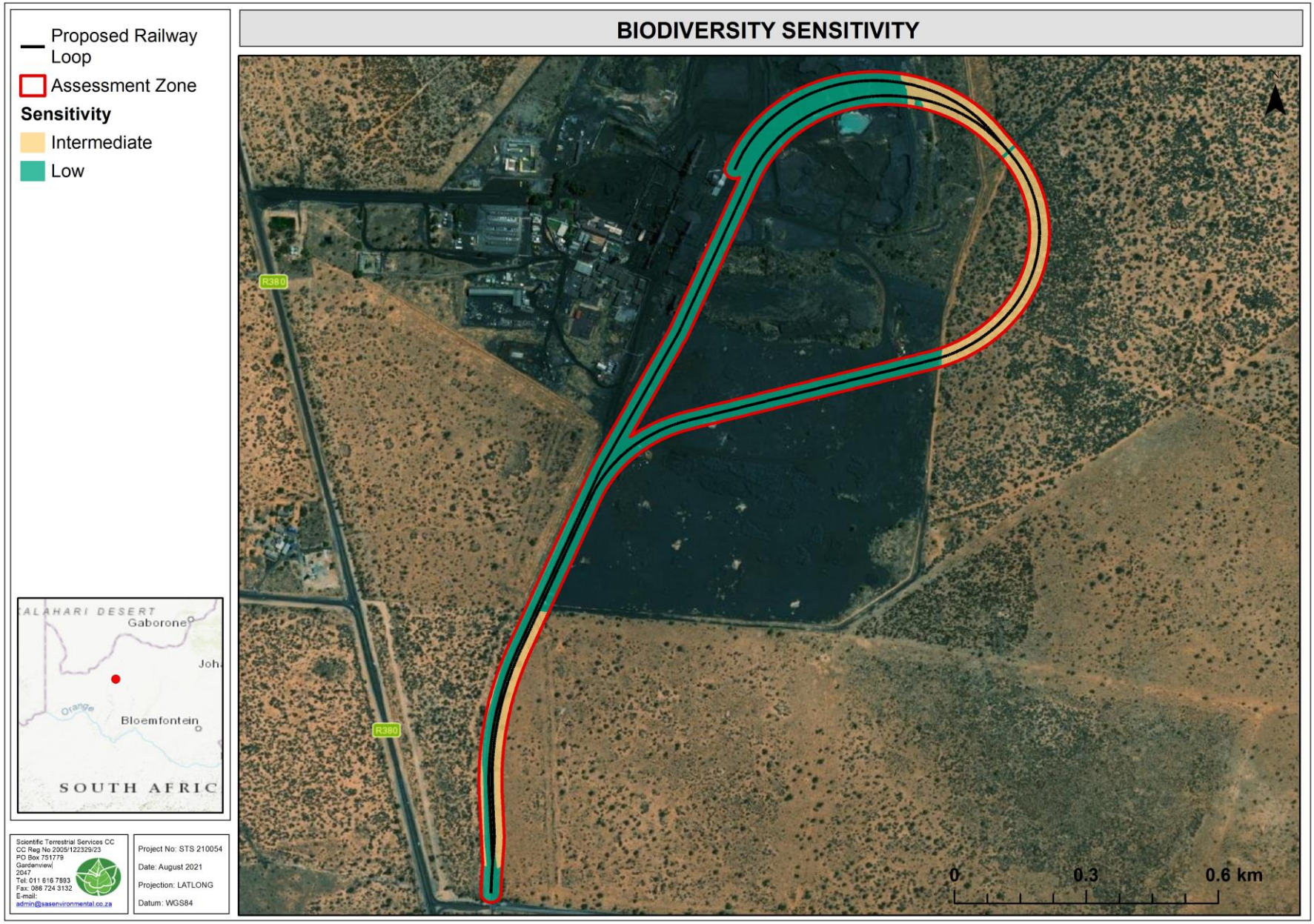


Figure 9: Combined floral and faunal sensitivity map for the proposed railway loop.

6. IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts arising from the proposed development of the railway loop alternatives at the South 32 Wessels Mine. The impact assessment below focusses on the two proposed alternative railway loops and their associated 20 m buffer (the assessment zone).

An impact discussion relating to the i) construction, and ii) operational and maintenance phase impacts on fauna and flora is provided in Section 6.2. All mitigatory measures required to minimise the perceived impacts are presented in Section 6.3.

6.1 Impact Assessment considerations and outcome

Following the assessment of the ecological state and characteristics of the habitats associated with the proposed railway loop, SLR's impact assessment methodology was applied to ascertain the significance of perceived impacts to the faunal and floral ecology associated with each of the 2 alternatives. Details of the method of assessment are presented in Appendix D. The impact assessment was applied under two different scenarios: the first scenario assuming that no mitigation is applied, and the second scenario to ascertain the significance of impacts assuming that a high level of mitigation takes place (for each of the 2 alternatives).

The construction of the railway loop, regardless of which alternative is preferred, will inevitably impact upon the terrestrial ecology within the footprint area as a result of vegetation clearance and earth works. Both of the proposed railway loop are primarily located within the transformed areas associated with the mine. Within these areas, the development is expected to have minimal impacts to the receiving environment and the species therein. Where the proposed railway loop are located within the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland habitats, impacts to the receiving environment are likely, though, are not expected to be significantly high as these areas are not considered unique or of increased sensitivity. These habitats are well represented within the region, with several floral SCC being observed along each proposed railway alternative. In addition to the floral SCC observed, there is further potential that several more floral as well as faunal SCC may be present within the alternatives than what was recorded during this assessment of limited duration. As the proposed railway alternatives are linear in nature with a limited width, they are likely to result in a smaller impact footprint and not entail extensive ground clearing in a single location. Focus on footprint minimisation and edge effect control will however be key in decreasing the extent and significance of impacts.

Activities and impacts arising from the construction and operation of the proposed railway (for both alternatives) are likely to impact on floral and faunal species within the final railway footprint as follows:

- Loss of faunal and floral habitat;
- Loss of faunal and floral species diversity; and
- Loss of faunal and floral SCC.

The points listed below summarise the considerations made when applying the impact assessment:

- The impact assessment was applied considering the risk significance to the various habitats and the associated sensitivities relating to each of the proposed railway loop;
- The impact assessment was applied to the various habitat units, including species diversity. This was done as faunal and floral species diversity are intrinsically linked to habitat condition;
- The impact on floral and faunal SCC was assessed separately so as to gauge impacts on these species as SCC are of increased importance, with impacts to these species often used as a determinant to the acceptability of a project;
- The activities relating to the construction and operation of the railway is considered to be highly site specific, and provided all mitigation measures are implemented, are likely to have a limited impact in terms of the overall extent, notably as a significant portion of the railways is located within an area of low sensitivity; and
- Most impacts are considered to be easily detectable with the considered mitigation measures being easily implementable.

6.2 Floral and Faunal Impact Assessment

The tables below present the perceived impact on each of the Habitat Units for the i) Construction and ii) Operational Phase associated with the proposed railway loop in terms of floral species and habitat loss, both prior to and post mitigation measures. For the purpose of this impact assessment the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland have been assessed together, as they are of similar sensitivity, with general species composition and SCC also similar. Although their vegetation structure varies, the impacts to both these habitats will be similar. The transformed areas have however been assessed separately.

For the purpose of the impact assessment, the impact assessment was applied to the assessment zone as a whole and not each separate railway alternative. Both Alternatives will result in the same impact scores, with any minor differentiations not being evident in the scoring attributes of the impact methodology. Where minor differences are applicable, they have been discussed in the text accordingly.

6.2.1 IMPACT: Loss of Floral and Faunal Habitat and Species Diversity in the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland.

Both of the habitat units are considered to be of intermediate sensitivity. Although these habitat units have been subjected to anthropogenic activities and edge effects, they still share an affinity (in terms of structure and function) with the reference vegetation.

Impacts Associated with the Construction Phase:

The construction phase will result in the clearing of vegetation for the railway line (regardless of which alternative) within the footprint area and thus only a localised loss of floral and faunal species is anticipated. Despite the localised clearing of vegetation, the loss of habitat and species diversity outside of the direct development footprint may result during the construction phase if:

i. Vegetation clearance goes ahead unmanaged and unsupervised which may result in a larger than necessary area being cleared;
ii. AIPs are allowed to proliferate as a result of poorly managed disturbances and edge effects associated with the construction activities;
iii. Fire frequency increases as a result of construction activities;
iv. Snaring / hunting of faunal SCC by construction personnel in the adjacent areas; and
v. Indiscriminate driving of construction vehicles through natural vegetation is not managed. Vehicles must remain within designated roads only.

If mitigation measures as presented in section 6.3 are implemented, then the significance ratings of the impacts can be reduced. The impact significance prior to mitigation is expected to be medium. Post mitigation measures are expected to be low (Table 3).

Table 3: **Assessment of the impact for the Construction Phase: Loss of habitat and species diversity in the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland.**

Issue: loss of floral and faunal habitat and diversity		
Phases: Construction Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate (M)	Low (L)

Issue: loss of floral and faunal habitat and diversity		
Duration	Short-term (L)	Short-term (L)
Extent	Beyond site boundary (M)	Whole site (L)
Consequence	Medium	Low
Probability	Definite	Definite
Significance	**Medium**	**Low (L)**
Nature of cumulative impacts	Vegetation clearing activities will further contribute to habitat and species loss that is currently occurring in the region as a result of mining activities and the expansion of mines. The railway will further add to the overall loss of habitat in the local area as well as contribute to habitat fragmentation. Further habitat fragmentation will limit habitat connectivity and faunal species movement, with Alternative 1 likely to have result in greater habitat fragmentation than that of Alternative 2.	
Degree to which impact can be reversed	The impact can be managed during the construction phase.	
Degree to which impact may cause irreplaceable loss of resources	Low	
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: - Further loss of and altered floral and faunal species diversity; - Edge effects such as further habitat fragmentation and AIP proliferation; and - Potential increased bush encroachment.	

Impacts Associated with the Operational Phase:

The proposed railway loop will have a notably decreased impact during this phase. This is because no further vegetation clearing, or construction is anticipated to take place. However, ongoing impacts to the habitats and species diversity may still occur (regardless of which alternative is preferred) during the Operational Phase if:

i. AIP control and management plans are not implemented which may lead to ongoing displacement of natural vegetation outside of the footprint area as a result of AIP proliferation;

ii. Bush encroachment is not controlled leading to continued thickening of *Senegalia melifera* in the adjacent areas leading to decreased habitat functionality and suitability for fauna and flora species; and

iii. Poorly implemented rehabilitation activities in the disturbed areas post construction leading to habitat loss and further AIP proliferation.

If mitigation measures as presented in section 6.3 are implemented, then the significance ratings of the impacts can be reduced. The significance i) prior to mitigation measures is expected to be very low, and ii) post mitigation the significance is expected to be very low (Table 4).

Table 4: **Assessment of the impact for the Operational Phase: Loss of habitat and species diversity in the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland.**

Issue: loss of floral and faunal habitat and diversity		
Phases: Operational Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Minor (L)	Negligible (VL)
Duration	Long-term (H)	Long-term (H)
Extent	Part of site (VL)	Part of site (VL)
Consequence	Low (L)	Low (L)
Probability	Possible (M)	Conceivable (L)
Significance	Very low (VL)	Very Low (VL)
Nature of cumulative impacts	Operational activities will continue to contribute to edge effects, though these are likely to be limited in both intensity and extent. The operational phase, provided AIPs are suitably managed and disturbed areas rehabilitated, is not likely to significantly contribute to cumulative impacts in the local area.	
Degree to which impact can be reversed	High	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: - Loss of floral and faunal species habitat and diversity due to AIP proliferation; and - Edge effects and potential increased bush encroachment.	

6.2.2 IMPACT: Loss of Floral and Faunal Habitat and Species Diversity in the Transformed Areas.

The Transformed Areas is of low sensitivity and is not considered to be representative of the reference vegetation type (because of anthropogenic activities and extensive habitat transformation). Due to the overall disturbed nature of the Transformed areas, the construction and operation phases have been assessed together as have the impacts associated with Alternative 1 and 2, as the determining factors for the impact significance for both these phases did not differ.

Impacts Associated with the Construction and Operational Phase:

Potential impacts that may arise from these phases include:

i. AIPs are allowed to proliferate in disturbed areas; and

ii. AIPs stands in these areas become a source for further dispersal, spreading AIPs to natural areas outside of the mine altering faunal and floral habitat beyond the construction and operational footprints.

If mitigation measures as presented in Section 6.3 are implemented, then the significance ratings of the impacts can be reduced. The impact significance prior and post mitigation measures are expected to be very low (Table 5).

Table 5: **Assessment of impact for the Construction and Operational Phase: Loss of habitat and species diversity in the Transformed Areas.**

Issue: loss of floral and faunal habitat and diversity		
Phases: Construction and Operational Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Negligible (VL)	Negligible (VL)
Duration	Long-term (H)	Long-term (H)
Extent	Part of site (VL)	Part of site (VL)
Consequence	Low (L)	Low (L)
Probability	Conceivable (L)	Conceivable (L)
Significance	Very Low (VL)	Very Low (VL)
Nature of cumulative impacts	Should AIPs develop alongside the railway, these populations will become sources of seed dispersal into the surrounding natural areas as well as other areas within the mine itself. Cumulative impacts will include further proliferation of AIPs both in the mine and potentially outside the mine as seeds are dispersed. Such dispersal to the natural areas will further contribute to habitat degradation, impacting on faunal and floral species.	
Degree to which impact can be reversed	Impact can be readily managed during all phases.	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: - Edge effects such as further AIP proliferation.	

6.2.3 IMPACT: Loss of Floral and Faunal SCC.

Four floral SCC (*Vachellia erioloba*, *V. haematoxylon, Harpagophytum procumbens* and *Boophone disticha*) were observed within the assessment zone during the site assessment, whilst there is potential that six additional species may occur within the footprint areas (see Section 4.1 for details). No faunal SCC were observed during the site assessment, though, several may occur within / utilise the area for foraging (see Section 4.2 for details). It is recommended that prior to any construction activities taking place a walkdown be conducted of the selected railway alternative and all floral and faunal SCC observed be marked. The

relevant permits will need to be obtained for any rescue and relocation activities, or destruction purposes in terms of the larger trees that cannot successfully be relocated. Marking of floral SCC as well as the rescue and relocation activities must take place in the growing season, ideally post good rainfall (November/ December to February) when the smaller plants are identifiable / visible. During the winter month many of them die back with no surface vegetation visible.

Impacts Associated with the Construction Phase:

The construction phase (prior to the implementation of mitigation measures) will result in the clearing of vegetation as well earthworks which will disturb the subterranean soil habitat which may harbour bulbous floral SCC (e.g., species from the Amaryllidaceae and Iridaceae families) and smaller faunal SCC such as *Opistopthalmus* spp (Burrowing scorpion). The construction activities will lead to the loss of floral SCC located within the preferred railway alternative footprint and places smaller burrowing faunal SCC at risk of being crushed. The following impacts on floral and faunal SCC can be anticipated during this phase:

i. Loss of floral and faunal SCC within either alternative footprint due to vegetation clearing and earthworks;
ii. Potential further exploitation of SCC due to the removal and/or collection of SCC beyond the direct footprint;
iii. Small, less mobile, burrowing faunal SCC may be crushed during earthworks;
iv. Potential runaway fires started by construction staff which will impact on floral SCC in the surrounding habitats; and
v. Poorly managed edge effects (including ineffective rehabilitation of bare areas and the subsequent spread of AIP species into surrounding areas which may result in the degradation of habitat and SCC individuals.

If mitigation measures as presented in Section 6.3 are implemented, then the significance ratings of the impacts can be reduced. The impact significance prior to mitigation is expected to be medium. Post mitigation measures are expected to be low (Table 6).

Table 6: **Assessment of the impact for the Construction Phase: Loss of habitat and species diversity in the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera* – *Vachellia erioloba* – *Vachellia haematoxylon* Woodland.**

Issue: loss of floral and faunal SCC		
Phases: Construction Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Moderate (M)	Low (L)
Duration	Short-term (L)	Short-term (L)

Issue: loss of floral and faunal SCC		
Extent	Beyond site boundary (M)	Whole site (L)
Consequence	Medium	Low
Probability	Definite	Definite
Significance	**Medium**	**Low (L)**
Nature of cumulative impacts	Further loss of floral and faunal SCC from the area. For floral SCC, a decrease in individuals may result in lower pollination success rates, limiting population recovery in disturbed areas whilst potentially leading to decreased numbers in the natural areas as plants that die are not readily replaced by new ones from seed growth. For fauna, most faunal SCC will relocate to areas outside of the disturbance footprint, leading a decline and potential total absence of faunal SCC from the areas around the mine and result in increased competition for resources in the adjacent environment.	
Degree to which impact can be reversed	The impact can be managed during the construction phase.	
Degree to which impact may cause irreplaceable loss of resources	Low	
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: - Decrease in floral and faunal SCC abundance in the local area; and - Edge effects such as further habitat fragmentation and AIP proliferation.	

Impacts Associated with the Operational Phase:

The railway line (regardless of which alternative is preferred) will have a notably decreased impact during this phase as no further vegetation clearing, or construction is anticipated to take place. However, ongoing impacts to floral and faunal SCC may still occur during the Operational Phase if:

i. AIP control and management plans are not implemented leading to AIP proliferation; and
ii. Potential exploitation of SCC due to the collection of floral SCC and trapping/snaring of fauna SCC beyond the direct footprint.

If mitigation measures as presented in Section 6.3 are implemented, then the significance ratings of the impacts can be reduced. The significance both prior to and post mitigation measures is expected to be very low (Table 7).

Table 7: **Assessment of the impact for the Operational Phase: Loss of habitat and species diversity in the *Senegalia melifera* Thicket and the Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland.**

Issue: loss of floral and faunal habitat and diversity		
Phases: Operational Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Minor (L)	Negligible (VL)

Issue: loss of floral and faunal habitat and diversity		
Duration	Long-term (H)	Long-term (H)
Extent	Part of site (VL)	Part of site (VL)
Consequence	Low (L)	Low (L)
Probability	Possible (M)	Conceivable (L)
Significance	Very low (VL)	Very Low (VL)
Nature of cumulative impacts	Minimal contributions to cumulative impacts to the area are expected, however, further decline of floral and faunal SCC in the local area may occur if collection / snaring is allowed, and fragmentation of the habitat may result in increased persecution of species, impacting on overall species populations in the local area.	
Degree to which impact can be reversed	High	
Degree to which impact may cause irreplaceable loss of resources	Very low	
Residual impacts	Residual impacts are anticipated to be low. Potential residual impacts include: - Loss of floral and faunal SCC through AIP proliferation and illegal harvesting / snaring.	

Following the impact assessment and the resultant impacts to the receiving environment, it is evident that prior to mitigation measures, the development of the railway will result in medium to very low impact significances. With mitigation implemented, the impact significance levels can be reduced to low and very low. Both the alternatives will result in the clearance of vegetation and the subsequent loss of habitat and species however, it is recommended that Alternative 2 be the preferred option. Alternative 2 is closer to the existing mining area and is slightly shorter resulting in less vegetation clearance being required. Additionally, given the closer proximity of Alternative 2 to the mining area, the remaining section of vegetation located between the railway loop and the mine will be smaller, and as such, lead to less habitat fragmentation for faunal species.

6.3 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed railway loop in order to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be mitigated and minimised.

Table 8: A summary of the mitigatory requirements for the biodiversity associated with the proposed railway loop.

Project phase	Construction Phase
Impact Summary	Loss of floral and faunal habitat, species, and SCC
Proposed mitigation and management measures:	

Development footprint

- Prior to any vegetation clearance activities taking place a walkdown of the final railway footprint must be undertaken and all floral and faunal SCC encountered must be GPS marked and the necessary permits applied for with the relevant national and provincial departments. The site walk down is to be conducted prior to clearance activities and ideally post good rains between November and February when the smaller bulbous plants are growing and visible;
- The construction footprint must be kept as small as possible to minimise impact on the surrounding environment (edge effect management);
- Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved footprint. Where possible/ feasible;
- Clearing of vegetation should take place in a phased manner from north to south or vice versa. This will allow for any faunal species within the proposed railway loop to flee and avoid harm;
- It is recommended that culverts of sufficient size be placed under the railway line so as to allow for movement of small faunal species between the remaining natural area inside the railway loop and that of the larger natural area outside. Culverts should be regularly inspected for infilling and blockages, ensuring that they are kept clear and open;
- Smaller species such as scorpions and reptiles will not as readily able to move out of an area ahead of ground clearing. As such should any be observed in the construction site during clearing and construction activities, they are to be carefully and safely moved to an area of similar habitat outside of the disturbance footprint. Construction personnel are to be educated about these species and instructed not to kill them. Smaller scorpion species and harmless reptiles (that are likely present within the proposed railway loop) should be carefully relocated by a suitably nominated construction person. For larger venomous snakes, a suitably trained specialist, or on-site personnel, should be contacted to carry out the relocation of the species, should it not move off on its own;
- Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal;
- No hunting or trapping of faunal species is to be allowed by construction personnel;
- It is recommended that should a perimeter fence be erected, this fence must allow for the movement of small mammals, such as palisade fencing or cattle fencing, as opposed to solid constructions such as walls. Should the perimeter be walled in with an impermeable fence, it is recommended that small openings be left to allow for continuous movement of small terrestrial faunal species. Such openings must be continuously monitored and cleared of debris to ensure continued movement is possible;
- Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed;
- Care should be taken during the construction of the proposed development to limit edge effects to surrounding natural habitat. This can be achieved by:
  - Demarcating all footprint areas during construction activities;
  - No dumping of litter, rubble or cleared vegetation on site should be allowed. Rubble / waste should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste;
  - Manage the spread of AIP species as per the mines mine's Biodiversity Management plan.
- Appropriate sanitary facilities must be provided during the construction of the development and must be removed to an appropriate waste disposal site;
- If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site at all times. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and
- Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.

Alien Vegetation

- Edge effects arising from the proposed development, such as erosion and alien plant species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEM:BA Alien species lists, 2020), in line with the NEM:BA Alien and Invasive Species Regulations (2020);

• AIP monitoring and clearing/control should take place throughout the construction phase of the development, and a 30 m buffer surrounding the proposed railway loop should be regularly checked for AIP proliferation and to prevent inward and or/outward spread of AIPs, notably into non infested areas outside of the proposed railway loop or into newly rehabilitated areas; and • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.	
Floral and Faunal SCC	
• Should any floral SCC be observed and relocated, the relocation success of such species should be monitored during the construction phase to ensure immediate actions can be taken if it becomes evident that relocation is not successful; • No collection of floral SCC must be allowed by construction personnel; • Edge effect control needs to be implemented to prevent further degradation and potential loss of floral and faunal SCC outside of the proposed development footprint area; and • Should the presence of any faunal or floral SCC be noted within the development footprint post walkdown and during vegetation clearance / construction activities, a suitably qualified specialist should be consulted on the best way to proceed.	
Project phase	Operational and Maintenance Phase
Impact Summary	Loss of floral and faunal habitat, species, and SCC
Proposed mitigation and management measures:	
Development footprint	
• The footprint area must be regularly inspected for sign of erosion, edge effects and any new areas of disturbance which will lead to further habitat loss and/or the proliferation of AIPs; and • No dumping of litter or waste must be allowed on-site.	
Alien Vegetation	
• AIP proliferation which may affect adjacent natural areas needs to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEM:BA Alien species lists, 2020), in line with the NEM:BA Alien and Invasive Species Regulations (2020); • Ongoing AIP monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; and • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards.	
Floral and Faunal SCC	
• If any relocation of SCC took place, monitoring of relocation success should continue for at least three years after the completion of the construction phase, or until it is evident that the species have established self-sustaining populations.	

7. CONCLUSION

Scientific Terrestrial Services (STS) was appointed by SLR Consulting (South Africa) (Pty) Ltd to conduct a biodiversity assessment as part of the Basic Assessment process for the proposed extension of the railway infrastructure at the Wessels Mine in the Northern Cape. The project included the assessment of two proposed railway alternatives supplied by the mine of which only one will be selected for development.

During the field assessment, three habitat units were identified, namely the *Senegalia melifera* Thicket, the Open Mixed *Senegalia mellifera –Vachellia erioloba – Vachellia haematoxylon* Woodland and the Transformed habitat were identified. The majority of both of the railway loop alternatives are located within the Transformed habitat, which is characterised by the transformation of the indigenous vegetation to that of the current mining area as well as the

associated roads. The southern portion is associated with the Open Mixed *Senegalia mellifera –Vachellia erioloba – Vachellia haematoxylon* Woodland whilst the eastern portion is associated with the *Senegalia melifera* Thicket.

Four floral SCC were recorded on site, namely:

- The NFA:
  - *Vachellia erioloba & V. haematoxylon;*
- The NCNCA:
  - Schedule 1 – Specially Protected Species: *Harpagophytum procumbens;* and
  - Schedule 2 – Protected Species: *Boophone disticha* (Family Amaryllidaceae)*;*
- The NEM:BA Threatened or Protected Species (TOPS):
  - *Harpagophytum procumbens* (Protected).

Additionally, six other floral SCC have an increased probability of occurring within the assessment area. No faunal SCC were observed, though there remains the possibility that four may utilise the railway footprint area, most likely whilst foraging. Overall, the habitat units, due to their proximity to the existing mine footprint and past grazing impacts, have been degraded, with many areas becoming encroached. Given the aforementioned and taking into consideration the data from the field assessment, the two natural habitats have been assigned an intermediate sensitivity, whist the transformed areas are considered to be of low sensitivity.

Following the ecological assessment of the biodiversity within the proposed railway loop, the impacts associated with the proposed development activities were determined. The impacts on the floral and faunal habitat, diversity and SCC are considered to range from medium to very low significance prior to the implementation of mitigation measures. With mitigation fully implemented the impacts can be reduced to low and very-low significance impacts. No significant impacts[8] on the biodiversity associated with the proposed railway loop are however anticipated.

The Screening Tool returned a Low Sensitivity for the Animals and Plants theme and a Very High Sensitivity for the Terrestrial Biodiversity theme. Following the site assessment, and as presented within this report, the proposed railway loop align more with a higher sensitivity than that of the low sensitivity indicated in the screening tool. Such deviation was largely due to the relatively intact nature of the non-transformed areas as well as the presence of several floral SCC.

[8] **Significant impact**: An impact that may have a notable effect on one or more aspects of the environment or may result in non-compliance with accepted environmental quality standards, thresholds, or targets (DEA *et al.*, 2017).

Following the impact assessment and the analysis of the field data, Alternative 2 is deemed to the preferred option for development. Alternative 2 is located closer to the existing mine and as such, is likely to have been exposed to more edge effects (noise, dust etc) than alternative 1. Furthermore, Alternative 2 will result in a smaller section of vegetation being fragmented between the railway and the mine, resulting in a lower impact to habitat connectivity.

The objective of this study was to provide sufficient information on the biodiversity significance of the area, together with other studies on the physical and socio-cultural environment for the EAP and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The need for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure sustainable economic development of the country.

This report and the data contained herein fulfils the requirements for both the Plants and Animals Compliance Statements as well as the baseline data reporting requirements for the Basic Assessment process.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the proposed railway loop will be made in support of the principle of sustainable development.

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APPENDIX A - Legislative Requirements and Indemnity

THE CONSTITUTION OF THE REPUBLIC OF SOUTH AFRICA, 1996

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) (NEMA)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the Environmental Impact Assessment process depending on the nature of the activity and scale of the impact.

THE NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT, 2004 (ACT NO. 10 OF 2004) (NEM:BA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.
Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

THE NATIONAL FOREST ACT, 1998 (ACT NO. 84 OF 1998), AS AMENDED IN SEPTEMBER 2011 (NFA)

According to the department of Department of Forestry, Fisheries and the Environment (DFFE) (previously the Department of Agriculture, Forestry and Fisheries (DAFF)) ©2019 website (https://www.daff.gov.za/daffweb3/):
"In terms of the National Forests Act of 1998 certain tree species (types of trees) can be identified and declared as protected. The Department of Water Affairs and Forestry followed an objective, scientific and participative process to arrive at the new list of protected tree species, enacted in 2004. All trees occurring in natural forests are also protected in terms of the Act. Protective actions take place within the framework of the Act as well as national policy and guidelines. Trees are protected for a variety of reasons, and some species require strict protection while others require control over harvesting and utilization."

Applicable sections of the NFA pertaining to the proposed project include the below:

Section 12:

Declaration of trees as protected

1) The Minister may declare-
    a. particular tree,
    b. a particular group of trees,
    c. a particular woodland; or
    d. trees belonging to a particular species,
    to be a protected tree, group of trees, woodland or species.
2) The Minister may make such a declaration only if he or she is of the opinion that the tree, group of trees, woodland or species is not already adequately protected in terms of other legislation.
3) In exercising a discretion in terms of this section, the Minister must consider the principles set out in section 3(3) of the NFA.

Section 15(1):

No person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a licence granted by the Minister or in terms of an exemption from the provisions of this subsection published by the Minister in the Gazette.

Contravention of this declaration is regarded as a first category offence that may result in a person who is found guilty of being sentenced to a fine or imprisonment for a period up to three years, or both a fine and imprisonment.

GOVERNMENT NOTICE NUMBER R.1020: ALIEN AND INVASIVE SPECIES REGULATIONS, 2020 (IN GOVERNMENT GAZETTE 43735), INCLUDING GOVERNMENT NOTICE NUMBER 1003: ALIEN AND INVASIVE SPECIES LISTS, 2020 (IN GOVERNMENT GAZETTE 43726) AS IT RELATES TO THE NEM:BA

NEM:BA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

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

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act no 10 of 2004) as:

(a) A species that is not an indigenous species; or
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its

natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEM:BA (Alien and Invasive Species Regulations, 2020):

- **Category 1a**: Invasive species that require compulsory control;
- **Category 1b**: Invasive species that require control by means of an invasive species management programme;
- **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- **Category 3**: Ornamentally used plants that may no longer be planted.

THE CONSERVATION OF AGRICULTURAL RESOURCES ACT, 1983 (ACT NO. 43 OF 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

THE NORTHERN CAPE NATURE CONSERVATION ACT (ACT NO. 9 OF 2009) (NCNCA)

The purpose of this Act is to provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.

Restricted activities involving specially protected plants:
49(1) No person June, without a permit –
(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Possess;
(f) Cultivate; or
(g) Trade in,
A specimen of a specially protected plant
Restricted activities involving protected plants
50 (1) Subject to the provision of section 52, no person June, without a permit –
(a) Pick;
(b) Import;
(c) Export;
(d) Transport;
(e) Cultivate; or
(f) Trade in,
A specimen of a protected plant.

NORTHERN CAPE PROVINCIAL SPATIAL DEVELOPMENT FRAMEWORK (NCPSDF, 2019)

The Northern Cape Provincial Spatial Development Framework (NCPSDF) was developed in 2011 to meet the requirements of the Northern Cape Planning and Development Act, 1998 (Act 7 of 1998) and the Municipal Systems Act, 2000 (Act 32 of 2000).

Indemnity and Terms of use of this Report

The findings, results, observations, conclusions, and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints

relevant to the type and level of investigation undertaken and STS CC and its staff reserve the right to modify aspects of the report including the recommendations if, and when, new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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APPENDIX B - Floral Method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the focus area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g. NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the focus area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, "*low*", "*medium*", "*high*" and "*very high*" sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g. for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below[9]:

- **Very High**: Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High**: Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium**: Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low**: Areas where no SCC are known or expected to occur.

BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (http://posa.sanbi.org/) for species of conservation concern within a selected boundary;

- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from

[9] More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website: https://screening.environment.gov.za/screeningtool/#/pages/welcome

the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (http://redlist.sanbi.org/).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the focus area is situated but where it is deemed appropriate, a larger area can be included.

NEM:BA TOPS Species

The National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEM:BA) Threatened or Protected Species (TOPS) list (Government Gazette [GN] 29657, as amended in GN R1187 in Government Gazette 30568 of 2007 and again in GN 627 in Government Gazette 43386 of 2020) were taken into consideration.

Provincial: Specially Protected and Protected Species

The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA), provides a list of Specially Protected Species (Schedule 1) (Section 49(1) of the NCNCA) and Protected Species (Schedule 2) (Section 50(1) of the NCNCA) for the Northern Cape Province. These species formed part of the SCC assessment.

Nationally Protected Trees

The National Forest Act, 1998 (act 10 of 1998), as amended in September 2011 (NFA), affords protection to a list of tree species. All nationally protected trees were included as SCC in this report.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:
- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Vegetation Surveys

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the focus area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/focus area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a focus area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance, and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional, and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. To present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C - Faunal Method of Assessment

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the focus area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call, and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the focus area. Field surveys were undertaken utilising visual observation and bird call identification techniques in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles

During the field assessment, suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected for the presence of reptiles, and any individuals encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the focus area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians

Identifying amphibian species is done using direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the focus area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates

Whilst conducting transects through the focus area, all insect species visually observed were identified, and where possible photographs taken.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the focus area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids

Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC species within the focus area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC is described:

- "**Confirmed**': if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Faunal Habitat Sensitivity

The sensitivity of the focus area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the focus area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the focus area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contributes equally to the mean score, which determines the suitability and sensitivity of the focus area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation of the focus area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table C1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX D - Impact Assessment Methodology

The Impact Assessment Methodology is as per the SLR Consulting (South Africa) (Pty) Ltd methodology.

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	**VH**	**Low**	**Low**	**Medium**	**Medium**	**High**
	Long term	**H**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Medium term	**M**	**Very Low**	**Low**	**Low**	**Low**	**Medium**
	Short term	**L**	**Very low**	**Very Low**	**Low**	**Low**	**Low**
	Very short	**VL**	**Very low**	**Very Low**	**Very Low**	**Low**	**Low**
INTENSITY = L							
DURATION	Very long	**VH**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Long term	**H**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Medium term	**M**	**Low**	**Low**	**Medium**	**Medium**	**Medium**
	Short term	**L**	**Low**	**Low**	**Low**	**Medium**	**Medium**
	Very short	**VL**	**Very low**	**Low**	**Low**	**Low**	**Medium**
INTENSITY = M							
DURATION	Very long	**VH**	**Medium**	**High**	**High**	**High**	**Very High**
	Long term	**H**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**	**Medium**	**High**
	Very short	**VL**	**Low**	**Low**	**Low**	**Medium**	**Medium**
INTENSITY = H							
DURATION	Very long	**VH**	**High**	**High**	**High**	**Very High**	**Very High**
	Long term	**H**	**Medium**	**High**	**High**	**High**	**Very High**
	Medium term	**M**	**Medium**	**Medium**	**High**	**High**	**High**
	Short term	**L**	**Medium**	**Medium**	**Medium**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**Medium**	**High**
INTENSITY = VH							
DURATION	Very long	**VH**	**High**	**High**	**Very High**	**Very High**	**Very High**
	Long term	**H**	**High**	**High**	**High**	**Very High**	**Very High**
	Medium term	**M**	**Medium**	**High**	**High**	**High**	**Very High**
	Short term	**L**	**Medium**	**Medium**	**High**	**High**	**High**
	Very short	**VL**	**Low**	**Medium**	**Medium**	**High**	**High**

VL	**L**	**M**	**H**	**VH**
A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**VH**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Probable	**H**	**Very Low**	**Low**	**Medium**	**High**	**Very High**
	Possible/ frequent	**M**	**Very Low**	**Very Low**	**Low**	**Medium**	**High**
	Conceivable	**L**	**Insignificant**	**Very Low**	**Low**	**Medium**	**High**
	Unlikely/ improbable	**VL**	**Insignificant**	**Insignificant**	**Very Low**	**Low**	**Medium**
			VL	**L**	**M**	**H**	**VVH**
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

Mitigation measure development

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 impacts[10] 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.*

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 to construction and operation.

[10] Mitigation measures should address both positive and negative impacts

APPENDIX E - Vegetation Type

Kathu Bushveld (SVk 12)

Figure E1: SVk 12 Kathu Bushveld: *Open savanna dominated by Vachellia erioloba, Senegalia mellifera and Grewia Flava* with low cover of *Stipagrostis ciliata* against the red sand east of Oupos, in the Kuruman District north of Kathu. Image by M.C. Rutherford.

Remarks: One of the most strikingly dominant areas of tall *Vachellia erioloba* is centred on the town of Kathu, which was built around many of these trees.

Table E1: Floristic species of *The Kathu Bushveld* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Trees	**Small Tree**: *Senegalia erubescens* (d), *Boscia albitrunca* (d), *Terminalia sericea*. **Tall Tree:** *Vachellia erioloba*
Shrubs	**Tall Shrub**: *Diospyros lycioides* subsp. *lycioides* (d), *Dichrostachys cinerea*, *Grewia flava*, *Gymnosporia buxifolia*, *Rhigozum brevispinosum*. **Low Shrubs**: *Aptosimum decumbens*, *Grewia retinervis*, *Nolletia arenosa*, *Sida cordifolia*, *Tragia dioica*. **Succulent Shrub**: *Kalanchoe rotundifolia*, *Talinum caffrum*.
Forb layer	
Herbs	*Acrotome inflata*, *Erlangea misera*, *Gisekia africana*, *Heliotropium ciliatum*, *Hermbstaedtia fleckii*, *H. odorata*, *Limeum fenestratum*, *L. viscosum*, *Lotononis platycarpa*, *Senna italica* subsp. *arachoides*, *Tribulus terrestris*.
Gramminoid layer	
Graminoids	*Aristida meridionalis* (d), *Brachiaria nigropedata* (d), *Centropodia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis ciliata* (d), *Aristida congesta*, *Eragrostis biflora*, *E. chloromelas*, *E. heteromera*, *E. pallens*, *Melinis repens*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis*, *Tragus berteronianus*.

*(d) is for dominant

APPENDIX F - Species Lists

Floral Species List

Table F1: Dominant floral species encountered during the field assessment. Alien species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act No. 10 of 2004): Alien and Invasive Species Regulations, 2020 are indicated with an asterisk (*).

Scientific name	*Senegalia melifera* Thicket	Open Mixed *Senegalia mellifera – Vachellia erioloba – Vachellia haematoxylon* Woodland
Woody & Shrub species		
Senegalia mellifera	X	X
Grewia flava	X	X
Melolobium candicans	X	X
Vachellia erioloba	X	X
Vachellia haematoxylon		X
Senegalia hebeclada	X	X
Terminalia sericea	X	
Gewia bicolor	X	
Elephanthorhiza elephanthina	X	X
Forb & Herb Species		
Aptosimum elongatum	X	
Crotalaria orientalis	X	X
Cucumis africanus	X	X
Dimorphotheca sp	X	
felicia muricata	X	
Pentzia calcarean	X	X
Senna italica	X	
Hermannia crystallina	X	X
Indigofera alternans	X	
Dimorphotheca sp.	X	
Acanthosicyos naudinianus	X	X
Chrysocoma obtusata	X	X
Graminoid Species		
Schmidtia kalahariensis	X	X
Eragrostis lehmanniana	X	X
Pogonothria squarrosa	X	X
Stipagrostis uniplumis	X	X
Melenis repens	X	X
Aristida congesta	X	X
Aristida meridionalis	X	X
Digitaria eriantha	X	
Eragrosits nindensis	X	X
Stipagrostis obtusa	X	

Faunal Species List

At the time of the assessment, a limited number of faunal species were observed. Faunal species are however considered to be limited to common species adapted to increased levels of anthropogenic activities.

Table F2: Mammal species observed within the proposed railway loop.

Scientific Name	Common Name	IUCN
Cryptomus hottentosus	Common mole-rat)	LC
Raphicerus campestris	Steenbok	LC
Lupulella mesomelas	Black-backed jackal	LC
Tragelaphus strepsiceros	Kudu	LC
Elephantulus intufi	Bushveld Sengi	LC
Lepus capensis	Cape Hare	LC
Hystrix africaeaustralis	Porcupine	LC

LC = Least Concern

Table F3: Avifaunal species observed within the proposed railway loop.

Scientific Name	Common Name	IUCN
Streptopelia capicola	Cape turtledove	LC
Pycnonotus nigricans	Red-eyed Bulbul	LC
Columba guinea	Speckled pigeon	LC
Uraeginthus granatinus	Violet eared waxbill	LC
Colies colius	White-backed mousebird	LC
Afrotis afraoides	Northern Black Korhaan	LC
Ploceus velatus	Southern masked weaver	LC
Tockus leucomelas	Southern yellow-billed hornbill	LC
Laniarius astrococcineus	Crimson-breasted shrike	LC
Upupa africana	African Hoopoe	LC
Prinia masulosa	Karoo Prinia	LC
Passer melanurus	Cape Sparrow	LC
Sporopipes squamifrons	Scaly-feathered Finch	LC
Spreo bicolor	Pied Starling	LC
Saxicola torquata	African Stonechat	LC
Cisticola fulvicapillus	Neddicky	LC
Elanus caeruleus	Black-shouldered Kite	LC
Tchagra senegalus	Black-crowned Tchagra	LC
Calendulauda africanoides	Fawn-coloured Lark	LC
Dicrurus adsimilis	Fork-tailed Drongo	LC
Parus cinerascens	Ashy Tit	LC
Batis pririt	Pririt Batis	LC
Sigelus silens	Fiscal Flycatcher	LC
Erythropygia paena	Kalahari scrub Robin	LC

LC = Least Concern

Table F4: Insect species observed with the proposed railway loop

Scientific Name	Common Name	IUCN
Hodotermes mossambicus	Northern harvester termite	NYBA
Junonia hierta	Yellow Pansy	LC
Passalidius fortipes	Burrowing ground beetle	NYBA

Scientific Name	Common Name	IUCN
Apterogyna sp.	Velvet ant	NA
Gonometa postica	African silk moth	NYBA
Calidea dregii	Rainbow Shield Bug	NYBA
Belenois aurota	Brown-veined White	NYBA
Danaus chrysippus	African Monarch	NYBA
Eurema brigitta	Broad-bordered Grass Yellow	NYBA
Spalia sp	Sandman	NYBA
Loxostege frustalis	Karoo Moth	NYBA
Pachylomerus femoralis	Flattened Giant Dung Beetle	NYBA
Sphingonotus scabriculus	Blue-wing	NYBA
Sternocera sp	Giant Jewel Bug	NYBA
Acanthacris ruficornis	Garden Locust	NYBA
Gastrimargus sp.	N/A	NYBA
Rhachitopis sp	N/A	NYBA
Systophlochius palochius	Orange wing	NYBA
Anterhynchium fallax	N/A	NYBA
Camponotus fulvopilosus	Bal-byter	NYBA
Cynthia cardui	Painted Lady Butterfly	LC
Pantala flavescens	Wandering Glider	LC
Mylabris oculata	CMR Bean Beetle	NYBA

LC = Least concerned, NYBA = Not yet been assessed by the IUCN, DD = Data deficient

Table F5: Arachnid species observed within the proposed railway loop.

Scientific Name	Common Name	IUCN
Ageledidae sp	Funnel-web Spider	NYBA

NYBA = Not yet been assessed by the IUCN

Table F6: Reptile species observed within the proposed railway loop.

Scientific Name	Common Name	IUCN
Agama aculeata	Ground agama	LC
Pedioplanis namaquensis	Namaqua Sand Lizard	LC

NYBA = Not yet been assessed by the IUCN

APPENDIX G - Floral SCC

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. Due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. Because the Red List of South African plants is used widely in South African conservation practices such as systematic conservation planning or protected area expansion, we use an amended system of categories designed to highlight those species that are at low risk of extinction but of conservation concern.

Definitions of the national Red List categories

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

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- ^{N}**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- ^{N}**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
  - Restricted range: Extent of Occurrence (EOO) <500 km^2, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km^2, OR
  - Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
  - Small global population: Less than 10 000 mature individuals.
- **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

Floral Species of Conservation Concern (SCC) that were assessed for the proposed railway loop are listed within the table below:

According to the Floral Species List obtained from BODATSA, there are no Floral SCC expected for the area.

Table G1: Tree list according to the National Forest Act, 1998 (Act No. 84 of 1998) for the tree species expected to occur within the assessment zone.

Family	Scientific Name	Habitat	POC
Fabaceae	*Vachellia erioloba*	Savanna, semi-desert, and desert areas with deep, sandy soils and along drainage lines in very arid areas, sometimes in rocky outcrops	100%
Fabaceae	*Vachellia haematoxylon*	Bushveld, usually on deep Kalahari sand between dunes and dry watercourses.	100%
Capparaceae	*Boscia albitrunca*	This species is found in the drier parts of southern Africa, in areas of low rainfall.	80%

Table G2: POC assessment results for provincially protected floral species as per the Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA). Threatened status and additional information on species threat status, habitat and distribution was obtained from The Red List of South African Plants (http://redlist.sanbi.org/index.php). The Potential of Occurrence (POC) of these floral SCC within the assessment zone is also provided.

Species	Habitat and distribution details	IUCN	POC
Schedule 1 Specially Protected Species FAMILY PEDALIACEAE			
Harpagophytum procumbens	Geophyte, herb, creeper **Provincial distribution**: Free State, Limpopo, Northern Cape, North West **Major habitats: Terrestrial** **Description:** Well drained sandy habitats in open savanna and woodlands **Population trend:** Stable.	LC	**High**

Species	Habitat and distribution details	IUCN	POC
Schedule 1 Specially Protected Species FAMILY FABACEAE			
Lessertia frutescens subsp. *frutescens*	Shrub **Provincial distribution**: Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Northern Cape, Western Cape **Major habitats: Terrestrial**	LC	**Medium**
Schedule 2 Protected Species FAMILY AIZOACEAE (MESEMBRYANTHEMACEAE) - All species except those listed as Schedule 1			
Chasmatophyllum musculinum	Succulent **Provincial distribution**: Eastern Cape, Free State, Gauteng, Mpumalanga, Northern Cape, North West, Western Cape **Major habitats: Terrestrial** **Description:** Wide, but sparse distribution within the southern African interior. Habitat can range from rocky areas to deeper soils (Smith et al. 1998).	LC	**Low**
Ebracteola wilmaniae	Succulent **Range**: Widespread across the Northern Cape and North West Province, from Zeerust to Prieska. **Major habitats:** Grassland, Savanna. **Description:** Lithosols in chert or dolomite outcrops in grassland.	LC	**Low**
Lithops aucampiae subsp. *aucampiae* var. *aucampiae*	Succulent **Range**: Northern Cape. Kimberly to Upington. **Major habitats:** Savanna. **Description:** Red quartzite.	LC	**Low**
Galenia collina	Dwarf shrub **Provincial distribution:** Northern Cape, Western Cape. **Major habitats:** Terrestrial. **Description:** None provided.	LC	**Low**
Galenia prostrata	Dwarf shrub **Provincial distribution:** Eastern Cape, Free State, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** None provided. **Population trend:** Stable.	LC	**Low**
Nananthus aloides	Succulent **Range**: Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** Widespread in the climatically severe southern African interior. It grows mostly at the edge of pans in finely decomposed limestone, the plants often sunken into the ground, or among stones (The encyclopaedia of succulents). **Population trend:** None provided.	LC	**Low**
Plinthus cryptocarpus	Dwarf shrub **Range**: Northern Cape **Major habitats:** Terrestrial. **Description:** None provided. **Population trend:** None provided.	LC	**Low**
Prepodesma orpenii	Succulent **Range**: Northern Cape. **Major habitats:** Terrestrial. **Description:** Arid subtropics. It grows in dry plane lands on barren loamy shales or in crevices between quartzitic limestone stones (The encyclopaedia of succulents). **Population trend:** Stable.	LC	**Low**
Ruschia griquensis	Succulent; shrub **Range**: Free State, Northern Cape. **Major habitats:** Terrestrial **Description:** The plant sprawls on exposed, stony ground. **Population trend:** Stable.	LC	**Low**
Tetragonia arbuscula	Succulent; dwarf shrub **Range**: Eastern Cape, Free State, Northern Cape, Western Cape. **Major habitats:** Terrestrial. **Description:** Not provided.	LC	**Low**

Species	Habitat and distribution details	IUCN	POC
	Population trend: Not provided.		
Tetragonia calycina	Succulent; dwarf shrub **Range**: Eastern Cape, Free State, Northern Cape, Western Cape. **Major habitats:** Terrestrial. **Description:** Not provided. **Population trend:** Not provided.	LC	**Low**
Schedule 2 Protected Species FAMILY AMARYLLIDACEAE - All species except those listed as Schedule 1			
Boophone disticha	Geophyte **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape. **Major habitats:** Terrestrial. **Description:** Dry grassland and rocky areas. **Population trend:** Decreasing.	LC	**Confirmed**
Nerine laticoma	Geophyte **Range**: Eastern Cape, Free State, Gauteng, Limpopo, Mpumalanga, Northern Cape, North West. **Major habitats:** Terrestrial.	LC	**Medium**
Schedule 2 Protected Species FAMILY APOCYNACEAE - All species except those listed as Schedule 1			
Brachystelma circinatum	Succulent; geophyte **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Western Cape. **Major habitats:** Terrestrial. **Description:** Grows in various stony places and has adapted to different environmental factors (The encyclopaedia of succulents). **Population trend:** Not provided.	LC	**Low**
Cynanchum orangeanum	Herb **Range**: Eastern Cape, Free State, Northern Cape, North West. **Major habitats:** Terrestrial. **Population trend:** Not provided.	LC	**Low**
Fockea angustifolia	Succulent; climber **Range**: Free State, KwaZulu-Natal, Limpopo, Northern Cape, North West **Major habitats:** Terrestrial. **Description:** Occurs in dry areas on stony hillsides on granite or limestone (Pooley, 2005).	LC	**Low**
Gomphocarpus fruticosus	Herb; shrub **Range**: Widespread across South Africa, extending northwards to Angola, Zambia and Mozambique. **Major habitats:** Albany Thicket, Desert, Fynbos, Grassland, Indian Ocean Coastal Belt, Nama Karoo, Savanna, Succulent Karoo. **Description:** Dry sandy soils in open or disturbed places, often on riverbanks.	LC	**Low**
Gomphocarpus tomentosus	Herb; shrub **Range**: Widespread across the central and north-eastern interior of South Africa, extending northwards within southern Africa to southern Angola, Zimbabwe and southern Mozambique. **Major habitats:** Grassland, Nama Karoo, Savanna. **Description:** Sandy open or disturbed areas.	LC	**Low**
Huernia barbata subsp. *ingeae*	Succulent **Range**: Northern Cape. **Major habitats:** Terrestrial. **Description:** Not provided.	LC	**Low**
Microloma armatum	Dwarf shrub; shrub **Range**: Widespread, but sparsely distributed across southern Namibia and the Northern Cape Province, South Africa, extending as far south as Karoopoort east of Ceres in the Western Cape. **Major habitats:** Nama Karoo, Savanna, Succulent Karoo. **Description:** Arid shrubland and thornveld. Sometimes restricted to rock formations.	LC	**Low**
Orbea sp	Succulent **Range**: Widespread species	LC	**Medium**

Species	Habitat and distribution details	IUCN	POC
Pachypodium succulentum	Succulent; shrub **Range**: Eastern Cape, Northern Cape, Western Cape. **Major habitats:** Terrestrial. **Description:** It occurs in rocky grassland, koppies, steep hills and succulent scrub vegetation in the Western, Eastern and Northern Cape and western Free State, at altitudes up to 1 400 m (SANBI PlantZAfrica). **This species is listed on Appendix II of CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora).	LC	**Low**
Schedule 2 Protected Species FAMILY ASPHODELACEAE - All species except those listed as Schedule 1, and the species *Aloe ferox*			
Aloidendron dichotomum	**Range**: From Nieuwoudtville east to Olifantsfontein and northwards to the Brandberg in Namibia. **Major habitats:** Terrestrial. **Description:** On north-facing rocky slopes (particularly dolomite) in the south of its range. Any slopes and sandy flats in the central and northern parts of range. **Population trend:** Decreasing.	VU	**Low**
Bulbine abyssinica	Succulent; geophyte; herb **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape. **Major habitats:** Terrestrial. **Description:** It favours rocky grassland and shallow soil overlying rock but can also be found in woodland and along seepage areas.	LC	**Low**
Trachyandra saltii	Succulent; geophyte **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** In rocky montane grassland, margins of forest and vleis and open woodland, often on stony or sandy soils, including Kalahari sand.	LC	**Low**
Schedule 2 Protected Species FAMILY CAPPARACEAE - *Boscia* spp., i.e. Shepherd's trees, all species			
Boscia albitrunca	Shrub; tree **Range**: Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** This species is found in the drier parts of southern Africa, in areas of low rainfall.	LC	**Medium**
Schedule 2 Protected Species FAMILY CELASTRACEAE - *Gymnosporia* spp. All species			
Gymnosporia buxifolia	Shrub; tree **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape. **Major habitats:** Terrestrial. **Description:** Its natural habitat is in grasslands, fynbos, Nama-karoo, forests, thickets and savanna-bushveld. It occurs on hillsides, dry slopes of valleys, sometimes in riverbeds, often on termite mounds and it is often found as undergrowth to taller trees.	LC	**Low**
Schedule 2 Protected Species FAMILY CRASSULACEAE - All species except those listed in Schedule 1			
Crassula corallina	Succulent; herb **Range**: Northern Cape (Subsp. *corallina*, also occurs in the Eastern Cape, Free State, North West, Western Cape). **Major habitats:** Terrestrial. **Description:** It grows in quartzite outcrops in desert-like habitat and dry floodplain (The encyclopaedia of succulents).	LC	**Low**
Crassula muscosa	Succulent; herb **Range**: This species is widespread across Namaqualand, Bushmanland and the Karoo, extending to the coastal lowlands of the Western Cape and the western half of the Eastern Cape. It also occurs in Namibia. **Major habitats:** Terrestrial, including Postmasburg Thornveld.	NE	**Low**

Species	Habitat and distribution details	IUCN	POC
	Description: Occurs sheltered under shrubs or in rocky places in karroid shrubland, valley bushveld and fynbos.		
Kalanchoe rotundifolia	Succulent; dwarf shrub **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** A very common plant found growing as a pioneer plant usually in shade or half-shade, single or in large communities under trees or shrubs in bushland, woodland, open and secondary forests, savanna, open veld; sandy, limestone, brackish or rocky soils or on rocks, either in dry or wet habitats, sometimes in salt marshes.	LC	**Low**
Schedule 2 Protected Species FAMILY EUPHORBIACEAE - *Euphorbia* spp. All species			
Euphorbia crassipes or potentially *Euphorbia fusca* The separation of these two species as distinct is not universally accepted.	Dwarf succulent **Range**: Northern Cape. **Major habitats:** Namibia to Kliprand, Pofadder, Prieska and Kimberley. **Description:** Gravelly flats. **Suitable habitat on site:** Rocky Habitat.	LC	**Low**
Euphorbia davyi	Dwarf, spineless succulent shrub **Range**: Gauteng, Limpopo, North West. **Major habitats:** Terrestrial. **Description:** Rocky outcrops in grassland.	LC	**Low**
Euphorbia duseimata	Succulent; dwarf shrub **Range**: Free State, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** Sandy or turfy soils, Kalahari Thornveld and Bushveld.	LC	**Low**
Euphorbia gariepina	Succulent **Range**: Northern Cape and Namibia. From the Orange River to 160 km north of Windhoek. **Major habitats:** Terrestrial. **Description:** Sandy, gravelly soils.	LC	**Low**
Euphorbia wilmaniae	Spineless dwarf succulent **Range**: Northern Cape. Griqualand West Centre endemic species. **Major habitats:** Terrestrial. **Description:** Among boulders and rocks, often concealed in the crevices of the rocks.	LC	**Low**
Schedule 2 Protected Species FAMILY HYACINTHACEAE - *Eucomis* spp. Pineapple flower, all species			
Eucomis autumnalis	Geophyte **Range**: South Africa, Swaziland, Lesotho, Botswana, Zimbabwe and Malawi. **Major habitats:** Grassland **Description:** Damp, open grassland and sheltered places from the coast to 2450 m.	NE	**Low**
Schedule 2 Protected Species FAMILY IRIDACEAE - All species except those listed in Schedule 1			
Babiana bainesii	Geophyte; herb **Range**: Limpopo, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** Grassland, usually among small rocks.	LC	**Low**
Babiana hypogaea	Geophyte; herb **Range**: Free State, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** Red sand plains. Usually in Kalahari Sand or stony laterite in open woodland or grassland.	LC	**Medium**
Duthieastrum linifolium	Geophyte; herb **Range**: Free State, Northern Cape, North West. **Major habitats:** Terrestrial. **Description:** None provided	LC	**Low**
Freesia andersoniae	Geophyte; herb **Range**: Eastern Cape, Free State, Northern Cape, North West. Widespread across the central interior of South Africa. **Major habitats:** Grassland, Nama Karoo, Savanna.	LC	**Low**

Species	Habitat and distribution details	IUCN	POC
	Description: Wedged among rocks on lower slopes of dolerite and dolomite outcrops.		
Gladiolus orchidiflorus	Geophyte; herb **Range**: Free State, Northern Cape, Western Cape. **Major habitats:** Terrestrial. **Description:** Found on clay and sandstone soils from Namibia to Cape Flats and also to Free State and flowers in the spring.	LC	**Low**
Moraea polystachya	Geophyte; herb **Range**: Eastern Cape, North West, Western Cape. **Major habitats:** Terrestrial. **Description:** The habitat is well-drained flats and slight slopes, with collectors often referring to the presence of calcrete deposits.	LC	**Low**
Schedule 2 Protected Species FAMILY MELIACEAE - *Nymania capensis* (Thunb.) (Lindb.) Chinese Lantern			
Nymania capensis	Tree; shrub **Range**: Eastern Cape, Northern Cape, Western Cape. **Major habitats:** **Description:** It favours hot, dry, rocky habitats, but also occurs near dry, sandy rivers.	LC	**Low**
Schedule 2 Protected Species FAMILY OLEACEAE - *Olea europaea* subsp. *africana* (Mill.) (P.S. Green) Wild olive			
Olea europaea subsp. *africana*	Tree **Range**: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, Western Cape **Major habitats:** Terrestrial. **Description:** This tree is found in a variety of habitats, often near water, e.g. on rocky hillsides, on stream banks and in woodland (where it can reach 12 m) (SANBI PlantZAfrica).		**Low**
Schedule 2 Protected Species FAMILY OXALIDACEAE - *Oxalis* spp. Sorrel, all species except those species listed in Schedule 1			
Oxalis lawsonii	Geophyte **Range**: Free State, Northern Cape, North West. **Major habitats:** Terrestrial.	LC	**Low**
Schedule 2 Protected Species FAMILY SCROPHULARIACEAE - *Jamesbrittenia* spp. All species			
Jamesbrittenia atropurpurea	Shrub; dwarf shrub **Range**: Eastern Cape, Free State, Gauteng, Northern Cape, North West, Western Cape. **Major habitats:** Terrestrial. **Description:** This species grows in clay or loam flats, slopes and ridges among scrub.	LC	**Low**
Jamesbrittenia tysonii	Dwarf shrub **Range**: Eastern Cape, Northern Cape. **Major habitats:** Terrestrial. **Description:** It grows on slopes, along seasonal watercourses among scrub adapted to semi-arid terrain; also, on degraded land (Operation Wildflower).	LC	**Low**
Manulea burchellii	Herb **Range**: Northern Cape. **Major habitats:** Terrestrial. **Description:** None provided	LC	**Low**

CR PE = Critically Endangered (Possibly Extinct); **EN=** Endangered**; EW =** Extinct in the Wild; **NT =** Near Threatened; **VU=** Vulnerable; **P=** Protected **LC** = Least Concern; **POC** = Probability of Occurrence.

Table G3: TOPS list for South Africa – plant species.

NEM:BA TOPS LIST (PLANT SPECIES)				
Scientific Name	**Common Name**	**POC**	**Provincial Distribution**	**Conservation Status**
Adenia wilmsii	No common name	Low	Provincial distribution: Mpumalanga Range: Lydenburg to Waterval Boven Description: Dolerite outcrops or red loam soil, in open woodland, 1300-1500 m.	EN; P
Adenium swazicum	Swaziland Impala Lily	Low	Range: Kruger National Park to Swaziland along the Lebombo Mountains and adjacent areas in south-western Mozambique.	VU
Adenium swazicum	Swaziland Impala Lily	Low	Provincial distribution: Mpumalanga	VU
Aloe albida	Grass Aloe	Low	Provincial distribution: Mpumalanga Range: Aloe albida has a restricted range in the mountains south of Barberton, Mpumalanga, extending to Malolotja in north-western Swaziland.	NT
Aloe pillansii (now *Aloidendron pillansii*)	False Quiver Tree	Low	Provincial distribution: Northern Cape Range: Richtersveld and southern Namibia.	EN
Aloe simii	No common name	Low	Provincial distribution: Mpumalanga Range: This species is endemic to a small area in the transition area between the Mpumalanga Lowveld and Escarpment, where it occurs from Sabie southwards to White River and around Nelspruit. Description: It occurs along drainage lines and in wetlands in open woodland and grassland, 600-1100 m.	EN; P
Clivia mirabilis	Oorlogskloof Bush Lily	Low	Provincial distribution: Northern Cape, Western Cape	VU; P
Diaphananthe millarii	Tree Orchid	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal Range: East London and Durban.	VU
Disa macrostachya	No common name	Low	Provincial distribution: Northern Cape	EN; P
Disa nubigena	No common name	Low	Provincial distribution: Western Cape	Rare; P
Disa physodes	No common name	Low	Provincial distribution: Western Cape	CR; P
Disa procera	No common name	Low	Provincial distribution: Western Cape	EN; P
Disa sabulosa	No common name	Low	Provincial distribution: Western Cape	EN; P
Encephalartos aemulans	Ngotshe Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos altensteinii	Bread Palm	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Encephalartos arenarius	Dune Cycad	Low	Provincial distribution: Eastern Cape	EN
Encephalartos brevifoliolatus	Escarpment Cycad	Low	Provincial distribution: Limpopo	EW
Encephalartos caffer	Breadfruit Tree	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos cerinus	Waxen Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos cupidus	Blyde River Cycad	Low	Provincial distribution: Limpopo, Mpumalanga Description: Grassland, on steep, rocky slopes or cliffs and sometimes near seepage areas bordering gallery forests.	CR
Encephalartos dolomiticus	Wolkberg Cycad	Low	Provincial distribution: Limpopo	CR
Encephalartos dyerianus	Lowveld Cycad	Low	Provincial distribution: Limpopo	CR; P
Encephalartos eugene-maraisii	Waterberg Cycad	Low	Provincial distribution: Limpopo	EN
Encephalartos friderici-guilielmi	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos ghellinckii	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Encephalartos heenanii	Woolly Cycad	Low	Provincial distribution: Mpumalanga Description: Open areas of montane grasslands amidst scarp forest in deep valleys and ravines.	CR
Encephalartos hirsutus	Venda Cycad	Low	Provincial distribution: Limpopo	CR

NEM:BA TOPS LIST (PLANT SPECIES)				
Scientific Name	**Common Name**	**POC**	**Provincial Distribution**	**Conservation Status**
Encephalartos horridus	Eastern Cape Blue Cycad	Low	Provincial distribution: Eastern Cape	EN
Encephalartos humilis	No common name	Low	Provincial distribution: Mpumalanga Description: Montane and mistbelt grassland, rocky sandstone slopes.	VU; P
Encephalartos inopinus	Lydenburg Cycad	Low	Provincial distribution: Limpopo	CR
Encephalartos laevifolius	Kaapsehoop Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga Description: Steep, rocky slopes in mistbelt grassland, 1300-1500 m.	CR
Encephalartos lanatus	No common name	Low	Provincial distribution: Gauteng and western Mpumalanga Description: Sheltered, wooded ravines in sandstone ridges, 1200-1500 m.	NT; P
Encephalartos latifrons	Albany Cycad	Low	Provincial distribution: Eastern Cape	CR
Encephalartos lebomboensis	Lebombo Cycad	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Description: Cliffs and rocky ravines in savanna and grassland.	EN
Encephalartos lehmannii	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Encephalartos longifolius	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Encephalartos middelburgensis	Middelburg Cycad	Low	Provincial distribution: Gauteng, Mpumalanga Description: Open grasslands and in sheltered valleys.	CR
Encephalartos msinganus	Msinga, Cycad	Low	Provincial distribution: KwaZulu-Natal	CR
Encephalartos natalensis	Natal Giant Cycad	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	NT; P
Encephalartos ngoyanus	Ngoye Dwarf Cycad	Low	Provincial distribution: KwaZulu-Natal	VU
Encephalartos nubimontanus	Blue Cycad	Low	Provincial distribution: Limpopo	EW
Encephalartos paucidentatus	No common name	Low	Provincial distribution: Mpumalanga Description: Forest, occurs on steep rocky slopes and alongside streams in deep gorges.	VU; P
Encephalartos princeps	No common name	Low	Provincial distribution: Eastern Cape	VU; P
Encephalartos senticosus	No common name	Low	Provincial distribution: KwaZulu-Natal	VU; P
Encephalartos transvenosus	Modjadje Cycad	Low	Provincial distribution: Limpopo	LC; P
Encephalartos trispinosus	No common name	Low	Provincial distribution: Eastern Cape	VU; P
Encephalartos woodii	Wood's Cycad	Low	Provincial distribution: KwaZulu-Natal	EW
Euphorbia clivicola	No common name	Low	Provincial distribution: Limpopo	CR; P
Euphorbia meloformis	No common name	Low	Provincial distribution: Eastern Cape	NT; P
Euphorbia obesa	No common name	Low	Provincial distribution: Eastern Cape	EN; P
Harpagophytum procumbens	Devil's Claw	Confirmed	Provincial distribution: Free State, Limpopo, Northern Cape, North West	LC; P
Harpagophytum zeyherii	Devil's Claw	Low	Provincial distribution: Gauteng, Limpopo, Mpumalanga, North West	LC; P
Hoodia currorii	Ghaap	Low	Provincial distribution: Limpopo	P
Hoodia gordonii	Ghaap	Medium	Provincial distribution: Free State, Northern Cape, Western Cape	DDD; P
Jubaeopsis caffra	Pondoland Coconut	Low	Provincial distribution: Eastern Cape	EN
Merwilla plumbea	Blue Squill	Low	Provincial distribution: KwaZulu-Natal, Mpumalanga Major habitats: Grassland Description: Montane mistbelt and Ngongoni grassland, rocky areas on steep, well drained slopes. 300-2500 m.	NT
Newtonia hildebrandtii var. *hildebrandtii*	Lebombo Wattle	Low	Provincial distribution: KwaZulu-Natal	Now LC
Protea odorata	Swartland Sugarbush	Low	Provincial distribution: Western Cape	CR; P

NEM:BA TOPS LIST (PLANT SPECIES)				
Scientific Name	**Common Name**	**POC**	**Provincial Distribution**	**Conservation Status**
Siphonochilus aethiopicus	Wild Ginger	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: Sporadically from the Letaba catchment in the Limpopo Lowveld to Swaziland. Extinct in KwaZulu-Natal. Widespread elsewhere in Africa. Description: Tall open or closed woodland, wooded grassland or bushveld.	CR
Stangeria eriopus	No common name	Low	Provincial distribution: Eastern Cape, KwaZulu-Natal	VU; P
Warburgia salutaris	Pepper-bark Tree	Low	Provincial distribution: KwaZulu-Natal, Limpopo, Mpumalanga Range: North-eastern KwaZulu-Natal, Mpumalanga and Limpopo Province. Also occurs in Swaziland, Mozambique and Zimbabwe and Malawi. Description: Variable, including coastal, riverine, dune and montane forest as well as open woodland and thickets.	EN
Zantedeschia jucunda	Yellow Arum Lilly	Low	Provincial distribution: Limpopo	VU

CR = Critically Endangered, EN = Endangered, EW = Extinct in the Wild, NT = Near Threatened, VU = Vulnerable, P = Protected, POC = Probability of Occurrence.

APPENDIX H - Faunal SCC

The tables below list the faunal Species of Conservation Concern for the assessment zone:

Table H1: TOPS list of faunal species (2007) expected to occur within the Northern Cape.

Scientific Name	Common Name	Threat Status
Homopus signatus	Speckled tortoise	VU
Pachydactylus goodi	Good's Gecko	VU
Cordylus macropholis	Large-scaled Lizard	P
Cordylus imkeae	Rooiberg Girdled Lizard	P
Opistophthalmus ater	Steinkopf Burrowing Scorpion	CR
Acinonyx jubatus	Cheetah	VU
Manis temminckii	Pangolin	VU
Ceratotherium simum	Southern White Rhinoceros	P
Crocuta crocuta	Spotted Hyaena	P
Felis nigripes	Black-footed Cat	P
Hyaena brunnea	Brown Hyaena	NT
Neophron percnopterus	Egyptian Vulture	CR
Aquila rapax	Tawny Eagle	EN
Torgos tracheliotos	Lappet-faced Vulture	EN
Gyps africanus	White-backed Vulture	CR
Gyps coprotheres	Cape Vulture	EN
Neotis ludwigii	Ludwig's Bustard	EN
Polemaetus bellicosus	Martial Eagle	EN
Terathopius ecaudatus	Bateleur	EN
Anthropoides paradiseus	Blue Crane	P
Ardeotis kori	Kori Bustard	P
Orycteropus afer	Aardvark	P

CR= Critically Endangered, EN=Endangered, NT=Near Threatened, VU=Vulnerable, P=Protected

Table H2: Threatened species not yet listed above that may occur in the area.

Common Name	Species	NCCA 2009 Status	IUCN 2015 Status
Honey badger	*Mellivora capensis*	Specially Protected	LC
African wild cat	*Felis silvestris*	Specially protected	LC
Striped polecat	*Ictonyx striatus*	Specially protected	LC
African striped weasel	*Poecilogale albinucha*	Specially protected	LC
Aardwolf	*Proteles cristata*	Specially protected	LC
Cape fox	*Vulpes chama*	Specially protected	LC
Southern African hedgehog	*Atelerix frontalis*	Specially protected	LC
Leopard	*Panthera pardus*	Specially protected	VU
Black eagle	*Aquila verreauxii*	Specially Protected	VU
White-backed Vulture	*Gyps africanus*	Specially Protected	CR
Ludwig's Bustard	*Neotis ludwigii*	Specially protected	EN
Martial Eagle	*Polemeatus bellicosus*	Specially Protected	EN
Tawny Eagle	*Aquila rapax*	Specially Protected	EN
Cape Vulture	*Gyps coprotheres*	Specially Protected	EN
Lappet-faced Vulture	*Torgos tracheliotos*	Specially Protected	EN
Burchell's courser	*Cursorius rufus*	Protected	VU
Lanner Falcon	*Falco biarmicus*	Specially Protected	VU
Secretarybird	*Sagittarius serpentarius*	Specially Protected	VU
Kori Bustard	*Ardeotis kori*	NA	NT
African Rock Pipit	*Anthus crenatus*	Protected	NT
Burrowing scorpion	*Opistophthalmus carinatus*	Specially Protected	NYBA
Burrowing scorpion	*Opistophthalmus wahlbergii*	Specially Protected	NYBA
Common flap-neck chameleon	*Chamaeleo dilepis*	Specially Protected	LC
African rock python	*Python sebae*	Specially Protected	

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, NYBA = Not yet been assessed, NE = Not Evaluated, NA = Not applicable

The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA) lists several Specially Protected (Schedule 1) and several Protected Species (Schedule 2). Should any species that scored a POC of high, or whose presence was confirmed within the proposed railway loop area during the site assessment, it will be listed below. The lists as per the NCNCA can be accessed in the link provided:

https://sherloc.unodc.org/cld/uploads/res/document/northern-cape-nature-conservation-act-9-of-2009_html/NC_Nature_Conservation_Act.pdf

Table H3: Avifaunal Species for the pentads 2705_2250 and 2710_2250 within the QDS 2722BB

PENTADS	LINK TO PENTAD SUMMARY ON THE SOUTH AFRICAN BIRD ATLAS PROJECT 2 WEB PAGE
2705_2250	http://sabap2.adu.org.za/coverage/pentad/2705_2250
2710_2250	http://sabap2.adu.org.za/coverage/pentad/2710_2250

APPENDIX I - Specialist information

1. (a) (i) Details of the specialist who prepared the report

Christopher Hooton	B.Tech Nature Conservation (Tshwane University of Technology)
Christien. Steyn	MSc Plant Science (University of Pretoria)
Kim Marais	BSc (Hons) Zoology (University of the Witwatersrand)
Sanja Erwee	BSc (Zoology) (University of Pretoria)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Christien Steyn		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Fax:	011 615 6240/ 086 724 3132
Telephone:	011 616 7893		
E-mail:	christien@sasenvgroup.co.za		
Qualifications	MSc (Plant Science) (University of Pretoria) BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria) BSc Environmental Science (University of Pretoria)		
Registration / Associations	Member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the Botanical Society of South Africa (BotSoc)		

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Kim Marais		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Fax:	086 724 3132
Telephone:	011 616 7893		
E-mail:	kim@sasenvgroup.co.za		
Qualifications	BSc (Hons) Zoology (University of the Witwatersrand) BSc (Zoology and Conservation) (University of the Witwatersrand)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Member of South African Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christopher Hooton, declare that –
I act as the **independent specialist** in this application;

- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.

Specialist Signature

I, Christien Steyn, declare that -

- I act as the **independent specialist** (reviewer) in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

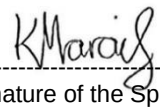
I, Sanja Erwee, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

I, Kim Marais, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Council for Natural Scientific Professions (SACNASP)
Member of the South African Association of Botanists (SAAB)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Input into Terrestrial Rehabilitation Plan design with the focus on the re-establishment of vegetation
- Floral Rescue and Relocation Plans
- Alien and Invasive Control Plan (AICP)
- Alien and Invasive Plant Identification and awareness training
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Desktop Studies, Mapping and Background Information Research

Training

- Advanced Grass Identification Course
- Practical Plant Identification, including Herbarium Usage and Protocols
- Vegetation Classification and Mapping: Use of Geographic Information System for understanding vegetation pattern and biodiversity conservation.
- Introduction to Statistics for Biologists: Applications of plant ecology principles in plant conservation, i.e., species distribution modelling, alien plant invasions, conservation planning
- Plant Functional Trait Course: Hands-on, field-based exploration of plant functional traits, along with experience in the usage of plant traits data in climate-change research and ecosystem ecology

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	GIS Technician and Visual Specialist
Joined SAS Environmental Group of Companies	2014

EDUCATION

Qualifications

BSC Zoology (University of Pretoria)	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017
ESRI MOOC ARCGIS Cartography	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Western Cape, Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Plant species and Landscape Plan

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil and land capability).

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KIM MARAIS

PERSONAL DETAILS

Position in Company	Senior Scientist Water Resource Manager
Joined SAS Environmental Group of Companies	2015

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 117137/17)
Member of the Western Cape Wetland Forum (WCWF)

EDUCATION

Qualifications

BSc (Hons) Zoology (University of the Witwatersrand)	2012
BSc (Zoology and Conservation) (University of the Witwatersrand)	2011

Short Courses

Aquatic and Wetland Plant Identification (Cripsis Environment)	2019
Tools for Wetland Assessment (Rhodes University)	2018
Certificate in Environmental Law for Environmental Managers (CEM)	2014
Certificate for Introduction to Environmental Management (CEM)	2013

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Biodiversity Action Plans (BAP)
- Alien and Invasive Control Plans (AICP)
- Faunal Eco Scans
- Faunal Impact Assessments

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Watercourse Maintenance and Management Plans
- Freshwater Offset Plan

Aquatic Ecological Assessment and Water Quality Studies

- Riparian Vegetation Integrity (VEGRAI)
- Water quality Monitoring
- Riverine Rehabilitation Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions
- Public Participation processes

Scientific Terrestrial Services

Applying science to the real world

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www.sasenvironmental.co.za

Name: Chris Hooton
Stephen van Staden
Date: Tuesday, 07 September 2021
Ref: STS 210054

SLR Consulting (South Africa) (Pty) Ltd
PO Box 1596,
Cramerview,
2060
Tel: 011 467 0945
Email: rbaker@slrconsulting.com

Attention: Mrs. Rizqah Baker

RE: AQUATIC BIODIVERSITY IMPACT AND COMPLIANCE STATEMENT AS PART OF THE BASIC ASSESSMENT PROCESS FOR THE PROPOSED WESSELS MINE RAILWAY EXTENSION, NORTHERN CAPE PROVINCE

1. INTRODUCTION AND BACKGROUND SETTING

Scientific Terrestrial Services (STS) CC was appointed by SLR Consulting (South Africa) (Pty) Ltd. to prepare an Aquatic biodiversity impact[1] and compliance statement as part of the Basic Assessment (BA) process for the proposed extension of the existing railway infrastructure at Wessels Mine which is operated by South32 Limited (South32), within the Northern Cape. The proposed upgrade of the railway infrastructure includes a single railway loop, hereafter referred to as the proposed railway loop (Appendix A, Figure A1 and A2). In order to identify all freshwater ecosystems that may be potentially impacted by the proposed project, a 500 m "zone of investigation" around the proposed railway loop in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500 m zone of investigation around proposed railway loop, will henceforth be referred to as the "investigation area".

The proposed railway loop is located within the John Toalo Gaetsewe District Municipality within the Joe Morolong Local Municipality in the Northern Cape Province. The Wessels Mine is located approximately 1.5 km north-east of Blackrock and is an operational underground manganese mine

[1]Although the DEFF (2020) Screening Tool refers to 'aquatic biodiversity', for the purposes of this investigation, 'aquatic' is taken to include all freshwater ecosystems including wetlands.

operating at a depth of approximately 350 m below surface. The Wessels Mine is further located approximately 12,5 km north east of the town of Hotazel, with the R380 roadway situated directly west of the proposed railway loop. The Ga-Mogara River is located approximately 6,4 km east of the proposed railway loop whilst the Kuruman River is approximately 5km north of the proposed railway loop. The majority of the proposed railway loop are situated within the mining area with limited indigenous vegetation remaining.

STS was required to report on aspects of the aquatic biodiversity and provide input into any development constraints the proposed project may have in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the National Water Act, 1998 (Act No. 36 of 1998). STS was required to, as necessary, assess the impact that the proposed project poses to the aquatic ecosystem and associated biodiversity within the receiving environment.

2. OUTCOMES OF THE APPLICATION OF THE DEPARTMENT OF ENVIRONMENTAL AFFAIRS (DEA) SCREENING TOOL.

The protocol for the assessment of aquatic biodiversity prepared in support of the Department of Forestry, Fisheries and Environment (DFFE) national web based environmental screening tool, provides the criteria for the assessment and reporting of impacts on aquatic biodiversity for activities requiring Environmental Authorisation (EA). For the aquatic biodiversity theme, the requirements are for landscapes or sites which support various levels of biodiversity. The relevant aquatic biodiversity theme in the national web based environmental screening tool has been provided by the South African National Biodiversity Institute (SANBI). Based on the sensitivity rating, a suitably qualified specialist must prepare the relevant report or opinion memo which is to be submitted as part of the BA application.

As part of the process of initiating the BA process, SLR Consulting applied the DFFE screening tool to the proposed railway loop. According to the national web based environmental screening tool, the proposed railway loop is located within an area of **Very High** aquatic biodiversity significance, as the proposed railway loop situated within a Freshwater Ecosystem Priority Area (FEPA) sub catchment (Figure A4). As a result, an applicant intending to undertake an activity on a site identified as being of “very high sensitivity” for an aquatic biodiversity theme must submit an Aquatic Biodiversity Impact Assessment or if the area is identified as being of “low sensitivity” then an Aquatic Biodiversity Compliance Statement must be compiled and submitted to the competent authority. It is noted, however, that during a site survey undertaken by a suitably qualified freshwater ecologist should the sensitivity be determined different from that assigned by the screening tool (i.e. that a high risk to the regional aquatic biodiversity or freshwater ecosystems in the area is likely even though it is assigned as a “low” sensitivity, or if it is assigned a high sensitivity, however, the proposed develop risk are deemed low) then the relevant assessment approach must be followed based on the site survey results and not the DFFE screening tool allocation.

3. DEFINITIONS AND LEGISLATIVE REQUIREMENTS

The legislation considered during this investigation included the following:

- The Constitution of the Republic of South Africa, 1996[2];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA); and
- Government Notice 509 (GN 509) as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

3.1 Freshwater Ecosystem Definition

The NWA is aimed at the protection of the country's water resources, defined in the Act as "a watercourse, surface water, estuary or aquifer". According to the NWA a watercourse means:
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare a watercourse.

The Act further provides definitions of wetland and riparian habitats as follows:
Wetland habitat is "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."
Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Thus, for the purposes of this site assessment, the definition of a freshwater ecosystem is considered to be synonymous with the definition of a watercourse as per the NWA.

4. DESKTOP INVESTIGATION FINDINGS

A desktop database analysis was undertaken prior to the site survey of the proposed railway loop (see Appendix A) as well as the associated 500 m investigation area. The results are summarised in the points below with the relevant maps presented in Appendix A.

- According to the National Freshwater Ecosystem Priority Area, 2011 (NFEPA) database (2011), there are no wetland or river features associated with the proposed railway loop and associated investigation area. The closest wetland feature, which is a natural flat wetland is located approximately 2 km north of the proposed railway loop; and

[2] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

- According to the National Biodiversity Assessment, 2018 (NBA): The South African Inventory of Inland Aquatic Ecosystems (SAIIAE) dataset corresponds with the NFEPA Database (2011) indicating that there are no wetland or river features associated with the proposed railway loop.

4.2 Site assessment results

The investigation area was assessed during the site assessment which was undertaken on the 10th of June 2021, using visual assessment methods as well as digital satellite imagery. During the field assessment, it was confirmed, as per the satellite imagery (Figure 1) and the NFEPA database (Appendix A), that the proposed railway loop does not traverse any freshwater features, nor are there any naturally occurring features within 500m.

Figure 1: Digital satellite imagery indicating no presence of freshwater features within the proposed railway loop route.

Although not assessed during the site assessment due to access constraints, the Biodiversity Management and Action Plan for the South32 Wessels Mine Mining Right Area and Operations (Dr. BJ Henning, 2020) does indicate a single artificial freshwater feature that is located approximately 216m north of the proposed railway loop (Figure 2 and 3 below). This feature is referred to as the Duck Pond and has been classified by Dr. BJ Henning as “an artificial wetland system according to the classification by SANBI and specifically a man-made endorheic depression”. Although the Duck Pond is considered to be artificial, it is pertinent to note that the proposed railway loop significant quantum of risk to this feature, nor with the railway loop hinder recharge of this system, predominantly since there is an active mining area located between the Duck Pond and the proposed railway loop which forms an existing barrier for recharge by clean water runoff originating from the railway loop locality.

According to the screening tool the overall aquatic sensitivity of the proposed railway loop is **Very High,** due to the proposed railway loop being situated within a FEPA catchment for the Ga-Mogara River. Given the small surface extent of the proposed railway, it is unlikely that the construction and operation of the railway will inhibit or decrease the overall catchment yield to the Ga-Mogara River. Additionally,

it must be noted that the Ga-Mogara River is situated approximately 6,4 km east of the proposed railway loop. Any surface water collection from rainfall events in the locality of the proposed railway loop currently infiltrate into the ground and are not transported over the surface to the Ga-Mogara River. The proposed railway loop will not inhibit water infiltration in the area and is unlikely to have any significant impact on the Ga-Mogara River.

Figure 2: Image depicting the freshwater feature known as the Duck Pond located north of the proposed railway loop (Dr. BJ Henning, 2020).

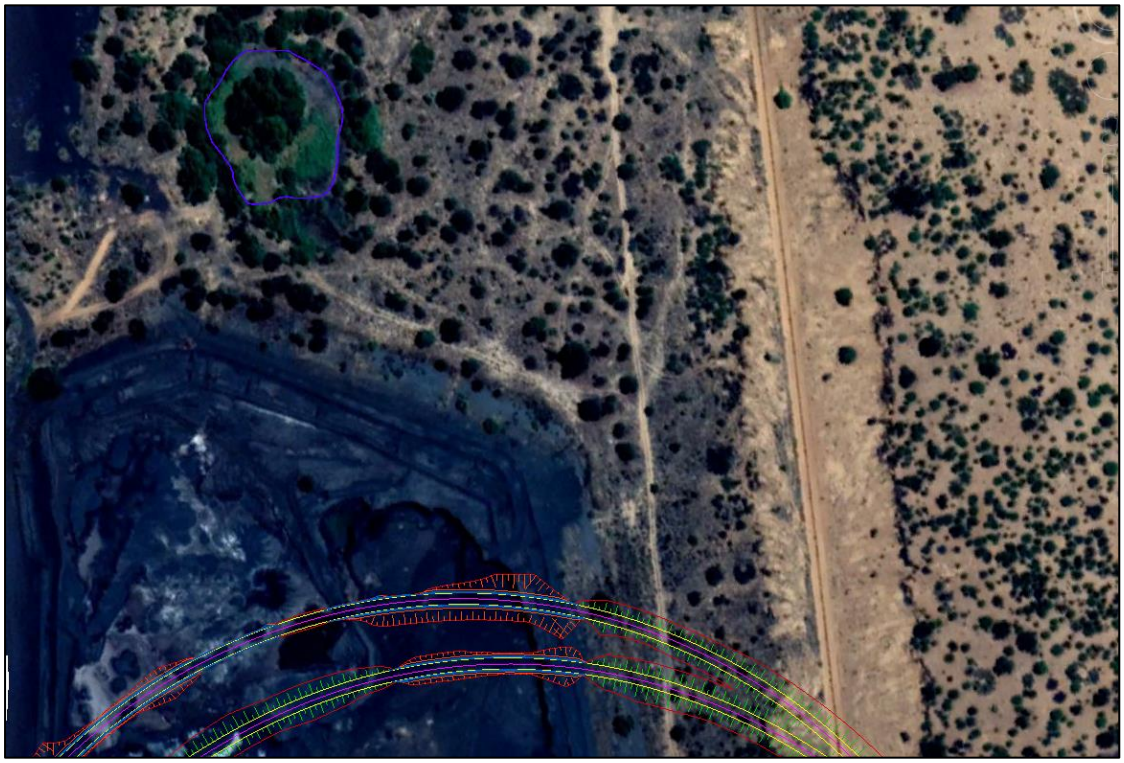

Figure 3: Satellite imagery indicating the locality of the artificial freshwater feature (blue polygon) in context to the proposed railway loop.

5. BUSINESS CASE, OPPORTUNITIES AND CONSTRAINTS APPLICABLE TO THE PROPOSED RAILWAY LOOP.

A single artificial feature identified as an endorheic system i.e., the Duck Pond, is situated approximately 216m north of the proposed railway loop. Due to the feature being artificial in nature and of an anthropogenic origin, it does not enjoy protection in terms of the NWA and NEMA. As a result, from a freshwater ecosystem resource management perspective, no development constraints are considered applicable and the proposed railway loop may be considered acceptable.

The proposed railway loop is not subject to any Zones of Regulation as per General Notice (GN 509) of the NWA and 32 m NEMA Zone of Regulation. As a result, this compliance statement must be submitted to the relevant competent authorities for approval prior to commencement of the construction of the proposed railway loop. Planning and construction of the railway must ensure continued free drainage of water within the landscape and ensure that no ponding of water adjacent the railway occurs.

We trust that we have interpreted your requirements correctly. Please do not hesitate to contact us if there are any aspects of this memorandum that you would like to discuss.

Yours Faithfully,

Stephen van Staden[3]
SACNASP REG.NO**: 400134/05 (Ecology)**

Declaration of independence and CV included in Appendix B and C respectively

[3] Co-authored by S. Pillay

6. REFERENCES

Department of Water Affairs and Forestry (DWAF). 2005. Final draft: A practical field procedure for identification and delineation of wetlands and Riparian areas.

Department of Water Affairs and Forestry (DWAF). 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas,* prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Report no. X. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water and Sanitation (DWS). 2014. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Secondary: C2 Compiled by RQIS-RDM: Online available: https://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx.

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NFEPA: Driver, A., Nel, J.L., Snaddon, K., Murruy, K., Roux, D.J., Hill, L., Swartz, E.R., Manuel, J. and Funke, N. 2011. Implementation Manual for Freshwater Ecosystem Priority Areas. Water Research Commission. Report No. 1801/1/11. Online available: http://bgis.sanbi.org/nfepa/project.asp

Van Deventer, H., Smith-Adao, L., Collins, N.B., Grenfell, M., Grundling, A., Grundling, P-L., Impson, D., Job, N., Lötter, M., Ollis, D., Petersen, C., Scherman, P., Sieben, E., Snaddon, K., Tererai, F. & Van der Colff, D. 2019. *South African National Biodiversity Assessment 2018: Technical Report. Volume 2b: Inland Aquatic (Freshwater) Realm. CSIR report number CSIR/NRE/ECOS/IR/2019/0004/A. South African National Biodiversity Institute, Pretoria. http://hdl.handle.net/20.500.12143/6230.*

Van Deventer, H.; Smith-Adao, L.; Mbona, N.; Petersen, C.; Skowno, A.; Collins, N.B.; Grenfell, M.; Job, N.; Lötter, M.; Ollis, D.; Scherman, P.; Sieben, E.; Snaddon, K. 2018. *South African Inventory of Inland Aquatic Ecosystems. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.*

APPENDIX A- DESK BASED DATABASE ANALYSES SUMMARY AND PROJECT MAPS

Table A1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the proposed railway loop and investigation area.

Aquatic ecoregion and sub-regions in which the proposed railway loop are located	
Ecoregion	Southern Kalahari
Catchment	Orange
Quaternary Catchment	D41M
WMA	Lower Vaal
subWMA	Molopo
Dominant characteristics of the Southern Kalahari (29.01) Aquatic Ecoregion Level 2 (Kleynhans *et al.*, 2007)	
Dominant primary terrain morphology	Plains; moderate relief, Closed Hills, mountains; moderate and high relief.
Dominant primary vegetation types	Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld
Altitude (m a.m.s.l)	700 - 1500
MAP (mm)	0 - 500
The coefficient of Variation (% of the MAP)	30 - 40
Rainfall concentration index	60 - >65
Rainfall seasonality	Late Summer
Mean annual temp. (°C)	16 - 22
Winter temperature (July)	0 - 22
Summer temperature (Feb)	16 - >32
Median annual simulated runoff (mm)	<5 – 40
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) [4]	
According to the NBA (2018): SAIIAE there are no wetlands or rivers associated with proposed railway loop or investigation area. The Ga-Mogara River is situated approximately 6,4 km east of the proposed railway loop.	

Detail of the proposed railway loop in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
FEPACODE	The proposed railway loop is situated within a SubWMA considered an **FEPA Catchment.** River FEPAs achieve biodiversity targets for river ecosystems and threatened fish species and were identified as rivers that are currently in a good condition (A or B ecological category). Although the FEPA status applies to the actual river reach, the surrounding land and smaller stream network need to be managed in a way that maintains the good condition of the river reach.
NFEPA Wetlands	According to the NFEPA Database there are no wetland features associated with the proposed railway loop and investigation area. The closest wetland feature is a natural flat wetland located 2 km to the north.
Wetland Vegetation Type	The proposed railway loop is situated within the Eastern Kalahari Bushveld Group 1, considered Least Threatened according to SANBI, 2012 and Mbona *et al.* (2015).
NFEPA Rivers	According to the NFEPA Database there are no rivers associated with the proposed railway loop nor the investigation area. The Ga-Mogara River is situated approximately 6,4 km east of the proposed railway loop.
Detail of the proposed railway loop in terms of the Northern Cape Critical Biodiversity Areas (2016)	
Other Natural Area	The majority of the proposed railway loop falls within an area classified as "Other Natural Areas (ONA). ONA consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).
National Web Based Environmental Screening Tool (2020).	
The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
According to the screening tool the overall aquatic sensitivity of the proposed railway loop is **Very High,** due to the proposed railway loop situated within a FEPA catchment**.**	

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; ETS = Ecosystem Threat Status; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area.

[4] The NBA (2018) Dataset includes the National Wetland Map 5 Information.

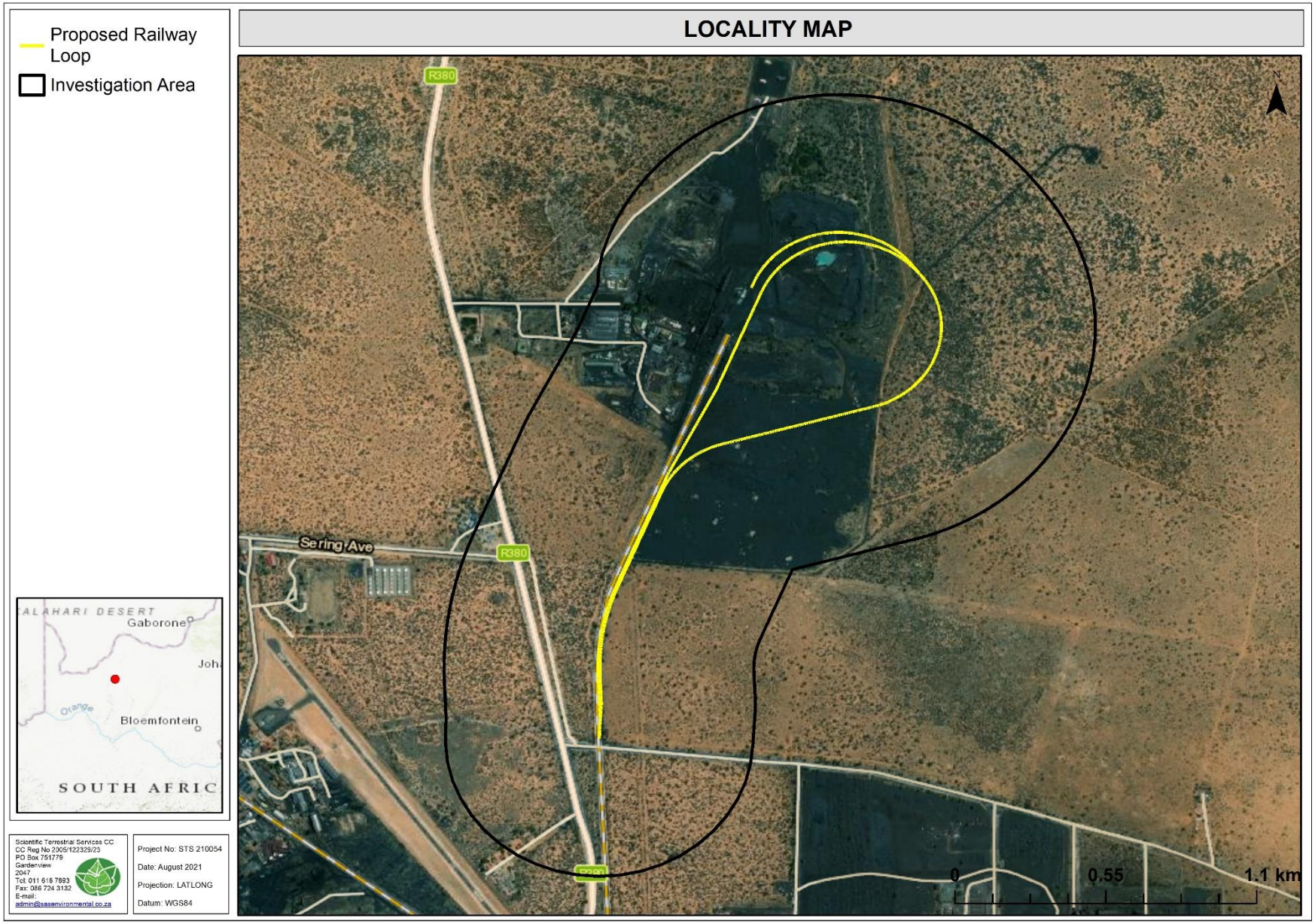


Figure A1: A digital satellite image depicting the location of the proposed railway loop in relation to the surrounding area.

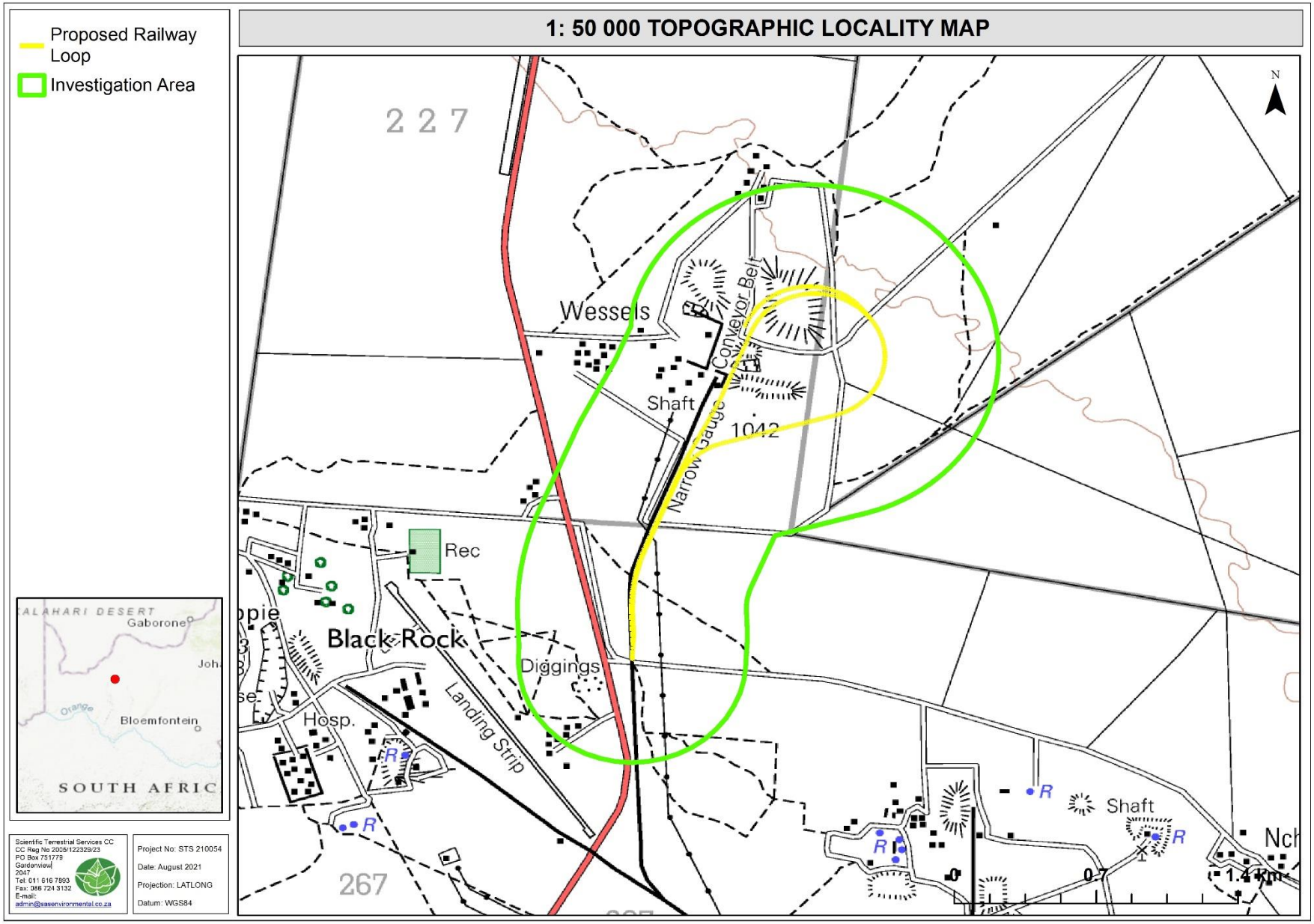


Figure A2: The proposed railway loop depicted on a 1:50 000 topographical map in relation to the surrounding area.

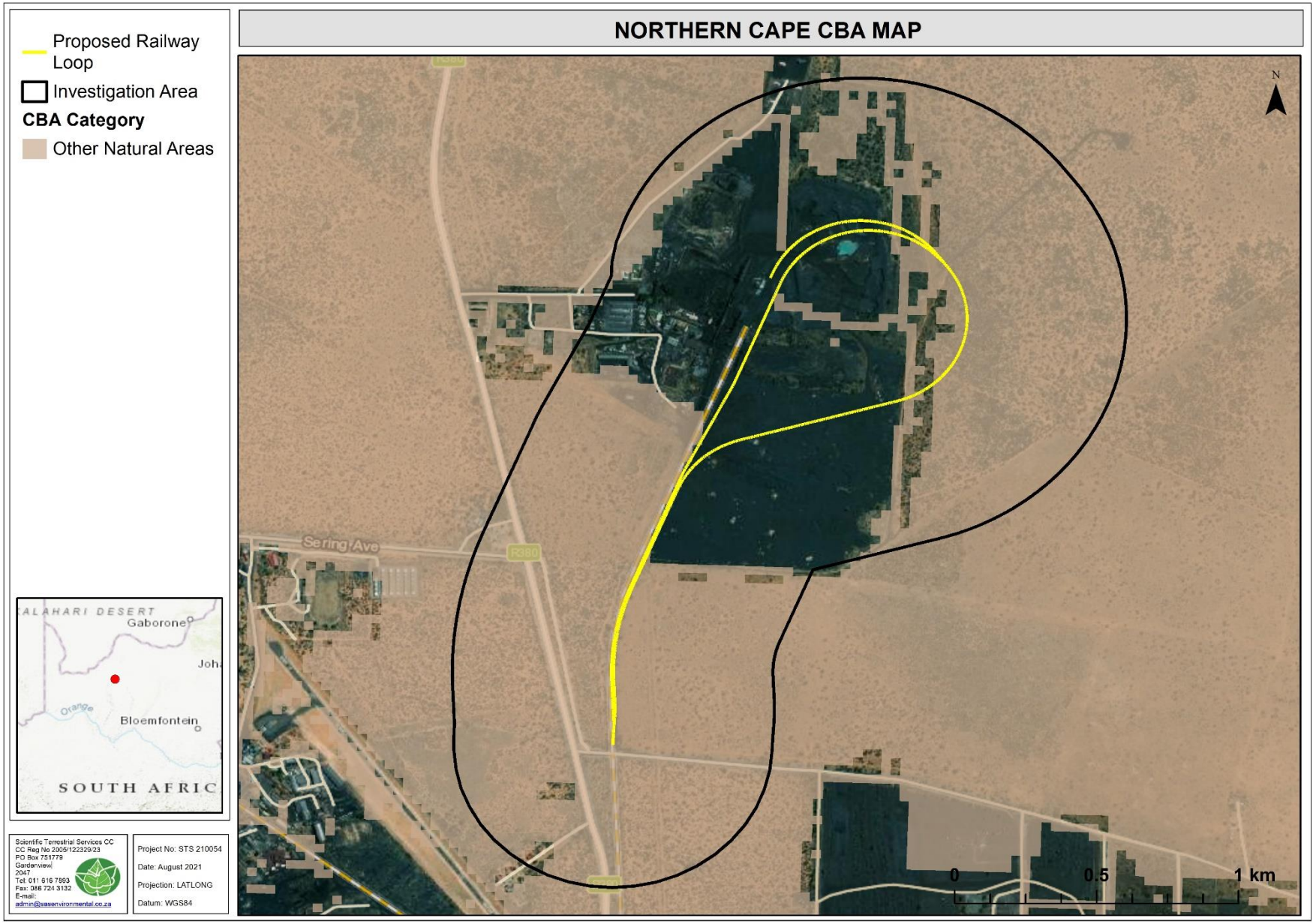


Figure A3: The sensitivity of the area associated with the proposed railway loop according to the Northern Cape CBA Map (2016).

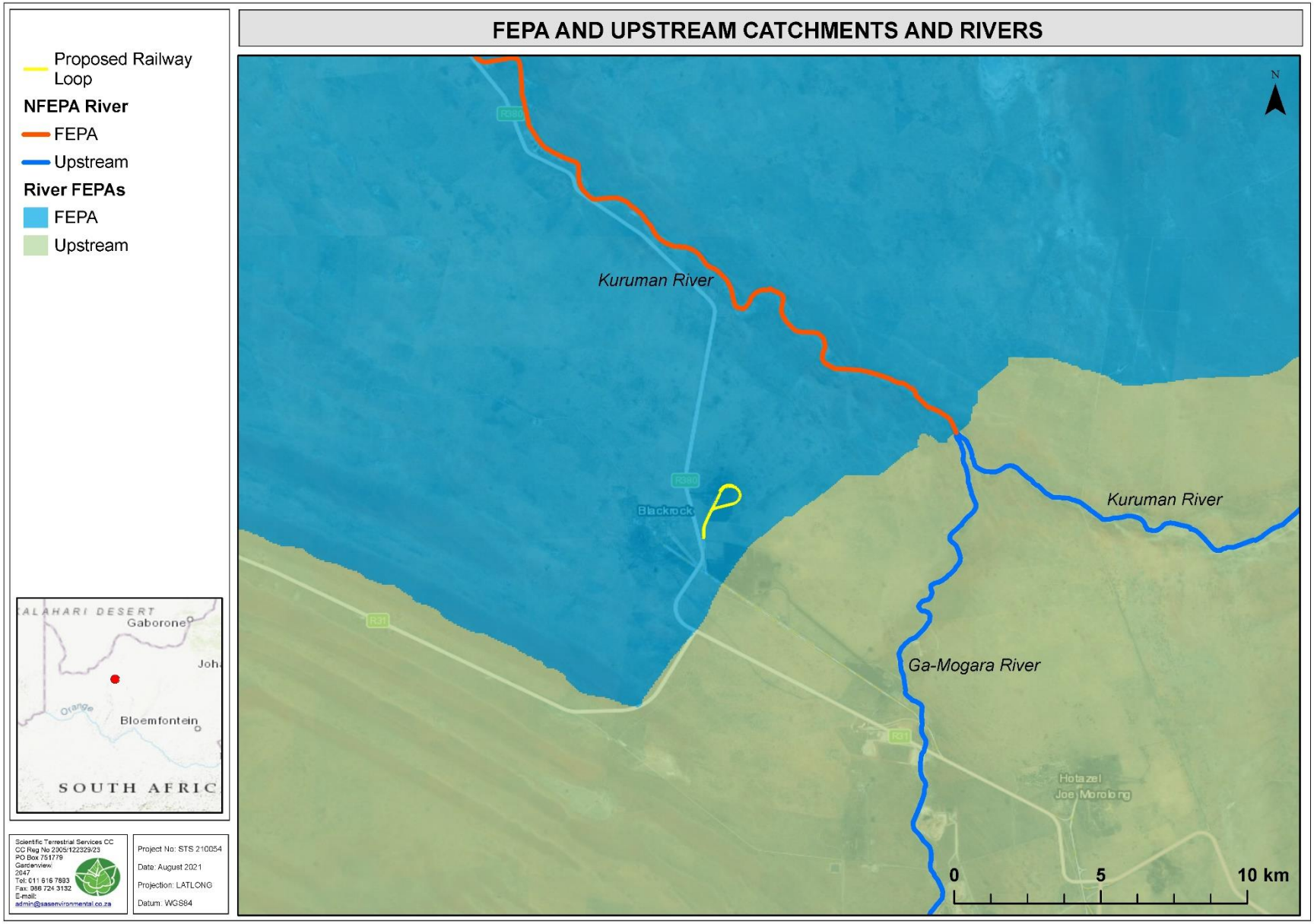


Figure A4: FEPA and upstream catchments associated with the proposed railway loop (NFEPA, 2011).

APPENDIX B - DECLARATION OF INDEPENDENCE

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Christopher Hooton BTech Nature Conservation (Tshwane University of Technology)

Sanja Erwee BSc Zoology (University of Pretoria)

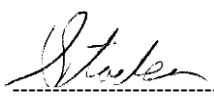
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority.

I, Stephen van Staden, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

I, Christopher Hooton, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct.

Specialist Signature

I, Sanja Erwee, declare that -

- I act as the **independent specialist** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

Signature of the Specialist

APPENDIX C- CV OF SPECIALISTS

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay, fluorspar
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTOPHER HOOTON

PERSONAL DETAILS

Position in Company	Senior Scientist, Member
	Biodiversity Specialist
Joined SAS Environmental Group of Companies	2013

EDUCATION

Qualifications

BTech Nature Conservation (Tshwane University of Technology)	2013
National Diploma Nature Conservation (Tshwane University of Technology)	2008

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape, Free State
Africa - Zimbabwe, Sierra Leone and Zambia

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Faunal Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	GIS Technician and Visual Specialist
Joined SAS Environmental Group of Companies	2014

EDUCATION

Qualifications

BSC Zoology (University of Pretoria)	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017
ESRI MOOC ARCGIS Cartography	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Western Cape, Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Plant species and Landscape Plan

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil and land capability).

HERITAGE IMPACT ASSESSMENT

In terms of Section 38(8) of the NHRA for the

Proposed upgrade to the existing railway infrastructure at the Wessels Mine near Hotazel in the Northern Cape

Prepared by CTS Heritage

CTS HERITAGE

For

SLR Consulting

June 2021

CTS HERITAGE

EXECUTIVE SUMMARY

1. Site Name:

Wessels Mine Railway Infrastructure

2. Location:

Near Hotazel in the Northern Cape

3. Locality Plan:

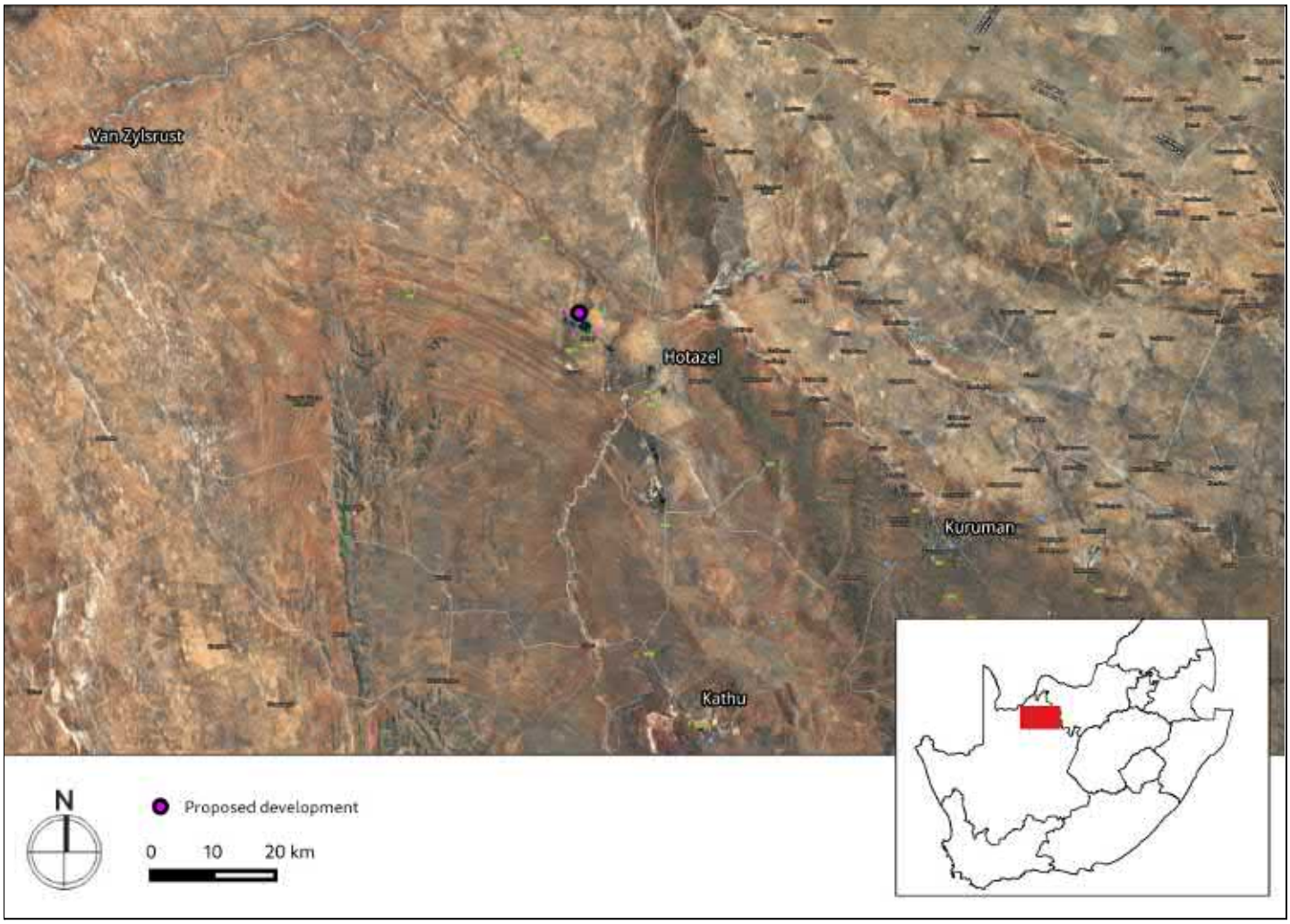


Figure 1: Location of the proposed development site

Cedar Tower Services (Pty) Ltd t/a CTS Heritage
34 Harries Street, Plumstead
Tel +27 (0)87 073 5739 **Email** info@ctsheritage.com **Web** http://www.ctsheritage.com

4. Description of Proposed Development:

South32 intends to upgrade the existing railway infrastructure at the Wessels Mine. The upgrade will consist of modifications to the staging rail lines and the design of a new rail balloon. The extension of the railway into the new railway balloon measures at approximately 2 500 m long and 25 m wide and would result in the clearing of indigenous vegetation (more than 1 hectare, but less than 20 hectares). Additionally, the railway would cross a section of the existing tailings dam and would thus result in the removal of approximately 15 000 – 25 000 m3 of material from the tailings area, which would then be deposited on another existing tailings dam. The new railway extension would be located within the existing Mining Right (MR) boundary at the Wessels Mine and amendments to the mine's Water Use Licence (WUL) are not required.

5. Heritage Resources Identified:

No heritage resources were identified within the area proposed for development. No graves were located or identified in the field assessment. Furthermore, no intangible heritage resources were identified. Interviews with mining officials revealed no known oral histories associated with this area or remnants of graves or symbolic heritage.

6. Anticipated Impacts on Heritage Resources:

Due to the nature of the landscape and disturbed site footprint, it is unlikely that the proposed development will negatively impact on significant heritage resources.

7. Recommendations:

There is no objection to the proposed development on heritage grounds and the following is recommended:

1. No mitigation is required prior to construction commencing.
2. The attached Chance Fossil Finds Procedure (Appendix 3) must be implemented during the construction phase of development, and included in the EMPr
3. If any archaeological resources or unmarked human remains are uncovered or exposed during excavations these must immediately be reported to the South African Heritage Resources Agency (SAHRA) (Att: Ms Natasha Higgitt 021 462 4502). Burials must not be removed until inspected by a professional archaeologist.

CTS HERITAGE

CONTENTS

APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

South32 intends to upgrade the existing railway infrastructure at the Wessels Mine. The upgrade will consist of modifications to the staging rail lines and the design of a new rail balloon. The extension of the railway into the new railway balloon measures at approximately 2 500 m long and 15 m wide and would result in the clearing of indigenous vegetation (more than 1 hectare, but less than 20 hectares). Additionally, the railway would cross a section of the existing tailings dam and would thus result in the removal of approximately 15 000 – 25 000 m3 of material from the tailings area, which would then be deposited on another existing tailings dam. The new railway extension would be located within the existing Mining Right (MR) boundary at the Wessels Mine and amendments to the mine's Water Use Licence (WUL) are not required.

1.2 Description of Property and Affected Environment

The environment consists of flat sandy plains covered with vegetation towards the east. The largest part of the environment is currently used for mining activities. The eastern section of the site footprint is situated just outside of the mine perimeter (fencing 0f 2,4m high). This section is located on open farmland and is undisturbed, except for a few cement abandoned foundations and one prospecting borehole. This area is mostly flat and sandy.

Towards the north and south of the balloon, the terrain has previously been very disturbed by various mining activities such as borrow pit excavations, road construction, construction of clear areas to process areas and loading zones. There is also a large mining heap just east of the mining plant. The area is also scattered with old machinery and industrial debris in certain areas. It is obvious that the mine altered this landscape through the years by means of construction and ground movement operations.

The entire site is very disturbed except for the eastern section of the loop/balloon which is situated in an undisturbed landscape. This undisturbed area covers a minimal area of approximately 1-2 ha. Noted disturbances include:

- Various two track gravel/sand roads throughout the site.
- Excavated borrow pits, quarries are present at several places on the site, especially around the mine plant.
- Large areas cleared for processing and loading of ore.
- Various disturbed areas previously used for construction activities, abandoned cement foundations in

certain areas and the presence of previous prospecting boreholes.

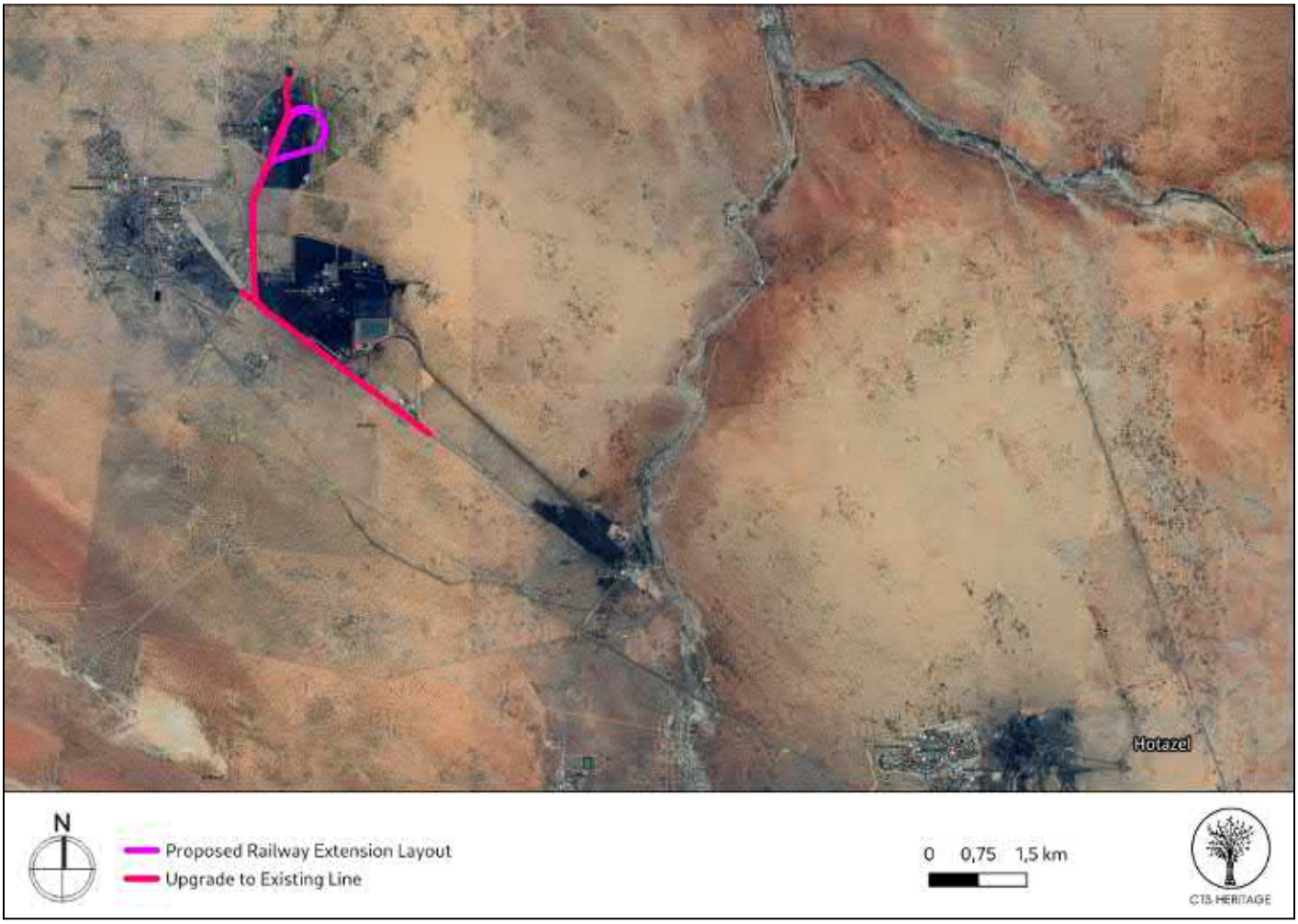


Figure 1.1: Proposed location of development and alternatives

Figure 1.2: Satellite image indicating proposed location of infrastructure upgrades and new development

Figure 1.3: Satellite image indicating proposed location of new development

2. METHODOLOGY

2.1 Purpose of HIA

The purpose of this Heritage Impact Assessment (HIA) is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written
- An archaeologist conducted a walk-through of the area proposed for development on 2 June 2021

- The identified resources were assessed to evaluate their heritage significance
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner

2.3 Assumptions and uncertainties

- The *significance* of heritage resources is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.
- It should be noted that archaeological and palaeontological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.
- It is further assumed that the fossil potential of a formation in the Project Area will be typical of that found in the region and more specifically, similar to that already observed in the surrounds of the Project Area. In many cases the information on fossil content is limited to the basics, such as in the case of geological mapping when the fossils are not the immediate focus. Scientifically important fossil shell and bone material is expected to be sparsely scattered in these coastal-plain deposits, but unless large and obvious, is not generally seen, under-estimating the fossil prevalence. Much depends on careful scrutiny of exposures and on spotting fossils as they are uncovered during digging *i.e.* by monitoring excavations. A limitation on predictive capacity exists in that it is not possible to predict the buried fossil content of an area or formation other than in general terms.

2.4 Constraints & Limitations

It was difficult to gain access to all the areas of the proposed development footprint due to the high levels of security associated with the mine. Certain areas were out of bounds to survey for impacts to archaeological resources but these areas were mostly within the mine perimeter where the site footprint is already very disturbed.

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Heritage Context of area proposed for development

The area proposed for the railway infrastructure upgrade and the new rail balloon is located within the existing Wessels Mine in close proximity to the town of Hotazel in the Northern Cape. Hotazel was designated as a town in the 1950's in order to service the surrounding manganese mines. As per Figure 2, the area proposed for development as well as its surroundings have previously been assessed for impacts to heritage resources. The specific area proposed for development in this application has been looked at by Hutton and Hutton (2013, SAHRIS NID 145193) and Kusel and van der Ryst (2009, SAHRIS NID 8383) who conducted an assessment for the neighbouring Black Rock Mine. These reports are relied on below to provide some insight into the heritage sensitivities of the area proposed for development.

According to Kusel and van der Ryst (2009), "The first Geologist to have surveyed the Northern Cape was Dr. A. W. Rogers of the Geological Commission of the Cape Colony in 1906. One of the features he noted was a small hill called Black Rock and reported on the presence of manganese ore at the base of the hill. In 1940 Associated Manganese Mines of South Africa acquired the manganese outcrop known as Black Rock and shortly afterwards started mining the deposit… A large black outcrop of Manganese ore is the outstanding feature in the landscape of the Black Rock mining area. This outcrop was mined since the 1940's both by open cast and underground mining… The original Black Rock outcrop and mining represent an important part of the mining history of Manganese mining in South Africa". For this reason, Kusel and van der Ryst (2009) recommend, among other things, that the Black Mountain Mine be declared as a National Heritage Site; however, no evidence of this recommendation being implemented has been identified.

Both Hutton and Hutton (2013) and Kusel and van der Ryst (2009) identified Early, Middle and Later Stone Age archaeological resources located within proximity of the proposed development (Figure 3). Hutton and Hutton (2013) and Kusel and van der Ryst (2009) both indicate that the identified artefacts are predominantly located along the Kuruman and Ga-Mogara River banks. Hutton and Hutton (2013) note that no heritage resources were identified in the areas located away from the rivers, described as consisting of "red Kalahari sands with little vegetation cover."

As per Figure 3, the heritage resources known from the broader area that are not associated with the banks of

surrounding rivers include a burial identified by Kusel and van der Ryst (2009) and two structures identified by Van Vollenhoven (2012, SAHRIS ID 48871). This burial site (SAHRIS SIte ID 45910) is described as “The area is fenced off and has some 60+ graves. The graves are those of black mine workers who died at the mine. The graves are unmarked with no tombstones. Only one grave has a date of 8/7/74. The cemetery most probably represents the graves of black mine workers from the 1940’s to the 7 1970’s. The graves are not visited any more by relatives as no grave goods are present. Most probably these graves are from migrant mine workers from far afield.” Sites 39460 and 39463 are both described by Van Vollenhoven (2012) as limestone houses, each date to the 1920’s and are likely the original farmsteads for their respective farms. Based on the information available, the area proposed for the upgrade of the railway infrastructure and proposed new rail balloon does not constitute a sensitive archaeological landscape and as such, it is unlikely that significant archaeological and built environment resources will be negatively impacted by the proposed development.

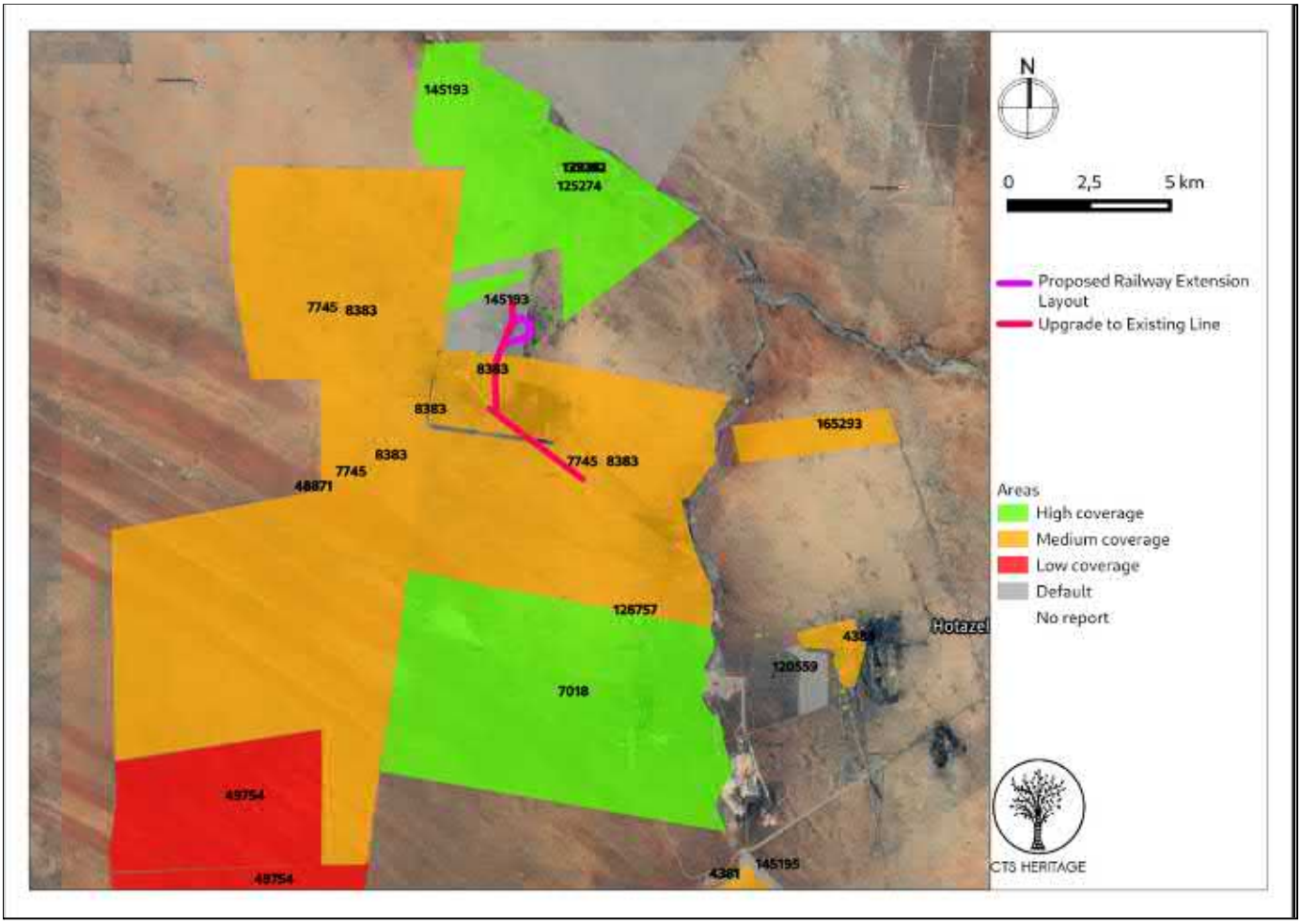


Figure 2.1: Spatialisation of heritage assessments conducted in proximity to the proposed development taken from SAHRIS (June, 2021)

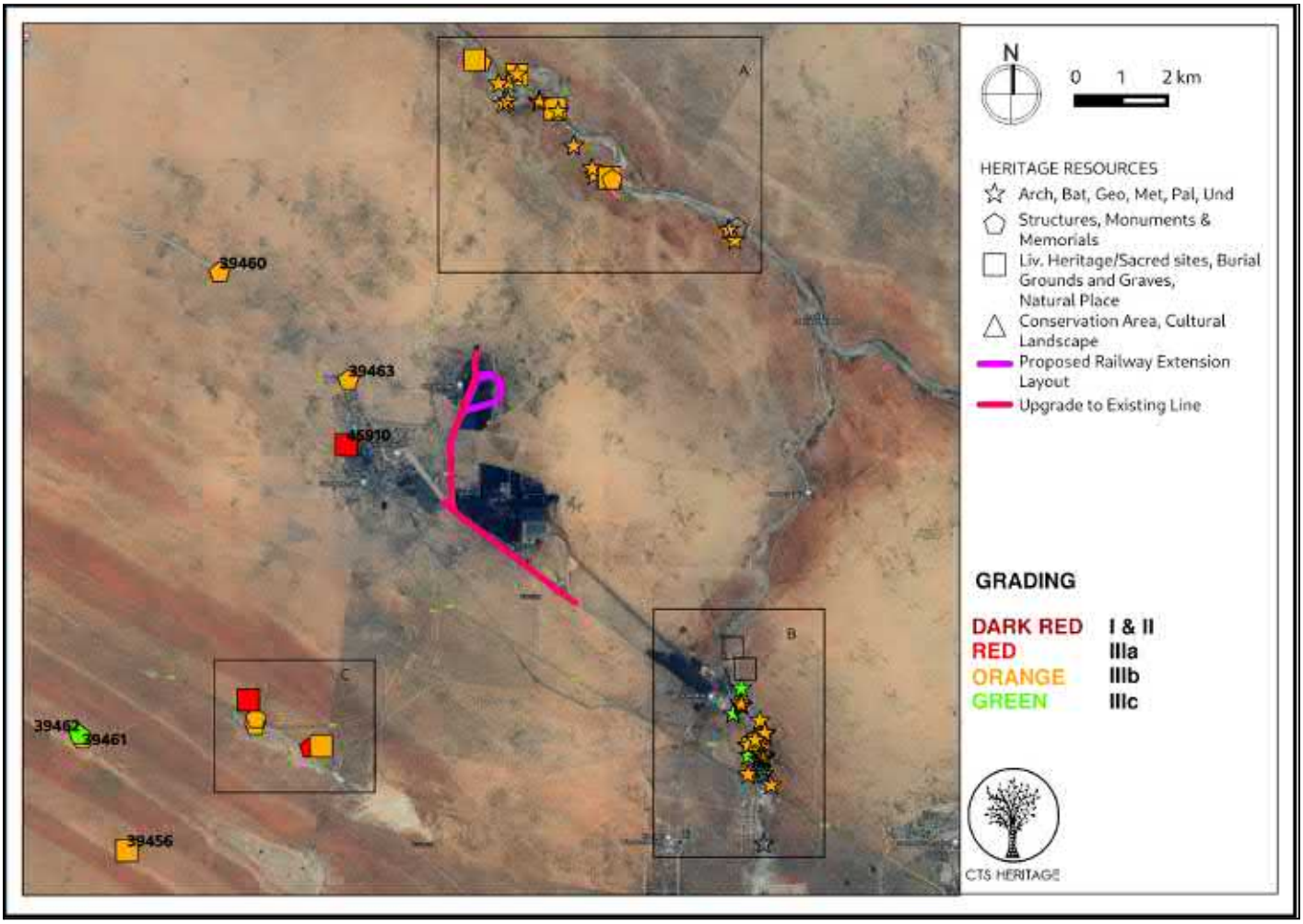


Figure 2.2: Spatialisation of known heritage resources in proximity to the proposed development (see Appendix for insets and list of resources)

3.2 Palaeontology

According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development is underlain by sediments of moderate palaeontological sensitivity. According to the extract from the Council of GeoScience Kuruman Map 2722 (Figure 5), the development area is underlain by red to flesh-coloured wind-blown sands. This corresponds with the findings of the HIA completed by Hutton and Hutton (2013) who note that geology "mainly consist(s) of aeolian red sand and the occasional surface calcrete with deep sandy soils of Hutton and Clovelly soil forms. The Kuruman River and associated river banks are embedded within the Kalahari sediments that cover

the Precambrian metamorphic crust. The riverbeds are silty, sandy and rocky and poorly drained."

As such, it is very unlikely that the proposed development will negatively impact on significant palaeontological heritage; however, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

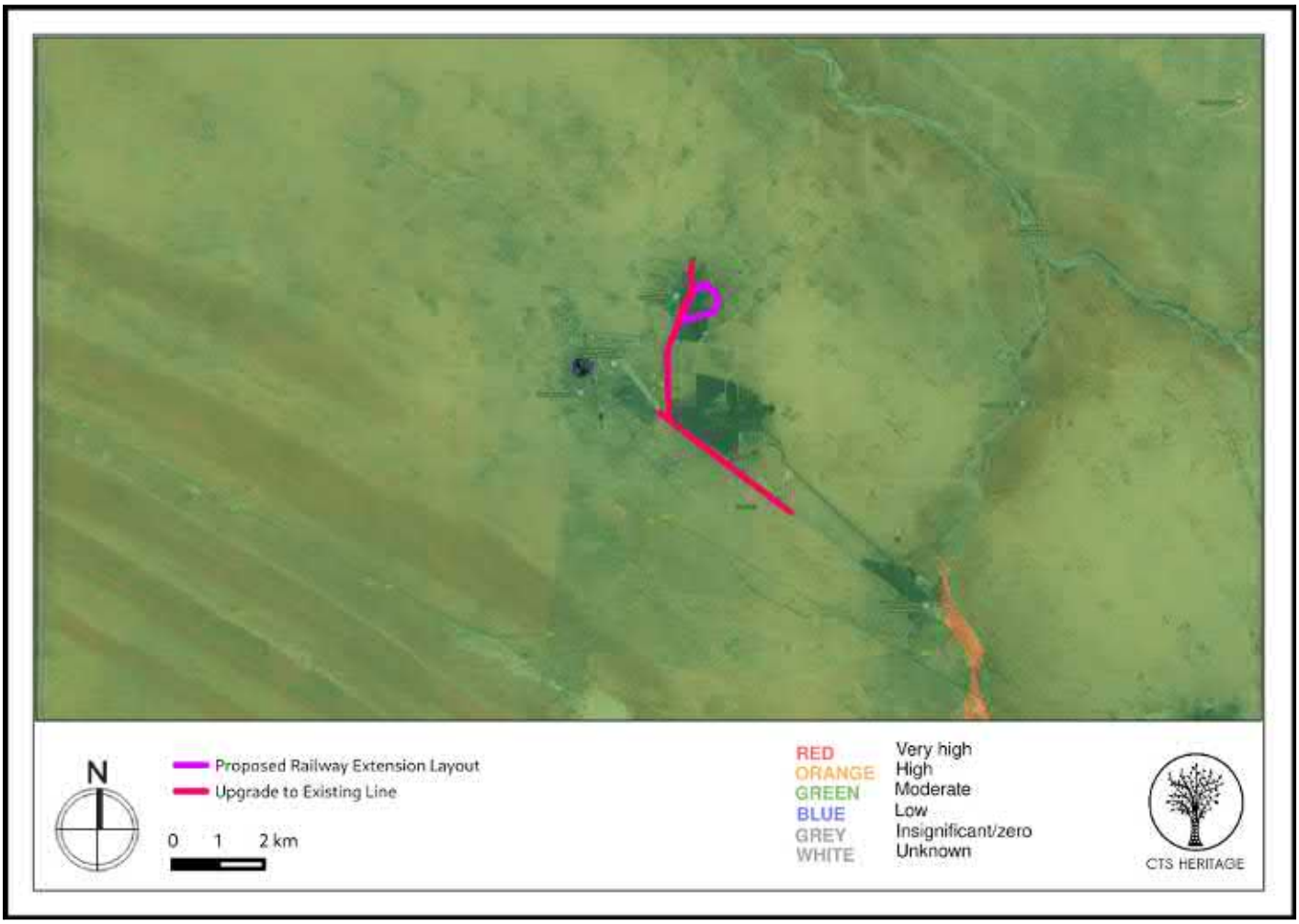


Figure 3.1: Palaeontological sensitivity of the proposed development area

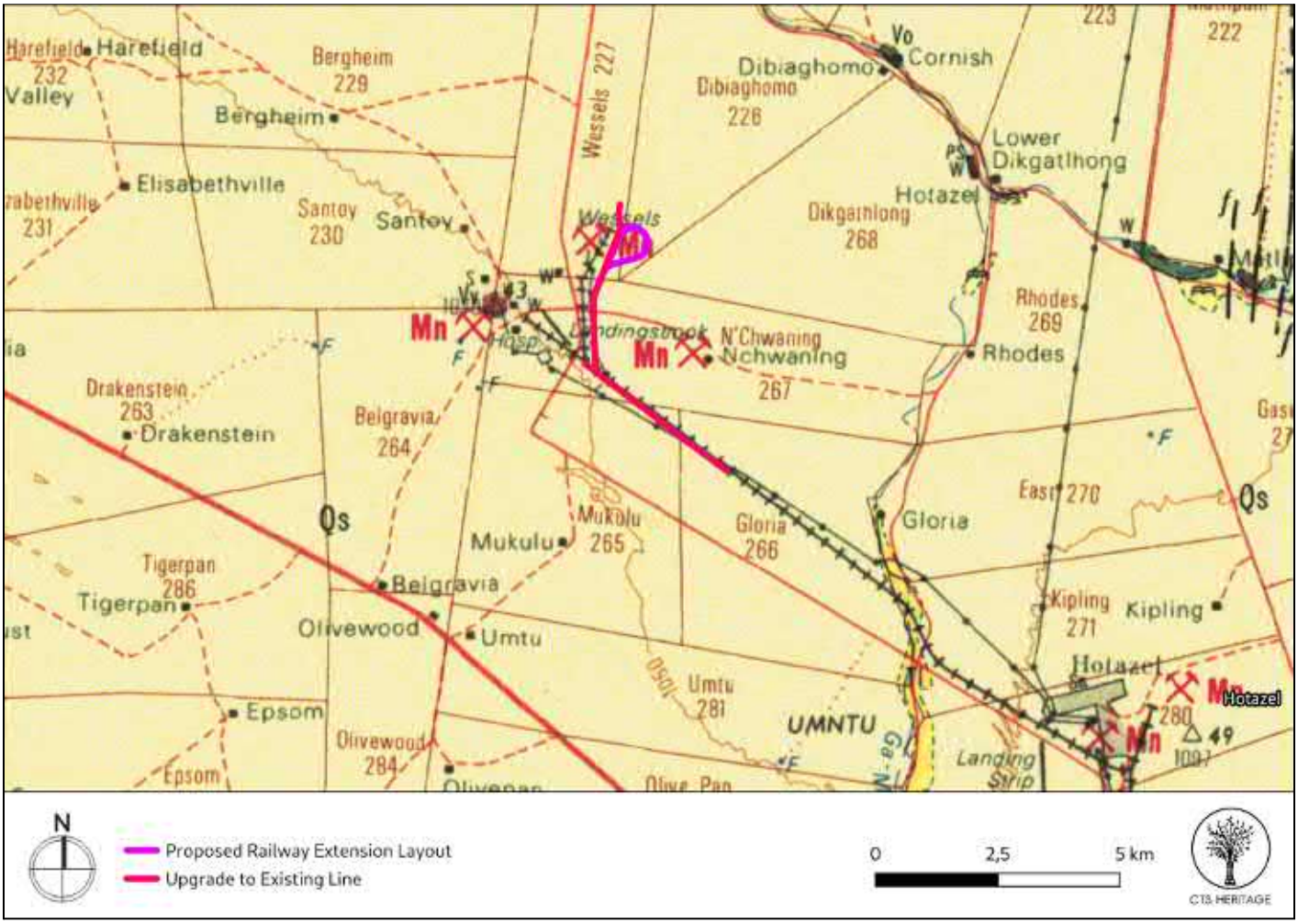


Figure 3.2: Extract from the Council for GeoScience Kuruman Map 2722 indicating that the area proposed for development is underlain by QC - red to flesh-coloured wind-blown sands

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

The field assessment identified no heritage resources located within or in close proximity to the proposed development area.

Figure 4.1 Contextual image of development area

Figure 4.2 Contextual image of development area

Figure 4.3 Contextual image of development area

Figure 4.4 Contextual image of development area

Figure 4.5 Contextual image of development area

Figure 4.6 Contextual image of development area

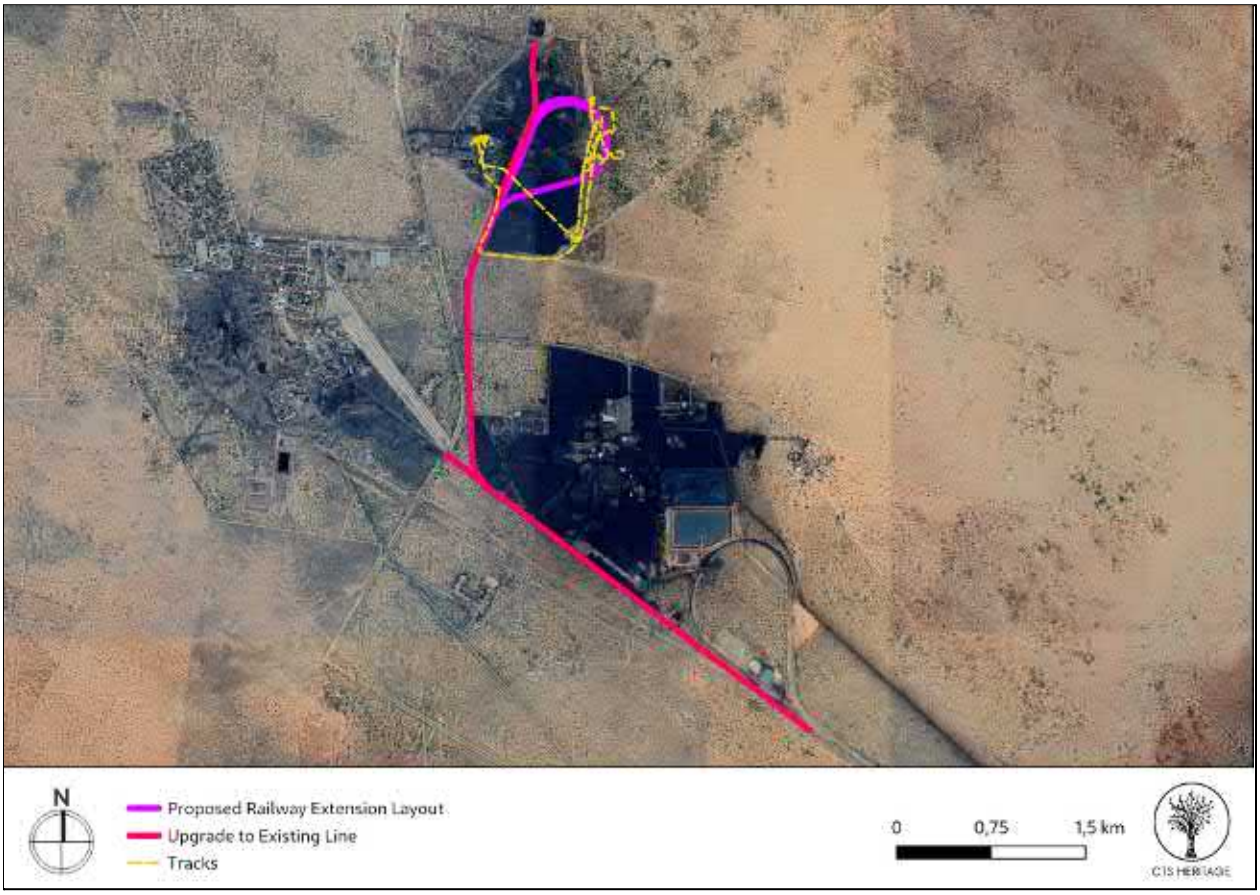


Figure 5: Track paths followed by archaeologist

4.2 Heritage Resources identified

No heritage resources were identified within the area proposed for development. No graves were located or identified in the field assessment. Furthermore, no intangible heritage resources were identified. Interviews with mining officials revealed no known oral histories associated with this area or remnants of graves or symbolic heritage.

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

The results of the study indicate that the proposed development site is not a sensitive archaeological landscape, and has been highly transformed by historical agriculture and industrial mining development. The proposed development will have no impact on any significant archaeological resources.

There are no significant natural landscape features on the proposed site or in the surrounding area. Furthermore, there are no indications of any structures of cultural significance located within the proposed development area.

Due to the extensively disturbed nature of the area proposed for development, it is assumed that heritage resources have been impacted by construction and mining activities. The small eastern section of the balloon/ site footprint is located within a mostly undisturbed landscape. This area was thoroughly surveyed on foot and no evidence of any heritage or cultural material was identified.

According to the extract from the Council of GeoScience Kuruman Map 2722 (Figure 5), the development area is underlain by red to flesh-coloured wind-blown sands. This corresponds with the findings of the HIA completed by Hutton and Hutton (2013) who note that geology "mainly consist(s) of aeolian red sand and the occasional surface calcrete with deep sandy soils of Hutton and Clovelly soil forms. The Kuruman River and associated river banks are embedded within the Kalahari sediments that cover the Precambrian metamorphic crust. The riverbeds are silty, sandy and rocky and poorly drained." As such, it is very unlikely that the proposed development will negatively impact on significant palaeontological heritage; however, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

Due to the nature of the landscape and disturbed site footprint, it is unlikely that the proposed development will negatively impact on significant heritage resources.

5.2 Sustainable Social and Economic Benefit

From the client:

The project is motivated by the inefficiency of the current railway configuration, which does not allow for optimal and cost-effective loading of manganese ore and product from the mine for transport to the market. The

proposed project would allow for more ore to be loaded onto the railway carts in a shorter space of time, hereby increasing outputs and productivity. It would also decrease the need for road transport, which is considered more expensive and inefficient in relation to rail transport. A staff complement of approximately 250 individuals will be required for the construction phase, hereby providing skilled and unskilled job opportunities. Procurement opportunities will be sourced locally, as far as possible.

As no impacts to heritage resources are anticipated, the socio-economic benefits outweigh the impacts to heritage resources.

5.3 Proposed development alternatives

Two development alternatives are proposed (Figure 1.2). The alternatives different in terms of footprint size. Alternative 2 would require the reconfiguration of the road intersection R380 x Access road to Nchwaning Mine and as such, this alternative is not preferred by the developer.

As no impacts to heritage resources are anticipated from either alternative, there is no preferred alternative in terms of impacts to heritage resources.

6. PUBLIC CONSULTATION

Public Participation on this HIA is being undertaken as part of a legislated Basic Assessment process. The BAR and EMPr will be updated to include any comments received during the pre-application notification period and will be made available for public review (for 30 calendar days). Registered I&APs will be notified when the BAR and EMPr will be available for review via SMS and email. Full copies of the BAR and EMPr will be made available on SLR's website and SLR's data-free website. A Non-Technical Summary will also be made available on SLR's websites and would be translated into Afrikaans and Setswana. Any heritage comments will be referred to SAHRA.

7. CONCLUSION

The site proposed for development is located within an area of low cultural landscape significance consisting predominantly of industrial mining development and agricultural fields intersected with roads. The results of the study indicate that the proposed development site is not a sensitive archaeological landscape, and has been

highly transformed by historical agriculture and industrial development. The proposed development will have no impact on any significant archaeological or cultural landscape heritage resources.

According to the extract from the Council of GeoScience Kuruman Map 2722 (Figure 5), the development area is underlain by red to flesh-coloured wind-blown sands. This corresponds with the findings of the HIA completed by Hutton and Hutton (2013) who note that geology "mainly consist(s) of aeolian red sand and the occasional surface calcrete with deep sandy soils of Hutton and Clovelly soil forms. The Kuruman River and associated river banks are embedded within the Kalahari sediments that cover the Precambrian metamorphic crust. The riverbeds are silty, sandy and rocky and poorly drained."

As such, it is very unlikely that the proposed development will negatively impact on significant palaeontological heritage; however, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

8. RECOMMENDATIONS

There is no objection to the proposed development on heritage grounds and the following is recommended:

4. No mitigation is required prior to construction commencing.
5. The attached Chance Fossil Finds Procedure (Appendix 3) must be implemented during the construction phase of development, and included in the EMPr
6. If any archaeological resources or unmarked human remains are uncovered or exposed during excavations these must immediately be reported to the South African Heritage Resources Agency (SAHRA) (Att: Ms Natasha Higgitt 021 462 4502). Burials must not be removed until inspected by a professional archaeologist.

9. REFERENCES

Impact Assessment References				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
4388	AIA Phase 1	Peter Beaumont	14/06/2008	Phase 1 Archaeological Impact Assessment Report on Areas at Hotazhel Mine on the Farm Hotazhel 280, Kgalagadi District Municipality, Northern Cape Province
7018	AIA Phase 1	Wouter Fourie, Jaco van der Walt	31/03/2007	Kalahari Manganese Mines: Heritage Assessment on Umtu 281, Olive Pan 282, Gama 283
7745	AIA Phase 1	Anton Pelser, Anton van Vollenhoven	03/05/2011	A REPORT ON A HERITAGE IMPACT ASSESSMENT (HIA) FOR A PROPOSED NEW RAIL CROSSING OVER THE GAMAGARA RIVER FOR THE GLORIA MINE OPERATIONS, ASSMANG BLACK ROCK, ON GLORIA 266, NORTH OF HOTAZEL, NORTHERN CAPE
8383	HIA Phase 1	Udo Kusel, M van der Ryst	18/09/2009	Cultural Heritage Resources impact assessment of manganese mining areas on the farms Belgravia 264, Santoy 230, Gloria 226 and Nichwaning 267, at Black Rockm North of Kuruman, Kgalagadi District Municipality, Northern Cape Province.
48871	HIA Phase 1	Anton van Vollenhoven	01/04/2012	A REPORT ON A HERITAGE IMPACT ASSESSMENT FORTHE PROPOSED MAIN STREET 778 (PTY) LTD MINING RIGHT APPLICATION CLOSE TO HOTAZEL, NORTHERN CAPE PROVINCE
49754	Heritage Scoping	Tobias Coetzee	31/07/2012	ARCHAEOLOGICAL SCOPING REPORT FOR THE PROPOSED PROSPECTING FOR IRON ORE AND MANGANESE ORE FOR AMARI MANGANESE (PTY) LTD ON THE FARMS CONSTANTIA 309, SIMONDIUM 308 AND PORTIONS 1, 2, 3 AND 8 OF THE FARM GOOLD 329 IN THE VICINITY OF District Municipality: Kgalagadi Northern Cape Province SOUTH AFRICA
120559	HIA Phase 1	Robert de Jong	16/05/2010	HIA PROPOSED LAND USE CHANGE TO PROVIDE FOR THE EXTENSION OF THE TOWN OF HOTAZEL PHASE III
125274	Heritage Impact Assessment Specialist	Wouter Fourie	22/07/2013	Tshipi Ã© Ntle Manganese Mining: Prospecting on Remaining extent of the farm Wessels 227 and Portions 1 and 2 and the remaining extent of the farm Dibiaghomo 226, near Black Rock in the Northern Cape Province, Heritage Impact Assessment

	Reports			
128757	Archaeological Specialist Reports	Wouter Fourie	14/05/2013	Prospecting activities on the farm Gloria 266, near Hotazel in the Northern Cape Province Heritage Impact Assessment
129381	HIA Phase 1	Wouter Fourie	17/07/2013	Lehating Heritage Impact Assessment Proposed Lehating Mining (Pty) Ltd underground manganese mine on Portions 1 of the Farm Lehating 714 and Portion 2 of the farm Wessels 227, approximately 20km northwest of Hotazel, Northern Cape Province
132292	HIA Phase 1	Wouter Fourie		Heritage Impact Assessment for the Proposed Lehating Mining (Pty) Ltd underground manganese mine on Portions 1 of the Farm Lehating 714 and Portion 2 of the farm Wessels, 227, approximately 20km northwest of Hotazel, Northern Cape Province
145193	HIA Phase 1	Louisa Hutten, Willem Hutten	18/11/2013	HIA report for Boerdraai 228 and Wessels 227 portion 2
165293	AIA Phase 1	Neels Kruger	18/05/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF A DEMARCATED SURFACE PORTION ON THE FARM RHODES 269 FOR THE PROPOSED RHODES 1 PHOTOVOLTAIC POWER PLANT & ACCESS ROAD DEVELOPMENT, JOE MOROLONG LOCAL MUNICIPALITY, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

CTS HERITAGE

APPENDICES

CTS HERITAGE

APPENDIX 1: Desktop Screening Assessment

CTS HERITAGE

HERITAGE SCREENER

CTS Reference Number:	**CTS21_071**
HWC Ref Number	
Client:	**SLR**
Date:	**June 2021**
Title:	**Proposed extension of the railway infrastructure at the Wessels Mine near Hotazel in the Northern Cape**

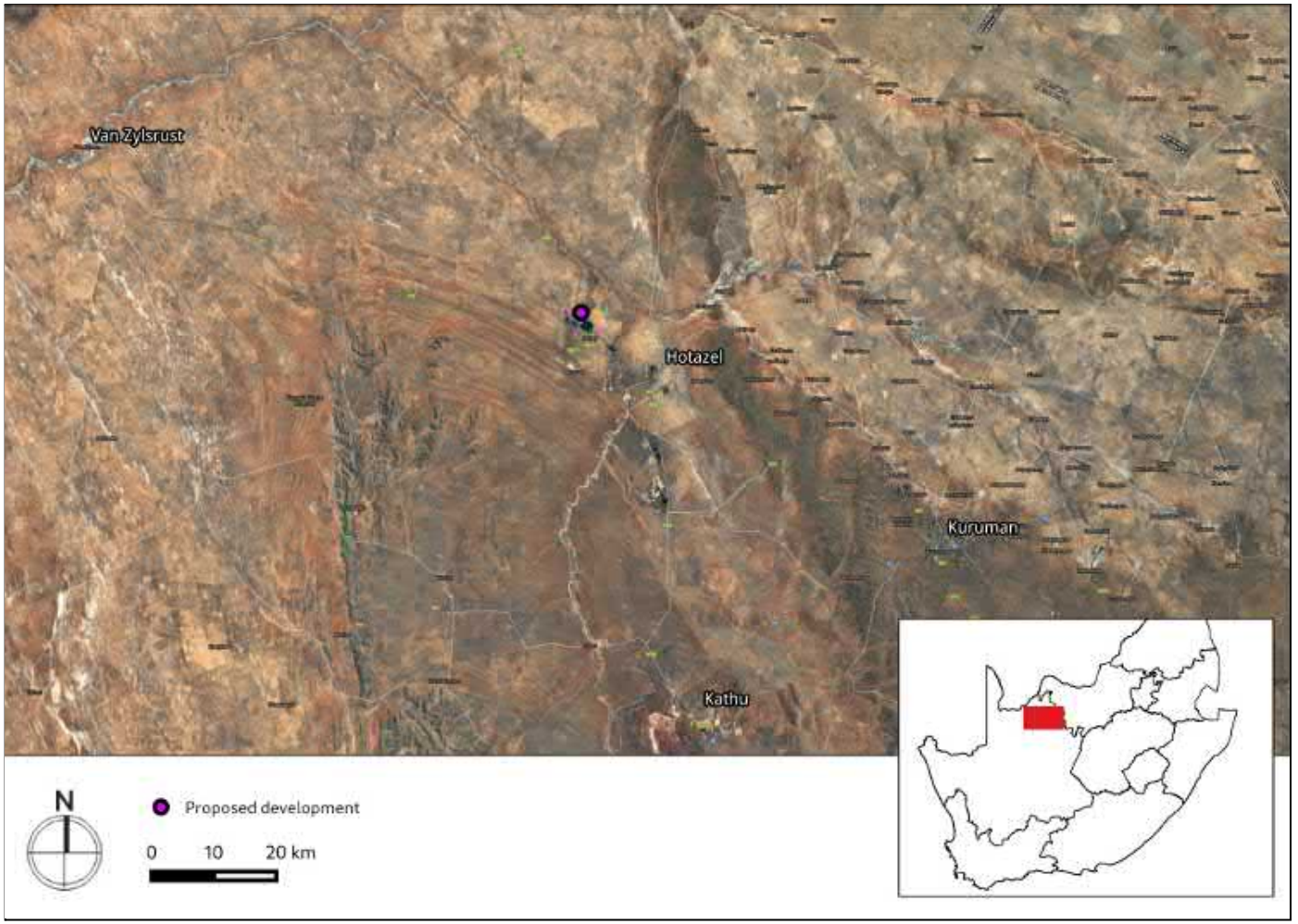


Figure 1a. Satellite map indicating the location of the proposed development in the Western Cape Province

Recommendation:	**RECOMMENDATION** **Based on the available information, the proposed development is not likely to impact on significant cultural landscape, built environment, archaeological or palaeontological heritage resources and as such, it is recommended that no further studies in terms of section 38 of the NHRA are required.**

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1. Proposed Development Summary

Hotazel Manganese Mines (Pty) Ltd (HMM), a subsidiary of South32 Limited (South32), intends to upgrade the existing railway infrastructure at the Wessels Mine. The upgrade will consist of modifications to the staging rail lines and the design of a new rail balloon. The extension of the railway into the new railway balloon measures at approximately 2 500 m long and 25 m wide and would result in the clearing of indigenous vegetation (more than 1 hectare, but less than 20 hectares). Additionally, the railway would cross a section of the existing tailings dam and would thus result in the removal of approximately 15 000 – 25 000 m3 of material from the tailings area, which would then be deposited on another existing tailings dam. The new railway extension would be located within the existing Mining Right (MR) boundary at the Wessels Mine and amendments to the mine's Water Use Licence (WUL) are not required.

2. Application References

Name of relevant heritage authority(s)	SAHRA
Name of decision making authority(s)	Northern Cape DMRE

3. Property Information

Latitude / Longitude	27° 7'7.57"S 22°51'22.79"E
Erf number / Farm number	Farm Wessels 227
Local Municipality	Joe Morolong
District Municipality	John Taolo Gaetsewe
Province	Northern Cape
Current Use	Mine
Current Zoning	Agriculture

4. Nature of the Proposed Development

Total Surface Area	<4ha

Depth of excavation (m)	Typical earthworks excavations will be less than 2 m. Pilling for structures can be 40 m deep.
Height of development (m)	The rail will not protrude more than 2m. The indexer will be less than 5m high. The stacker reclaimers and silos can be up to 40m high.

5. Category of Development

x	**Triggers: Section 38(8) of the National Heritage Resources Act**
	Triggers: Section 38(1) of the National Heritage Resources Act
x	1. Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.
	2. Construction of a bridge or similar structure exceeding 50m in length.
	3. Any development or activity that will change the character of a site-
	a) exceeding 5 000m^2 in extent
	b) involving three or more existing erven or subdivisions thereof
	c) involving three or more erven or divisions thereof which have been consolidated within the past five years
	4. Rezoning of a site exceeding 10 000m^2
	5. Other (state):

6. Additional Infrastructure Required for this Development

None

7. Mapping (please see Appendix 3 and 4 for a full description of our methodology and map legends)

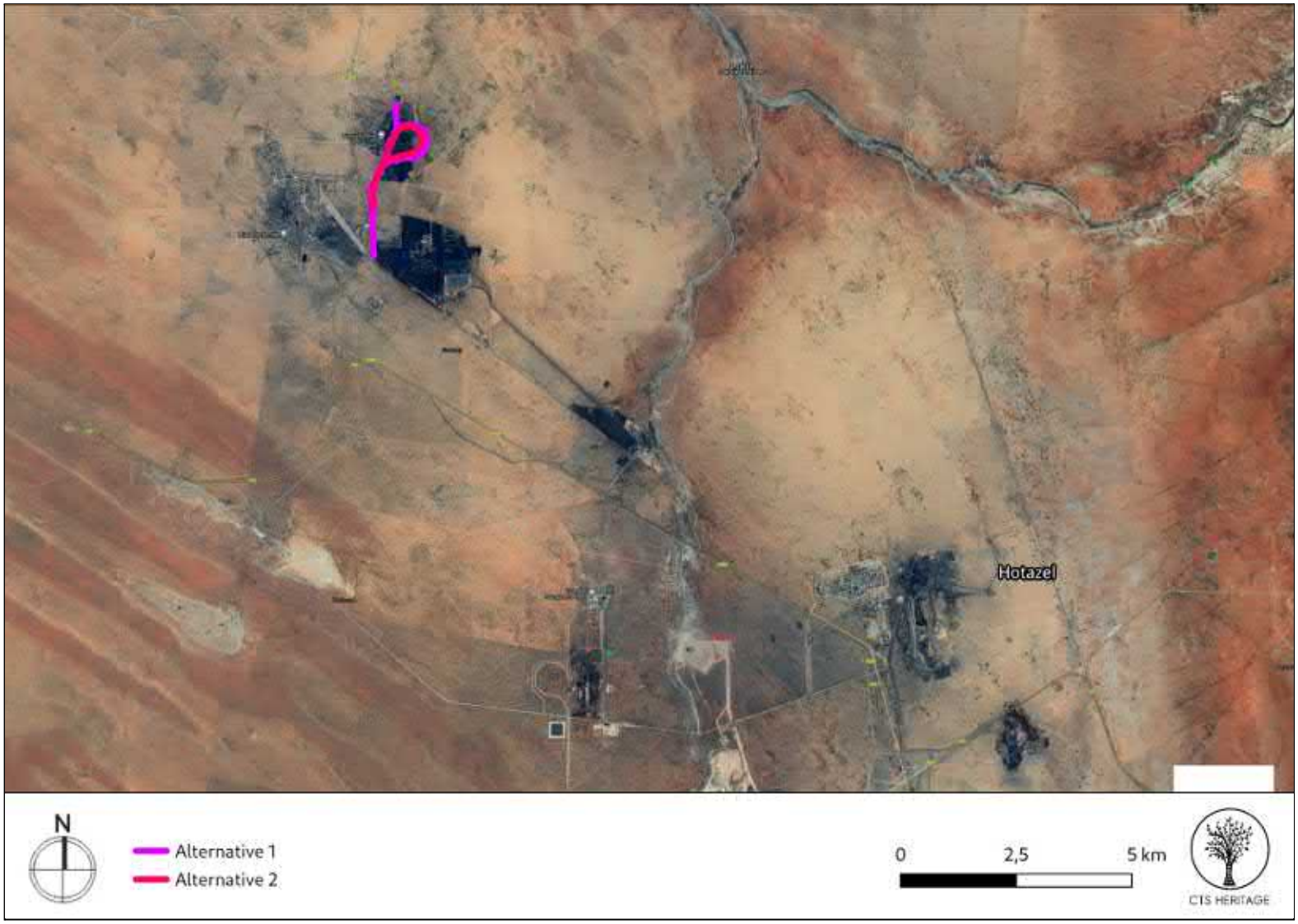

Figure 1b Overview Map. Satellite image (2019) indicating the proposed development area at closer range.

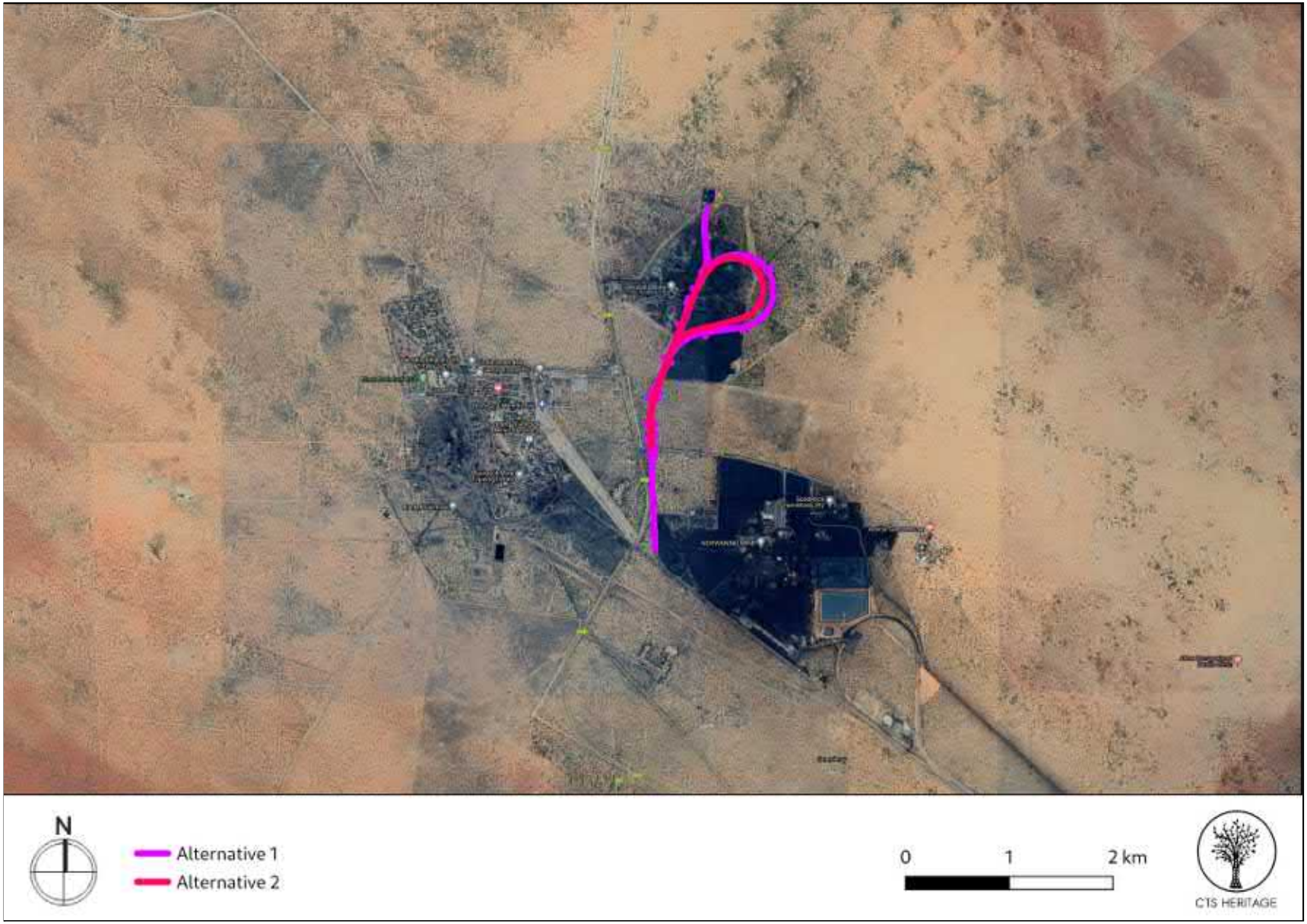

Figure 1c. Overview Map. Satellite image (2019) indicating the proposed development area at closer range.

Figure 1d. Overview Map. Satellite image (2019) indicating the proposed development area at closer range.

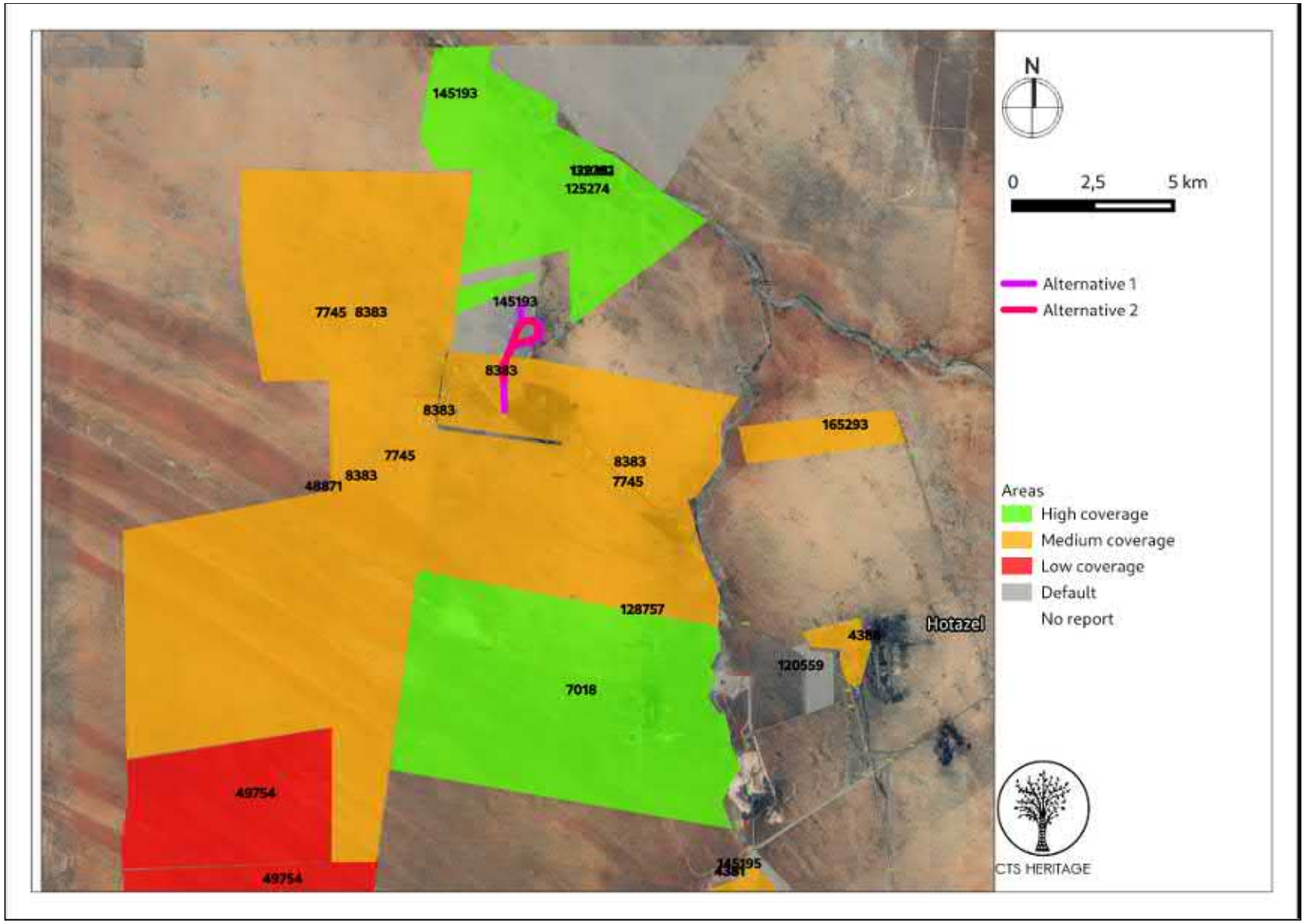

Figure 2. Previous HIAs Map. Previous Heritage Impact Assessments surrounding the proposed development area within 15km, with SAHRIS NIDS indicated. Please see Appendix 2 for a full reference list.

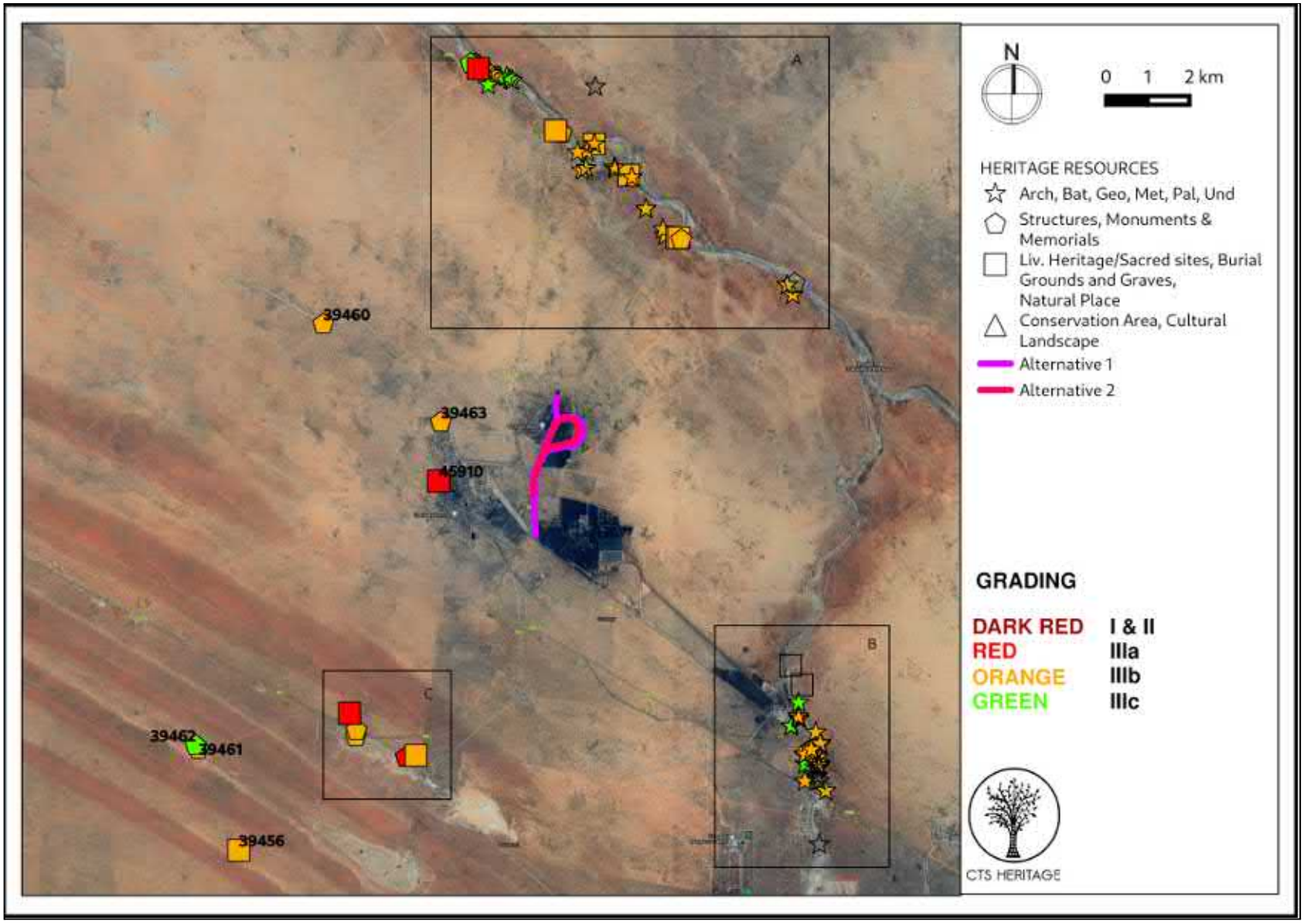

Figure 3. Heritage Resources Map. Heritage Resources previously identified in and near the study area, with SAHRIS Site IDs indicated. Please See Appendix 4 for full description of heritage resource types.

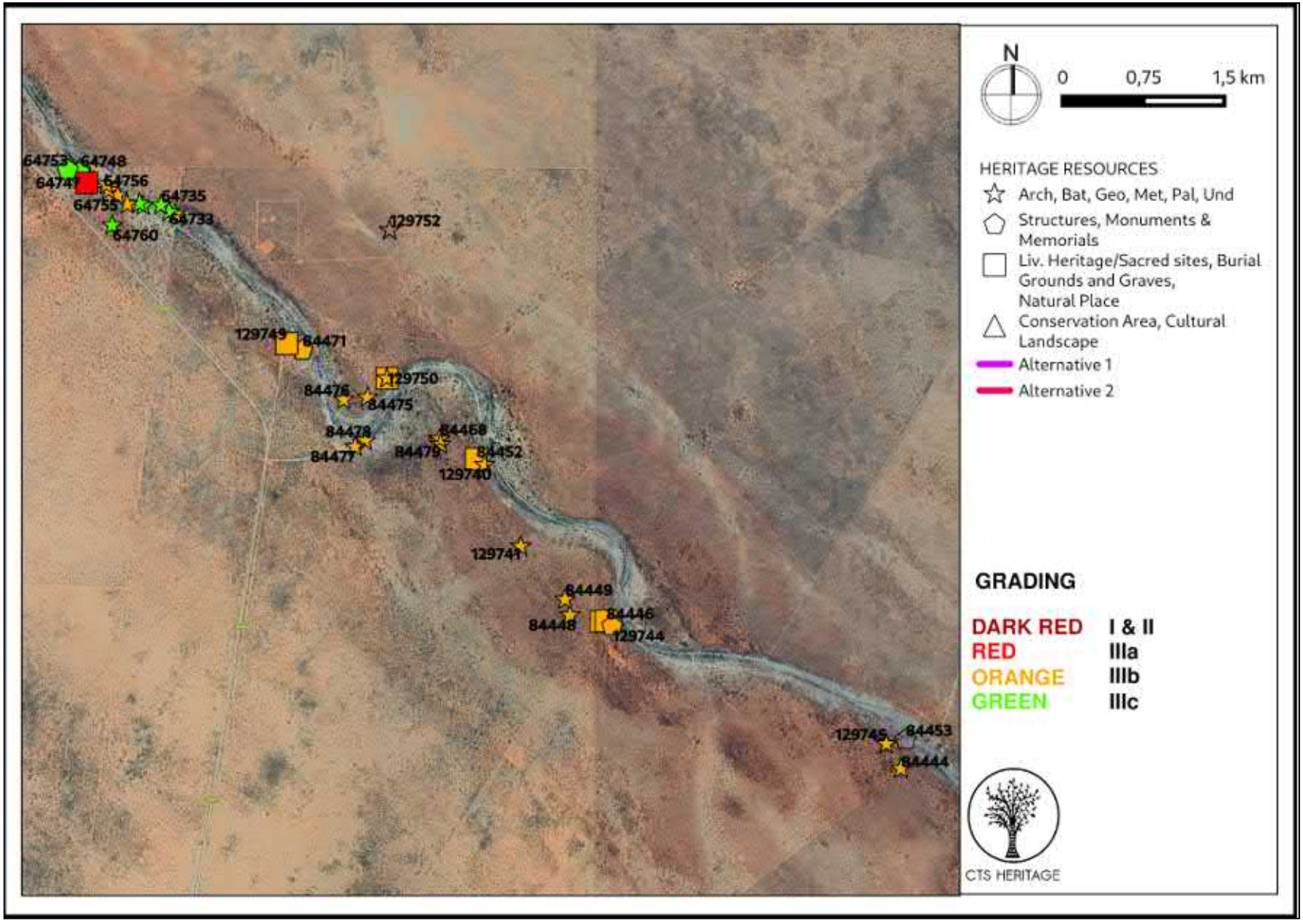

Figure 3a. Heritage Resources Map. Inset A

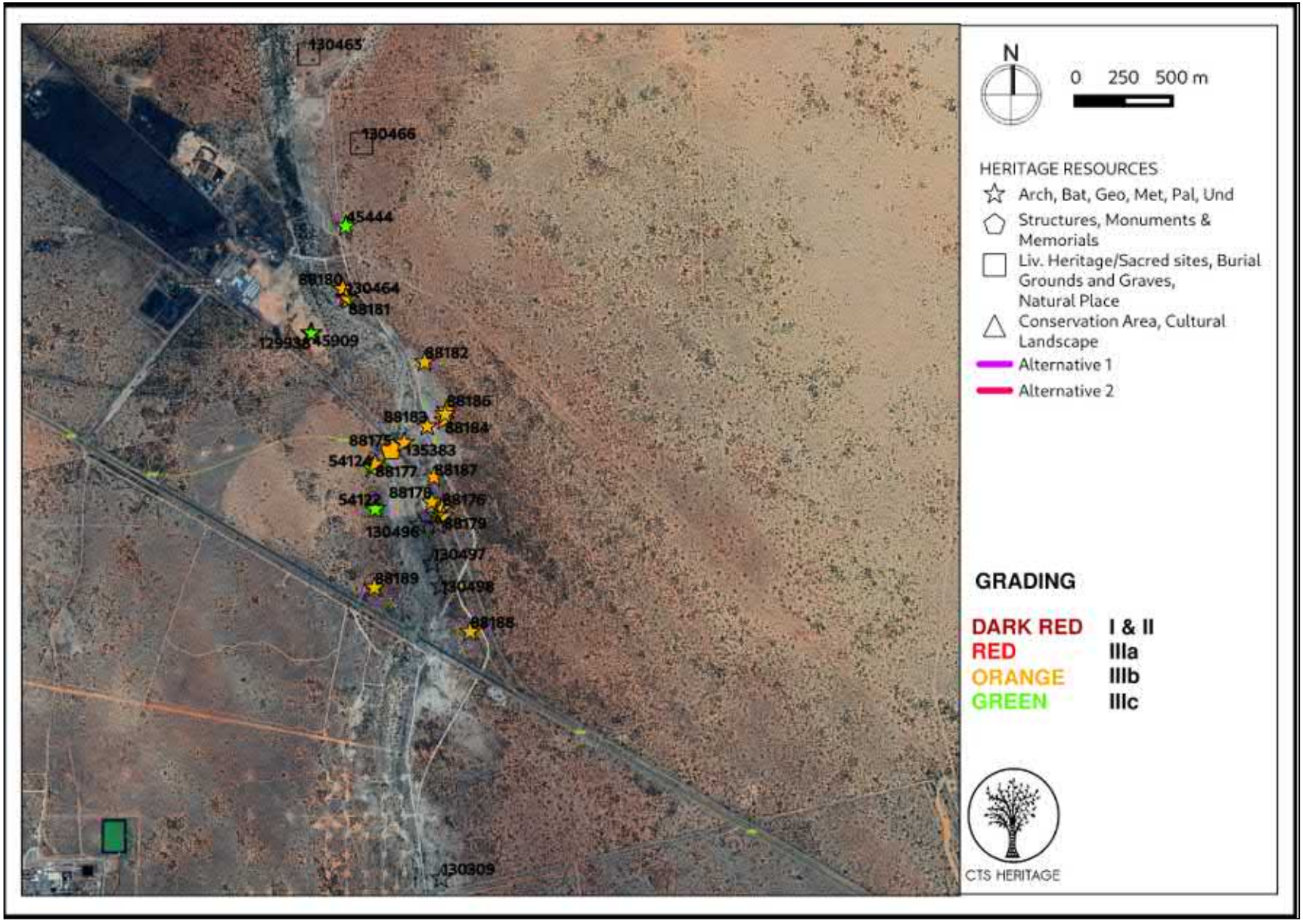

Figure 3b. Heritage Resources Map. Inset B

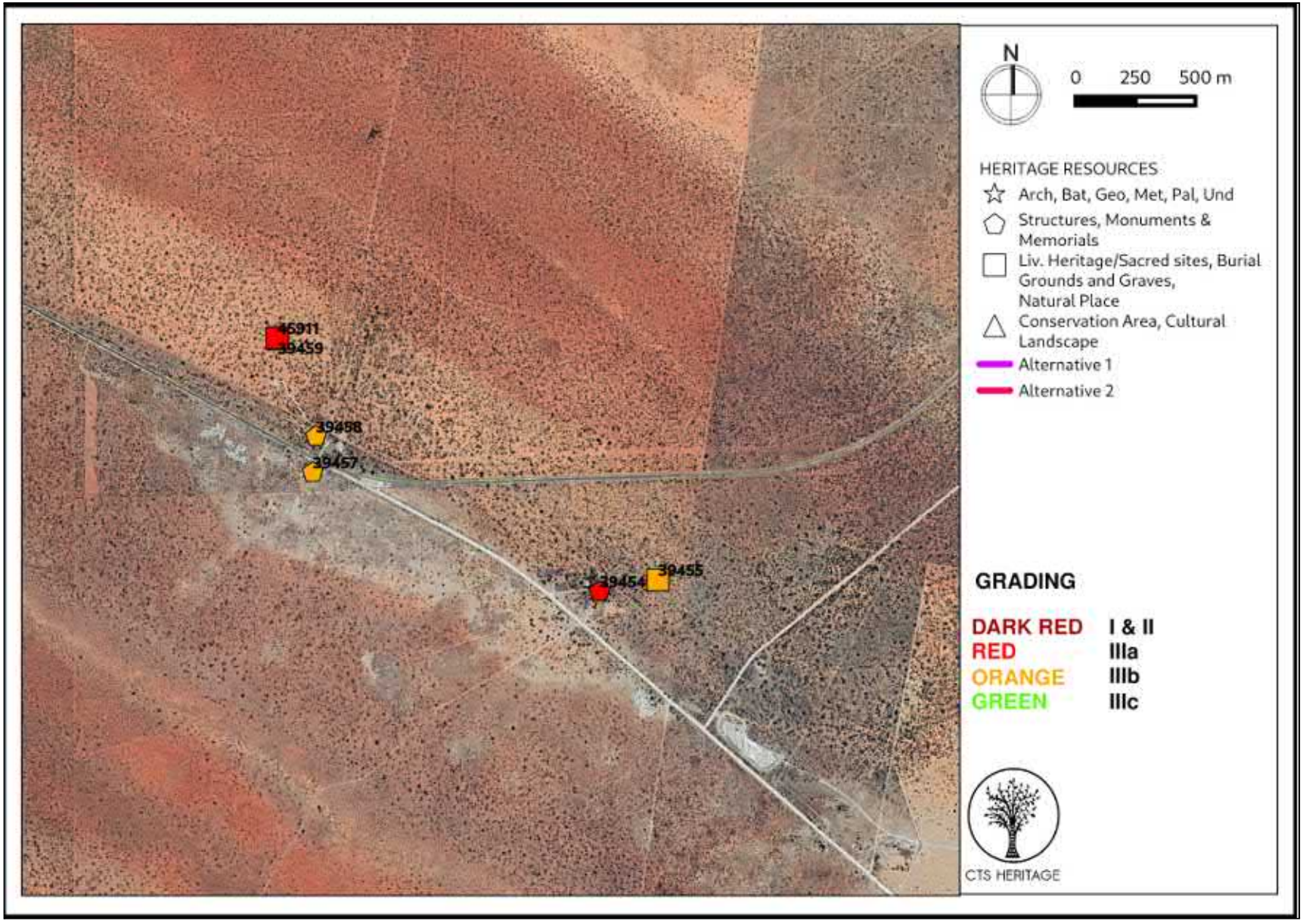

Figure 3c. Heritage Resources Map. Inset C

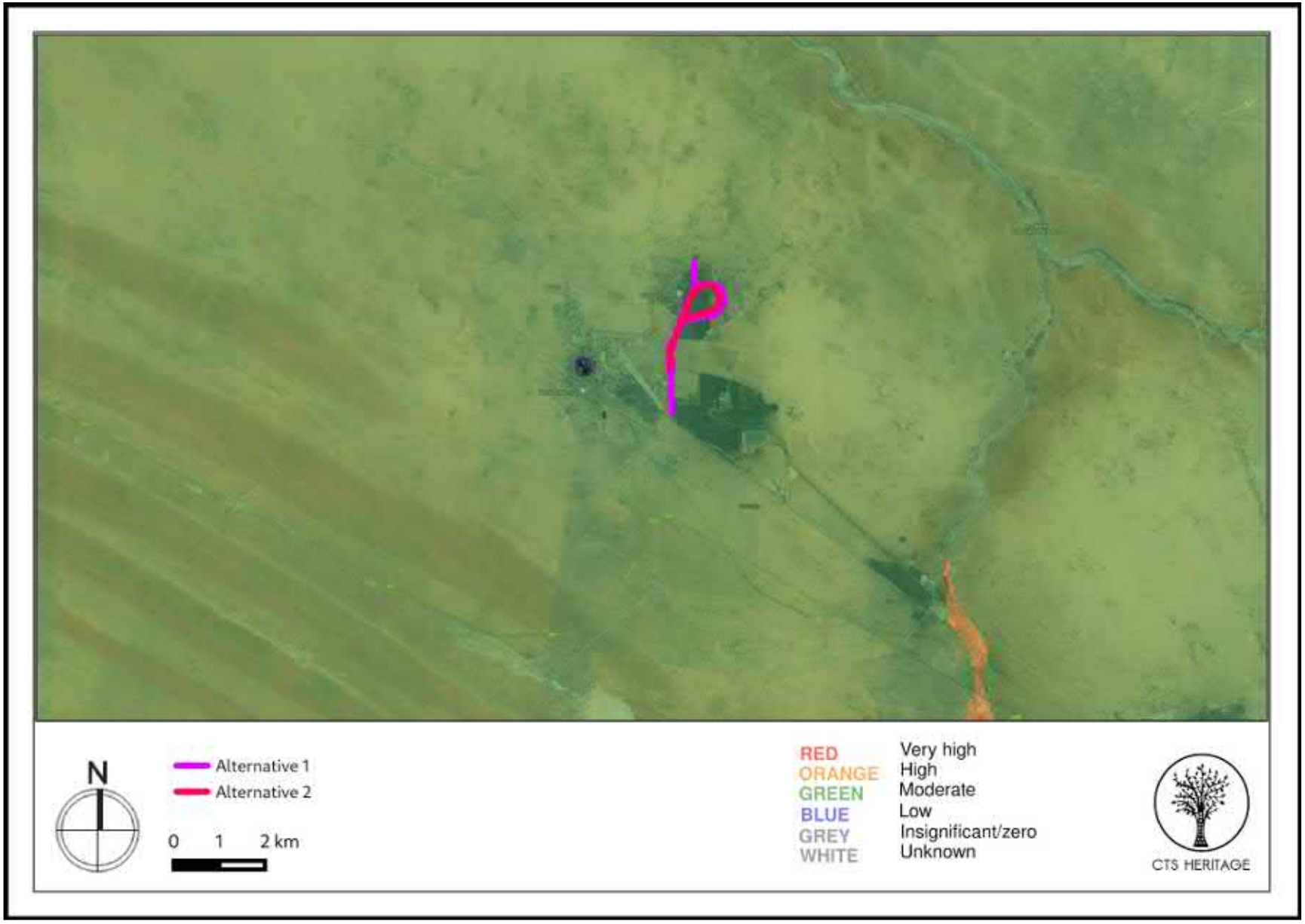

Figure 4. Palaeosensitivity Map. Indicating varied fossil sensitivity underlying the study area. Please See Appendix 3 for a full guide to the legend.

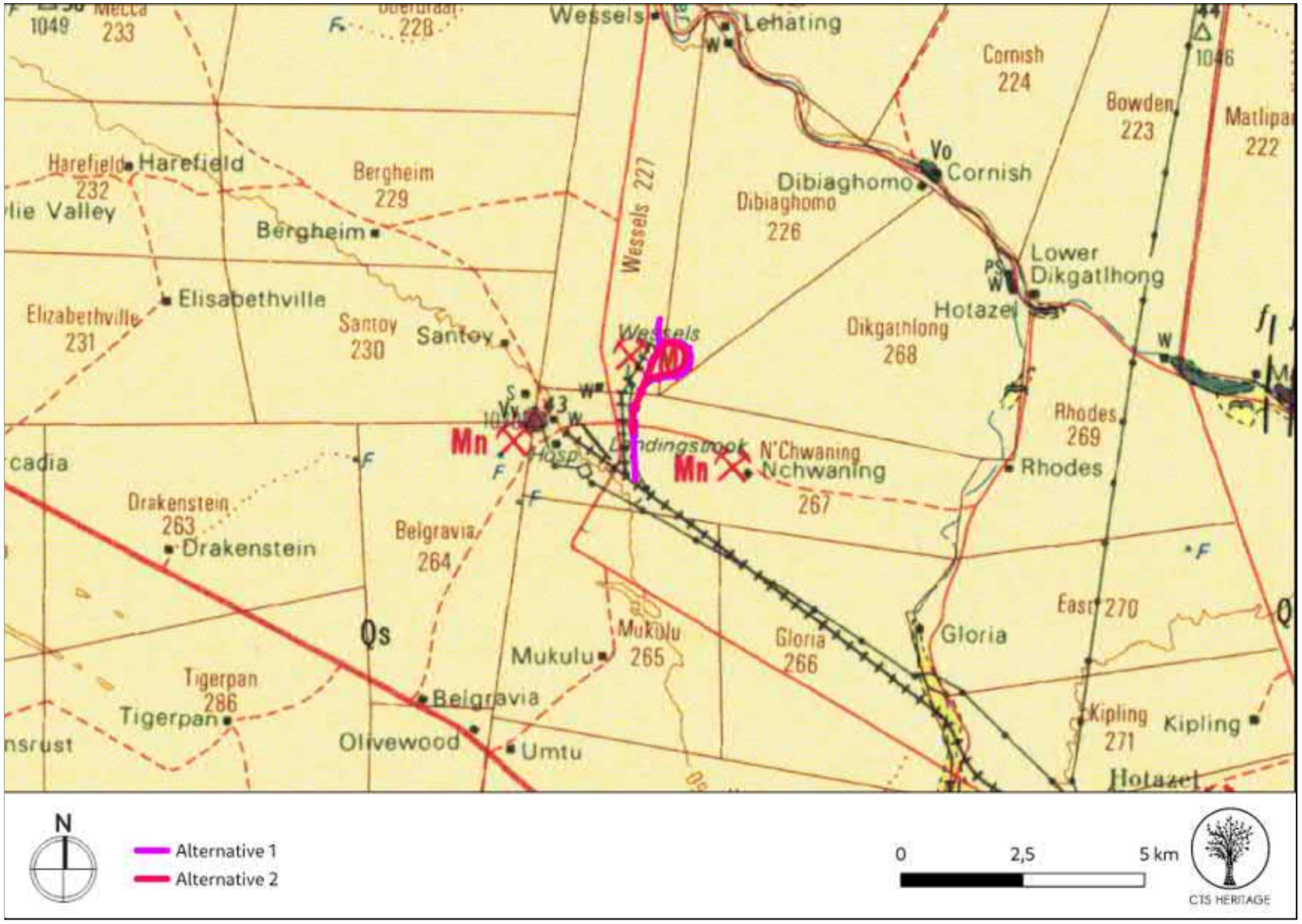

Figure 5. Geology Map. Extract from the Council for GeoScience Kuruman Map 2722 indicating that the area proposed for development is underlain by QC - red to flesh-coloured wind-blown sands

8. Heritage statement and character of the area

The area proposed for the railway infrastructure upgrade and the new rail balloon is located within the existing Wessels Mine in close proximity to the town of Hotazel in the Northern Cape. Hotazel was designated as a town in the 1950's in order to service the surrounding manganese mines. As per Figure 2, the area proposed for development as well as its surroundings have previously been assessed for impacts to heritage resources. The specific area proposed for development in this application has been looked at by Hutton and Hutton (2013, SAHRIS NID 145193) and Kusel and van der Ryst (2009, SAHRIS NID 8383) who conducted an assessment for the neighbouring Black Rock Mine. These reports are relied on below to provide some insight into the heritage sensitivities of the area proposed for development.

According to Kusel and van der Ryst (2009), "The first Geologist to have surveyed the Northern Cape was Dr. A. W. Rogers of the Geological Commission of the Cape Colony in 1906. One of the features he noted was a small hill called Black Rock and reported on the presence of manganese ore at the base of the hill. In 1940 Associated Manganese Mines of South Africa acquired the manganese outcrop known as Black Rock and shortly afterwards started mining the deposit… A large black outcrop of Manganese ore is the outstanding feature in the landscape of the Black Rock mining area. This outcrop was mined since the 1940's both by open cast and underground mining… The original Black Rock outcrop and mining represent an important part of the mining history of Manganese mining in South Africa". For this reason, Kusel and van der Ryst (2009) recommend, among other things, that the Black Mountain Mine be declared as a National Heritage Site; however, no evidence of this recommendation being implemented has been identified.

Both Hutton and Hutton (2013) and Kusel and van der Ryst (2009) identified Early, Middle and Later Stone Age archaeological resources located within proximity of the proposed development (Figure 3). Hutton and Hutton (2013) and Kusel and van der Ryst (2009) both indicate that the identified artefacts are predominantly located along the Kuruman and Ga-Mogara riverbanks. Hutton and Hutton (2013) note that no heritage resources were identified in the areas located away from the rivers, described as consisting of "red Kalahari sands with little vegetation cover."

As per Figure 3, the heritage resources known from the broader area that are not associated with the banks of surrounding rivers include a burial identified by Kusel and van der Ryst (2009) and two structures identified by Van Vollenhoven (2012, SAHRIS ID 48871). This burial site (SAHRIS Site ID 45910) is described as follows; "The area is fenced off and has some 60+ graves. The graves are those of black mine workers who died at the mine. The graves are unmarked with no tombstones. Only one grave has a date of 8/7/74. The cemetery most probably represents the graves of black mine workers from the 1940's to the 1970's. The graves are not visited any more by relatives as no grave goods are present. Most probably these graves are from migrant mine workers from far afield." Sites 39460 and 39463 are both described by Van Vollenhoven (2012) as limestone houses, each date to the 1920's and are likely the original farmsteads for their respective farms. Based on the information available, the area proposed for the upgrade of the railway infrastructure and proposed new rail balloon does not constitute a sensitive archaeological landscape and as such, it is unlikely that significant archaeological and built environment resources will be negatively impacted by the proposed development.

According to the SAHRIS Palaeosensitivity Map (Figure 4), the area proposed for development is underlain by sediments of moderate palaeontological sensitivity. According to the extract from the Council of GeoScience Kuruman Map 2722 (Figure 5), the development area is underlain by red to flesh-coloured wind-blown sands. This corresponds with the findings of the HIA completed by Hutton and Hutton (2013) who note that geology "mainly consist(s) of aeolian red sand and the occasional surface calcrete with deep sandy soils of Hutton and Clovelly soil forms. The Kuruman River and associated river banks are embedded within the Kalahari sediments that cover the Precambrian metamorphic crust. The riverbeds are silty, sandy and rocky and poorly drained." As such, it is very unlikely that the proposed development will negatively impact on significant palaeontological heritage; however, it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

RECOMMENDATION

Based on the available information, the proposed development is not likely to impact on significant cultural landscape, built environment, archaeological or palaeontological heritage resources and as such, it is recommended that no further studies in terms of section 38 of the NHRA are required, however it is recommended that the attached Chance Fossil Finds Procedure be implemented for the duration of construction activities.

CTS HERITAGE

APPENDIX 1: List of heritage resources in proximity to the development area

Site ID	Site no	Full Site Name	Site Type	Grading
88186	GLO012	GLORIA 266/ 012	Artefacts	Grade IIIb
88187	GLO013	GLORIA 266/ 013	Artefacts	Grade IIIb
88189	GLO015	GLORIA 266/ 015	Artefacts	Grade IIIb
88177	GLO003	GLORIA 266/ 003	Artefacts	Grade IIIb
88178	GLO004	GLORIA 266/ 004	Artefacts	Grade IIIb
88179	GLO005	GLORIA 266/ 005	Artefacts	Grade IIIb
88180	GLO006	GLORIA 266/ 006	Artefacts	Grade IIIb
88182	GLO008	GLORIA 266/ 008	Artefacts	Grade IIIb
88184	GLO010	GLORIA 266/ 010	Artefacts	Grade IIIb
88185	GLO011	GLORIA 266/ 011	Artefacts	Grade IIIb
88188	GLO014	GLORIA 266/ 014	Artefacts	Grade IIIb
84447	TSHIPI007	Tshipi é Ntle Manganese Mining 007	Burial Grounds & Graves, Artefacts	Grade IIIa
84444	TSHIPI009	Tshipi é Ntle Manganese Mining 009	Archaeological	Grade IIIb
84445	TSHIPI010	Tshipi é Ntle Manganese Mining 010	Archaeological	Grade IIIb
84446	TSHIPI008	Tshipi é Ntle Manganese Mining 008	Burial Grounds & Graves	Grade IIIa
84448	TSHIPI006	Tshipi é Ntle Manganese Mining 006	Archaeological	Grade IIIb
84449	TSHIPI005	Tshipi é Ntle Manganese Mining 005	Archaeological	Grade IIIb

84450	TSHIPI004	Tshipi é Ntle Manganese Mining 004	Archaeological	Grade IIIb
84451	TSHIPI003	Tshipi é Ntle Manganese Mining 003	Archaeological	Grade IIIb
84452	TSHIPI002	Tshipi é Ntle Manganese Mining 002	Burial Grounds & Graves	Grade IIIa
84453	TSHIPI001	Tshipi é Ntle Manganese Mining 001	Building	Ungraded
84468	TSHIPI011	Tshipi é Ntle Manganese Mining 011	Archaeological	Grade IIIb
84473	TSHIPI014	Tshipi é Ntle Manganese Mining 014	Burial Grounds & Graves	Grade IIIa
54122	GLRA01	Gloria 266 01	Artefacts	Grade IIIc
84474	TSHIPI015	Tshipi é Ntle Manganese Mining 015	Archaeological, Burial Grounds & Graves	Grade IIIb
84475	TSHIPI016	Tshipi é Ntle Manganese Mining 016	Archaeological	Grade IIIb
84476	TSHIPI017	Tshipi é Ntle Manganese Mining 017	Archaeological	Grade IIIb
84478	TSHIPI019	Tshipi é Ntle Manganese Mining 019	Archaeological	Grade IIIb
84479	TSHIPI012	Tshipi é Ntle Manganese Mining 012	Archaeological	Grade IIIb
84477	TSHIPI018	Tshipi é Ntle Manganese Mining 018	Archaeological	Grade IIIb
64732	WESS001	Wessels 227/ 001	Artefacts	Grade IIIb
45909	BR01	Black Rock 01	Artefacts	Grade IIIc
45910	BR02	Black Rock 02	Burial Grounds & Graves	Grade IIIa
64733	WESS002	Wessels 227/ 002	Artefacts	Grade IIIc
45911	BR03	Black Rock 03	Burial Grounds & Graves	Grade IIIa

64735	WESS003	Wessels 227/ 003	Artefacts	Grade IIIc
64737	WESS004	Wessels 227/ 004	Artefacts	Grade IIIc
64738	WESS005	Wessels 227/ 005	Artefacts	Grade IIIc
64740	WESS006	Wessels 227/ 006	Artefacts	Grade IIIb
64745	WESS008	Wessels 227/ 008	Structures	Grade IIIc
64747	WESS009	Wessels 227/ 009	Structures	Grade IIIc
64748	WESS010	Wessels 227/ 010	Structures	Grade IIIc
64750	WESS011	Wessels 227/ 011	Structures	Grade IIIc
64753	WESS012	Wessels 227/ 012	Building	Grade IIIc
64755	WESS013	Wessels 227/ 013	Artefacts	Grade IIIb
64756	WESS014	Wessels 227/ 014	Artefacts	Grade IIIb
64758	WESS015	Wessels 227/ 015	Artefacts	Grade IIIb
64760	WESS016	Wessels 227/ 016	Artefacts	Grade IIIc
64743	WESS007	Wessels 227/ 007	Burial Grounds & Graves	Grade IIIa
39454	HOT068	Hotazel 068	Building	Grade IIIa
39457	HOT071	Hotazel 071	Building	Grade IIIb
54124	GLRA02	Gloria 266 02	Artefacts	Grade IIIc
39458	HOT072	Hotazel 072	Building	Grade IIIb
39460	HOT074	Hotazel 074	Building	Grade IIIb

39461	HOT075	Hotazel 075	Building	Grade IIIb
39462	HOT076	Hotazel 076	Building	Grade IIIc
39463	HOT077	Hotazel 077	Building	Grade IIIb
45444	Gloria 01	Gloria Mine, Vaal Gamagara Village 01	Artefacts	Grade IIIc
39455	HOT069	Hotazel 069	Burial Grounds & Graves	Grade IIIb
39456	HOT070	Hotazel 070	Burial Grounds & Graves	Grade IIIb
39459	HOT073	Hotazel 073	Burial Grounds & Graves	Grade IIIb
88175	GLO001	GLORIA 266/ 001	Bridge	Grade IIIb
88176	GLO002	GLORIA 266/ 002	Artefacts	Grade IIIb
88181	GLO007	GLORIA 266/ 007	Artefacts	Grade IIIb
88183	GLO009	GLORIA 266/ 009	Artefacts	Grade IIIb
135383	BMRO001	BLACK ROCK MINING	Artefacts	Grade IIIb
84471	TSHIPI013	Tshipi é Ntle Manganese Mining 013	Building	Grade IIIb
129739	2722BB/Mining/ farm Lehating 225/Site DIB2	Cemetery	Burial Grounds & Graves	Grade IIIb
129740	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB3	Archaeological site	Archaeological	Ungraded
129741	2722BB/Mining/ Farm Dibiaghomo	Archaeological site	Archaeological	Ungraded

	226/Site DIB4			
129742	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB7	Grave site	Burial Grounds & Graves	Grade IIIb
129743	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB8A	Cemetery	Burial Grounds & Graves	Grade IIIb
129744	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB8B	Farmstead	Structures	Grade IIIb
129745	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB10	Archaeological site	Archaeological	Ungraded
129746	2722BB/Mining/ Farm Dibiaghomo 226/Site DIB11	Stone artefacts	Artefacts	Ungraded
129748	2722BB/Mining/ Farm Dibiaghomo 226/Site WES1	original farmstead of the farm Wessels	Structures	Ungraded
129749	2722BB/Mining/ Farm Dibiaghomo 226/Site WES2	Grave site	Burial Grounds & Graves	Grade IIIb
129750	2722BB/Mining/ Farm Dibiaghomo 226/Site WES3	Archaeological site	Archaeological	Ungraded
129751	2722BB/Mining/	Archaeological site	Archaeological	Ungraded

	Farm Dibiaghomo 226/Site WES7			
129752	2722BB/Mining/Farm Lehating 714/Site LM01	Stone artefacts	Archaeological	Ungraded
129938	BRMO Stone Age Site	BRMO Stone Age site no 1 along the Gamagara RiverN	Archaeological	
130307	HOTZ01	HOTAZEL 280	Artefacts	Grade IV
130308	HOTZ02	HOTAZEL 280	Artefacts	
130309	UMT01	UMTU SUBSTATION	Artefacts	
130197	HMK1a	Mokala Manganese Archaeological site - HMK1a	Deposit	
130464	JTG01	John Taolo Gaetsewe	Artefacts	
130465	JTG02	John Taolo Gaetsewe	Burial Grounds & Graves	
130466	JTG03	John Taolo Gaetsewe	Burial Grounds & Graves	
130495	MKL01	Mokala	Artefacts	
130496	MKL02a	Mokala	Artefacts	
130497	MKL02b	Mokala	Artefacts	
130498	MKL03	Mokala	Artefacts	

CTS HERITAGE

APPENDIX 2: Reference List

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
4388	AIA Phase 1	Peter Beaumont	14/06/2008	Phase 1 Archaeological Impact Assessment Report on Areas at Hotazhel Mine on the Farm Hotazhel 280, Kgalagadi District Municipality, Northern Cape Province
7018	AIA Phase 1	Wouter Fourie, Jaco van der Walt	31/03/2007	Kalahari Manganese Mines: Heritage Assessment on Umtu 281, Olive Pan 282, Gama 283
7745	AIA Phase 1	Anton Pelser, Anton van Vollenhoven	03/05/2011	A REPORT ON A HERITAGE IMPACT ASSESSMENT (HIA) FOR A PROPOSED NEW RAIL CROSSING OVER THE GAMAGARA RIVER FOR THE GLORIA MINE OPERATIONS, ASSMANG BLACK ROCK, ON GLORIA 266, NORTH OF HOTAZEL, NORTHERN CAPE
8383	HIA Phase 1	Udo Kusel, M van der Ryst	18/09/2009	Cultural Heritage Resources impact assessment of manganese mining areas on the farms Belgravia 264, Santoy 230, Gloria 226 and Nichwaning 267, at Black Rockm North of Kuruman, Kgalagadi District Municipality, Northern Cape Province.
48871	HIA Phase 1	Anton van Vollenhoven	01/04/2012	A REPORT ON A HERITAGE IMPACT ASSESSMENT FORTHE PROPOSED MAIN STREET 778 (PTY) LTD MINING RIGHT APPLICATION CLOSE TO HOTAZEL, NORTHERN CAPE PROVINCE
49754	Heritage Scoping	Tobias Coetzee	31/07/2012	ARCHAEOLOGICAL SCOPING REPORT FOR THE PROPOSED PROSPECTING FOR IRON ORE AND MANGANESE ORE FOR AMARI MANGANESE (PTY) LTD ON THE FARMS CONSTANTIA 309, SIMONDIUM 308 AND PORTIONS 1, 2, 3 AND 8 OF THE FARM GOOLD 329 IN THE VICINITY OF District Municipality: Kgalagadi Northern Cape Province SOUTH AFRICA
120559	HIA Phase 1	Robert de Jong	16/05/2010	HIA PROPOSED LAND USE CHANGE TO PROVIDE FOR THE EXTENSION OF THE TOWN OF HOTAZEL PHASE III
125274	Heritage Impact Assessment Specialist Reports	Wouter Fourie	22/07/2013	Tshipi Ã© Ntle Manganese Mining: Prospecting on Remaining extent of the farm Wessels 227 and Portions 1 and 2 and the remaining extent of the farm Dibiaghomo 226, near Black Rock in the Northern Cape Province, Heritage Impact Assessment

128757	Archaeological Specialist Reports	Wouter Fourie	14/05/2013	Prospecting activities on the farm Gloria 266, near Hotazel in the Northern Cape Province Heritage Impact Assessment
129381	HIA Phase 1	Wouter Fourie	17/07/2013	Lehating Heritage Impact Assessment Proposed Lehating Mining (Pty) Ltd underground manganese mine on Portions 1 of the Farm Lehating 714 and Portion 2 of the farm Wessels 227, approximately 20km northwest of Hotazel, Northern Cape Province
132292	HIA Phase 1	Wouter Fourie		Heritage Impact Assessment for the Proposed Lehating Mining (Pty) Ltd underground manganese mine on Portions 1 of the Farm Lehating 714 and Portion 2 of the farm Wessels, 227, approximately 20km northwest of Hotazel, Northern Cape Province
145193	HIA Phase 1	Louisa Hutten, Willem Hutten	18/11/2013	HIA report for Boerdraai 228 and Wessels 227 portion 2
165293	AIA Phase 1	Neels Kruger	18/05/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF A DEMARCATED SURFACE PORTION ON THE FARM RHODES 269 FOR THE PROPOSED RHODES 1 PHOTOVOLTAIC POWER PLANT & ACCESS ROAD DEVELOPMENT, JOE MOROLONG LOCAL MUNICIPALITY, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE

CTS HERITAGE

APPENDIX 3 - Keys/Guides

Key/Guide to Acronyms

AIA	Archaeological Impact Assessment
DARD	Department of Agriculture and Rural Development (KwaZulu-Natal)
DEA	Department of Environmental Affairs (National)
DEADP	Department of Environmental Affairs and Development Planning (Western Cape)
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape)
DEDECT	Department of Economic Development, Environment, Conservation and Tourism (North West)
DEDT	Department of Economic Development and Tourism (Mpumalanga)
DEDTEA	Department of economic Development, Tourism and Environmental Affairs (Free State)
DENC	Department of Environment and Nature Conservation (Northern Cape)
DMR	Department of Mineral Resources (National)
GDARD	Gauteng Department of Agriculture and Rural Development (Gauteng)
HIA	Heritage Impact Assessment
LEDET	Department of Economic Development, Environment and Tourism (Limpopo)
MPRDA	Mineral and Petroleum Resources Development Act, no 28 of 2002
NEMA	National Environmental Management Act, no 107 of 1998
NHRA	National Heritage Resources Act, no 25 of 1999
PIA	Palaeontological Impact Assessment
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
VIA	Visual Impact Assessment

Full guide to Palaeosensitivity Map legend

	RED:	VERY HIGH - field assessment and protocol for finds is required
	ORANGE/YELLOW:	HIGH - desktop study is required and based on the outcome of the desktop study, a field assessment is likely
	GREEN:	MODERATE - desktop study is required
	BLUE/PURPLE:	LOW - no palaeontological studies are required however a protocol for chance finds is required
	GREY:	INSIGNIFICANT/ZERO - no palaeontological studies are required
	WHITE/CLEAR:	UNKNOWN - these areas will require a minimum of a desktop study.

CTS HERITAGE

APPENDIX 4 - Methodology

The Heritage Screener summarises the heritage impact assessments and studies previously undertaken within the area of the proposed development and its surroundings. Heritage resources identified in these reports are assessed by our team during the screening process.

The heritage resources will be described both in terms of **type**:

- Group 1: Archaeological, Underwater, Palaeontological and Geological sites, Meteorites, and Battlefields
- Group 2: Structures, Monuments and Memorials
- Group 3: Burial Grounds and Graves, Living Heritage, Sacred and Natural sites
- Group 4: Cultural Landscapes, Conservation Areas and Scenic routes

and **significance** (Grade I, II, IIIa, b or c, ungraded), as determined by the author of the original heritage impact assessment report or by formal grading and/or protection by the heritage authorities.

Sites identified and mapped during research projects will also be considered.

DETERMINATION OF THE EXTENT OF THE INCLUSION ZONE TO BE TAKEN INTO CONSIDERATION

The extent of the inclusion zone to be considered for the Heritage Screener will be determined by CTS based on:

- the size of the development,
- the number and outcome of previous surveys existing in the area
- the potential cumulative impact of the application.

The inclusion zone will be considered as the region within a maximum distance of 50 km from the boundary of the proposed development.

DETERMINATION OF THE PALAEONTOLOGICAL SENSITIVITY

The possible impact of the proposed development on palaeontological resources is gauged by:

- reviewing the fossil sensitivity maps available on the South African Heritage Resources Information System (SAHRIS)
- considering the nature of the proposed development
- when available, taking information provided by the applicant related to the geological background of the area into account

DETERMINATION OF THE COVERAGE RATING ASCRIBED TO A REPORT POLYGON

Each report assessed for the compilation of the Heritage Screener is colour-coded according to the level of coverage accomplished. The extent of the surveyed coverage is labeled in three categories, namely low, medium and high. In most instances the extent of the map corresponds to the extent of the development for which the specific report was undertaken.

Low coverage will be used for:

- desktop studies where no field assessment of the area was undertaken;
- reports where the sites are listed and described but no GPS coordinates were provided.
- older reports with GPS coordinates with low accuracy ratings;
- reports where the entire property was mapped, but only a small/limited area was surveyed.
- uploads on the National Inventory which are not properly mapped.

Medium coverage will be used for

- reports for which a field survey was undertaken but the area was not extensively covered. This may apply to instances where some impediments did not allow for full coverage such as thick vegetation, etc.
- reports for which the entire property was mapped, but only a specific area was surveyed thoroughly. This is differentiated from low ratings listed above when these surveys cover up to around 50% of the property.

High coverage will be used for

- reports where the area highlighted in the map was extensively surveyed as shown by the GPS track coordinates. This category will also apply to permit reports.

RECOMMENDATION GUIDE

The Heritage Screener includes a set of recommendations to the applicant based on whether an impact on heritage resources is anticipated. One of three possible recommendations is formulated:

(1) The heritage resources in the area proposed for development are sufficiently recorded - The surveys undertaken in the area adequately captured the heritage resources. There are no known sites which require mitigation or management plans. No further heritage work is recommended for the proposed development.

This recommendation is made when:

- enough work has been undertaken in the area
- it is the professional opinion of CTS that the area has already been assessed adequately from a heritage perspective for the type of development proposed

(2) The heritage resources and the area proposed for development are only partially recorded - The surveys undertaken in the area have not adequately captured the heritage resources and/or there are sites which require mitigation or management plans. Further specific heritage work is recommended for the proposed development.

This recommendation is made in instances in which there are already some studies undertaken in the area and/or in the adjacent area for the proposed development. Further studies in a limited HIA may include:

- improvement on some components of the heritage assessments already undertaken, for instance with a renewed field survey and/or with a specific specialist for the type of heritage resources expected in the area
- compilation of a report for a component of a heritage impact assessment not already undertaken in the area

- undertaking mitigation measures requested in previous assessments/records of decision.

(3) The heritage resources within the area proposed for the development have not been adequately surveyed yet - Few or no surveys have been undertaken in the area proposed for development. A full Heritage Impact Assessment with a detailed field component is recommended for the proposed development.

Note:
The responsibility for generating a response detailing the requirements for the development lies with the heritage authority. However, since the methodology utilised for the compilation of the Heritage Screeners is thorough and consistent, contradictory outcomes to the recommendations made by CTS should rarely occur. Should a discrepancy arise, CTS will immediately take up the matter with the heritage authority to clarify the dispute.

CTS HERITAGE

APPENDIX 2: Archaeology Field Notes - June 2021

FIELD NOTES

Phase 1 Archaeological Impact Assessment

Site ID: Wessels Mine on the farm Wessels 227- NORTHERN CAPE

Phase 1 survey conducted				
CRM Archaeologist	Jan Engelbrecht		Date/s	2021-06-02
Additional surveyors	None			
Type of survey	Pedestrian/Vehicular		Transects	30-50m
Technical equipment	GPS	Garmin Etrex 10 and Locus Maps	Camera	Canon Ixus

PROJECT PARTICULARS

Technical information

Project description	
Project name	The prpoposed upgrade of an existing railway infrastructure by South 32 at Wessels Mine in the Northern Cape
Description	The upgrade will consist of modifications to the staging rail lines and the design of a new rail balloon. The extension of the railway into the new railway balloon measures at approximately 2 500 m long and 25 m wide.
Developer	
South 32: Wessels Mine	
Contact information	Cell: 072 429 6545
Development type	Mining/Industrial
Landowner	
South 32	
Contact information	Contact person: Mr. Wonder Sigwebela Cell: 072 429 6545
Consultants	

Environmental	South 32
Heritage and archaeological	UBIQUE Heritage Consultants and CTS Heritage
Paleontological	Unknown
Property details	
Province	Northern Cape
District municipality	John Taolo Gaetsewe
Local municipality	Joe Morolong
Topo-cadastral map	1:50 000
Farm name	Farm Wessels 227
Closest town	Black Rock, Hotazel and Kuruman
GPS Co-ordinates	27° 7'7.57"S 22°51'22.79"E
Property size	Unknown
Development footprint size	Approximately 4 ha
Land use	
Previous	Agriculture
Current	Mining
Rezoning required	No
Sub-division of land	No

Development criteria in terms of Section 38(1) NHRA Yes/No	
Construction of a road, wall, power line, pipeline, canal or other linear forms of development or barrier exceeding 300m in length.	Yes
Construction of bridge or similar structure exceeding 50m in length.	No
Construction exceeding 5000m ².	No
Development involving three or more existing erven or subdivisions.	No
Development involving three or more erven or divisions that have been consolidated within the past five years.	No
Rezoning of site exceeding 10 000m ².	No
Any other development category, public open space, squares, parks, recreation grounds.	No

GENERAL ENVIRONMENT, INFRASTRUCTURE AND LANDSCAPE

Site description

Description of the general area affected by development
Type of environment
The project area consists of flat sandy plains covered with vegetation towards the east. The largest part of the environment is currently used for mining activities.

Terrain description
The eastern section of the site footprint is situated just outside of the mine parimeter (fencing 0f 2,4m high). This section is located on open farmland and is undisturbed, except for a few cement abandoned foundations and one prospecting borehole. This area is mostly flat and sandy. Towards the north and south of the balloon, the terrain is previously very disturbed by various mining activities such as burrow pit excavations, road construction, constrauction of clear areas to process ore and loading zones. There is also a large mining heap just east of the mining plant. The area is also scattered with old machinery and industrial debris in certain areas. It is obvious that minng operations in the area have altered this landscape through the years due to construction and ground movement operations.
Geology
A few scatters of dolomite could be identified on the surface of the ground. Except for the Manganese ore mined at this plant, no significant Geology was identified.

Vegetation		
The undisturbed area asw ell as certain parts within the mine parimeter the following vegetation was identified: • *Schmidtia kalahariensis* (Kalahari Sour Grass) • Acacia melifera (Blackthorn acacia) • *Rhigozum trichotomum* (Three-Thorn) • *Acacia eriloba* (Camelthorn Tree) • *Stipagrostis uniplumis* (Silky Bushman Grass) • *Aristida adscensionis* (Annual Bristle Grass)		
Waterways/sources		
No prominent natural waterways were identified on the site footprint. Man made furrows and trenches are present within the destirbed areas.		
Site boundaries		
North: Mining area and neighbouring farms towards the NE. **East**: Neighbouriong farms**. West**: Mining plant and mining area. **South**: Mining area.		
Site access		GPS Co-ordinates
South 32 Wessels Mine Security gate then towards the site in a southern, eastern and northern direction from the mining plant		27° 7'7.57"S 22°51'22.79"E
Disturbances		
Natural erosion		
No significant natural erosion		
Human-made		
1. Various two track gravel/sand roads throughout the site. 2. Excavated borrow pits, quarries present at several places on the site especially around the mine plant. 3. Large areas cleared for processing and loading of oar. 4. Various disturbed areas previously constructions, abandoned cement foundations in certain areas and the presence of previous prospecting boreholes.		
Notes		
The entire site is very disturbed except for the eastern section of the loop/balloon which is situated in a undisturbed landscape. This undisturbed area covers a minimal area of approximately 1-2 ha.		

Environmental recording

Way point	Photo number	Description	Location
Site-specific points of interest/ natural significance			
N/A	1 to 4	Contextual images taken from South to North within the undisturbed area adjacent to the mine parimeter.	**N/A**
N/A	5 to 8	Contextual images taken from North to South within the undisturbed area adjacent to the mine perimeter.	**N/A**

N/A	9 to 13	Contextual images taken in the NE section of the site footprint towards various directions (NEWS 360˚panorama view)	**N/A**
N/A	14 to 22	Contextual images taken in the Northern section of the site footprint towards various directions (NEWS 360˚ panorama view)	**N/A**
N/A	23 to 40	Contextual images taken from within the mine perimeter. This area is significantly disturbed by previous mining activities and construction.	**N/A**

HERITAGE RESOURCES RECORDING

Stone Age Resources Identified

Point ID & Site #	Photo #	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
N/A	N/A	Type lithic/s Raw material N in m². Context Additional	No finds	N/A	**N/A**	N/A

HERITAGE RESOURCES RECORDING

Historical Period Resources Identified

Point ID & Site #	Photo #	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
N/A	N/A	Type of feature Material N in m². Context Additional	No finds	N/A	**N/A**	N/A

HERITAGE RESOURCES RECORDING

Iron Age/ Agri-pastoral Early Farming Communities Resources Identified

Point ID & Site #	Photo #	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
N/A	N/A	Material N in m². Context Additional	No finds	N/A	**N/A**	N/A

HERITAGE RESOURCES RECORDING

Graves Identified

Point ID & Site #	Photo #	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
N/A	N/A	Grave markers Inscription Graves' Orientation Dimensions/ Extent Additional	No graves located and/or identified	N/A	**N/A**	N/A

HERITAGE RESOURCES RECORDING

Intangible Heritage Resources/ Cultural Landscape Identified

Point ID & Site #	Photo #	Description		Period	Location	Field rating/ Significance/ Recommended Mitigation
N/A	N/A	Nature Cultural evidence Access Affected community	No intangible resources identified. Interviews with mining officials revealed no oral history or remnants of graves or symbolic heritage.	N/A	**N/A**	N/A

IDENTIFIED HERITAGE RESOURCES DISCUSSION

Specialist comments

Stone Age finds
No Stone Age finds located, identified or recorded.
Iron Age/ Agri-pastoralist Early Farming communities finds
No Iron Age finds located, identified or recorded.
Historical finds
No Historical finds located, identified or recorded.
Identified graves
No graves identified, rcorded or located on site footprint.
Intangible Heritage/ Cultural Landscape
No intangible heritage recorded. Interviews were done with mining officials.
Other
Due to the extensive disturbed area identified as the proposed development footprint, we concluded that all heritage resources have been destroyed by such disturbances caused by construction and mining activities. The small eastern section of the balloon/ site footprint located within a mostly undisturbed landscape that was thoroughly surveyed on foot and no evidence of any heritage or cultural material was identified in this area on the surface of the ground.

IDENTIFIED HERITAGE RESOURCES MITIGATION

Specialist recommendations

Stone Age finds
No mitigation measures. Project may continue.
Iron Age/ Agri-pastoralist Early Farming communities finds
No mitigation measures. Project may continue.
Historical finds
No mitigation measures. Project may continue.
Identified graves
No mitigation measures. Project may continue.
Intangible Heritage/ Cultural Landscape
No mitigation measures. Project may continue.
Other
Due to the nature of the landscape and disturbed site footprint and after our field survey, we see no reason for the development not to continue from a Heritage perspective.

ADDITIONAL NOTES AND RESOURCES

Attached Field Data

Filename	File type	Description
HIA Wessels Mine CTS Hotazel	Folder	• 40 Jpeg numbered images • 3 GPX files with survey tracks • 1 KMZ file with polygons of disturbed and undisturbed areas • 1 Field Report of AIA and survey
Additional Notes		
We have to mention that it was quite difficult to gain access to all the areas of the footprint due to the high security level of the mine. Certain areas were ou of bounds to survey, but these areas were within the mine parimeter where the site footprint is very disturbed.		

UBIQUE
HERITAGE CONSULTANTS

JAN ENGELBRECHT
ARCHAEOLOGIST
HERITAGE SPECIALIST

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Declaration of independence:

I, Jan Engelbrecht, hereby confirm my independence as a heritage specialist and declare that:

- I am suitably qualified and accredited to act as an independent specialist in this application;
- I do not have any vested interests (either business, financial, personal or other) in the proposed development project other than remuneration for the heritage assessment and heritage management services performed;
- The work was conducted objectively and ethically, in

accordance with a professional code of conduct and within the framework of South African heritage legislation.

Signed:
JAC. Engelbrecht

Date: 2021-06-04
UBIQUE Heritage Consultants

APPENDIX 3: HWC Chance Fossil Finds Procedure

CTS HERITAGE

CHANCE FINDS OF PALAEONTOLOGICAL MATERIAL

(Adopted from the HWC Chance Fossils Finds Procedure: June 2016)

Introduction

This document is aimed to inform workmen and foremen working on a construction and/or mining site. It describes the procedure to follow in instances of accidental discovery of palaeontological material (please see attached poster with descriptions of palaeontological material) during construction/mining activities. This protocol does not apply to resources already identified under an assessment undertaken under s. 38 of the National Heritage Resources Act (no 25 of 1999).

Fossils are rare and irreplaceable. Fossils tell us about the environmental conditions that existed in a specific geographical area millions of years ago. As heritage resources that inform us of the history of a place, fossils are public property that the State is required to manage and conserve on behalf of all the citizens of South Africa. Fossils are therefore protected by the National Heritage Resources Act and are the property of the State. Ideally, a qualified person should be responsible for the recovery of fossils noticed during construction/mining to ensure that all relevant contextual information is recorded.

Heritage Authorities often rely on workmen and foremen to report finds, and thereby contribute to our knowledge of South Africa's past and contribute to its conservation for future generations.

Training

Workmen and foremen need to be trained in the procedure to follow in instances of accidental discovery of fossil material, in a similar way to the Health and Safety protocol. A brief introduction to the process to follow in the event of possible accidental discovery of fossils should be conducted by the designated Environmental Control Officer (ECO) for the project, or the foreman or site agent in the absence of the ECO It is recommended that copies of the attached poster and procedure are printed out and displayed at the site office so that workmen may familiarise themselves with them and are thereby prepared in the event that accidental discovery of fossil material takes place.

Actions to be taken

One person in the staff must be identified and appointed as responsible for the implementation of the attached protocol in instances of accidental fossil discovery and must report to the ECO or site agent. If the ECO or site agent is not present on site, then the responsible person on site should follow the protocol correctly in order to not jeopardize the conservation and well-being of the fossil material.

Once a workman notices possible fossil material, he/she should report this to the ECO or site agent.Procedure to follow if it is likely that the material identified is a fossil:

- The ECO or site agent must ensure that all work ceases immediately in the vicinity of the area where the fossil or fossils have been found;
- The ECO or site agent must inform SAHRA of the find immediately. This information must include photographs of the findings and GPS co-ordinates;
- The ECO or site agent must compile a Preliminary Report and fill in the attached Fossil Discoveries: Preliminary Record Form within 24 hours without removing the fossil from its original position. The Preliminary Report records basic information about the find including:
    - The date
    - A description of the discovery
    - A description of the fossil and its context (e.g. position and depth of find)
    - Where and how the find has been stored
    - Photographs to accompany the preliminary report (the more the better):
        - A scale must be used
        - Photos of location from several angles
        - Photos of vertical section should be provided
        - Digital images of hole showing vertical section (side);
        - Digital images of fossil or fossils.

Upon receipt of this Preliminary Report, SAHRA will inform the ECO or site agent whether or not a rescue excavation or rescue collection by a palaeontologist is necessary.

- Exposed finds must be stabilised where they are unstable and the site capped, e.g. with a plastic sheet or sand bags. This protection should allow for the later excavation of the finds with due scientific care and diligence. SAHRA can advise on the most appropriate method for stabilisation.
- If the find cannot be stabilised, the fossil may be collect with extreme care by the ECO or the site agent and put aside and protected until SAHRA advises on further action. Finds collected in this way must be safely and securely stored in tissue paper and an appropriate box. Care must be taken to remove the all fossil material and any breakage of fossil material must be avoided at all costs.

No work may continue in the vicinity of the find until SAHRA has indicated, in writing, that it is appropriate to proceed.

CTS HERITAGE

FOSSIL DISCOVERIES: PRELIMINARY RECORDING FORM		
Name of project:		
Name of fossil location:		
Date of discovery:		
Description of situation in which the fossil was found:		
Description of context in which the fossil was found:		
Description and condition of fossil identified:		
GPS coordinates:	*Lat:*	*Long:*
If no co-ordinates available then please describe the location:		
Time of discovery:		
Depth of find in hole		
Photographs (tick as appropriate and indicate number of the photograph)	*Digital image of vertical section (side)*	
	Fossil from different angles	
	Wider context of the find	
Temporary storage (where it is located and how it is conserved)		
Person identifying the fossil Name:		
Contact:		
Recorder Name:		
Contact:		
Photographer Name:		
Contact:		

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Palaeontological Impact Assessment for the proposed extension of the railway infrastructure at the Wessels Mine, near Hotazel, Northern Cape Province

Desktop Study (Phase 1)

For

CTS Heritage
SLR Consulting (South Africa)(Pty)Ltd

14 October 2021

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 32 years research; 24 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by CTS Heritage, Cape Town, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A Palaeontological Impact Assessment was requested by SAHRA (Case ID:17101) for the proposed extension of the existing railway infrastructure at the Wessels Mine, by Hotazel Manganese Mines (Pty) Ltd (HMM), a subsidiary of South32 Limited (South32).

To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

The proposed project lies on the aeolian sands of the Kalahari Group (Quaternary age). Rocks bearing iron and manganese are below the surface and they do not preserve any fossils. Aeolian sands do not preserve fossils as they are windblown. Rarely the sands will entrap more robust fossils, such as fragments of bones or wood, but these are not in situ. If palaeo-pans or palaeo-springs are in the area they might preserve fossils but no such feature is evident from the Google Earth imagery. There is an extremely small chance that fossils occur on the land surface, nonetheless a Fossil Chance Find Protocol should be added to the Environmental Management Programme (EMPr). Based on this information it is recommended that no palaeontological site visit is required and the proposed project may be authorised.

Impact assessment:

	Pre-mitigation	Post-mitigation
Significance	Very low	Insignificant

Mitigation: If fossils are found by the environmental officer or other responsible person, they should be photographed *in situ* and the location recorded by GPS. The fossils can be placed in a safe place until the palaeontologist has assessed their scientific importance and advised of the way forward.

Table of Contents

1. Background

Hotazel Manganese Mines (Pty) Ltd (HMM), a subsidiary of South32 Limited (South32), intends to upgrade the existing railway infrastructure at the Wessels Mine. The upgrade will consist of modifications to the staging rail lines and the design of a new rail balloon. The extension of the railway into the new railway balloon measures at approximately 2 500 m long and 25 m wide and would result in the clearing of indigenous vegetation (more than 1 hectare, but less than 20 hectares). Additionally, the railway would cross a section of the existing tailings dam and would thus result in the removal of approximately 15 000 – 25 000 m3 of material from the tailings area, which would then be deposited on another existing tailings dam. The new railway extension would be located within the existing Mining Right (MR) boundary at the Wessels Mine and amendments to the mine's Water Use Licence (WUL) are not required.

Since the proposed rail line route lies on moderately sensitive rocks as per the SAHRA Palaeosensitivity Map, SAHRA has requested a desktop Palaeontological Impact Assessment (Case Id: 17101). In order to comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project and is reported herein.

Table 1: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (amended 2017)

	A specialist report prepared in terms of the Environmental Impact Regulations of 2017 must contain:	**Relevant section in report**
ai	Details of the specialist who prepared the report	Appendix B
aii	The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
b	A declaration that the person is independent in a form as may be specified by the competent authority	Page
c	An indication of the scope of, and the purpose for which, the report was prepared	Section 1
ci	An indication of the quality and age of the base data used for the specialist report: SAHRIS palaeosensitivity map accessed – date of this report	Yes
cii	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 5
d	The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
e	A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
f	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 4

g	An identification of any areas to be avoided, including buffers	N/A
h	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
i	A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
j	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
k	Any mitigation measures for inclusion in the EMPr	Section 6, 8; Appendix A
l	Any conditions for inclusion in the environmental authorisation	N/A
m	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Appendix A
ni	A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
nii	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	N/A
o	A description of any consultation process that was undertaken during the course of carrying out the study	N/A
p	A summary and copies if any comments that were received during any consultation process	N/A
q	Any other information requested by the competent authority.	N/A

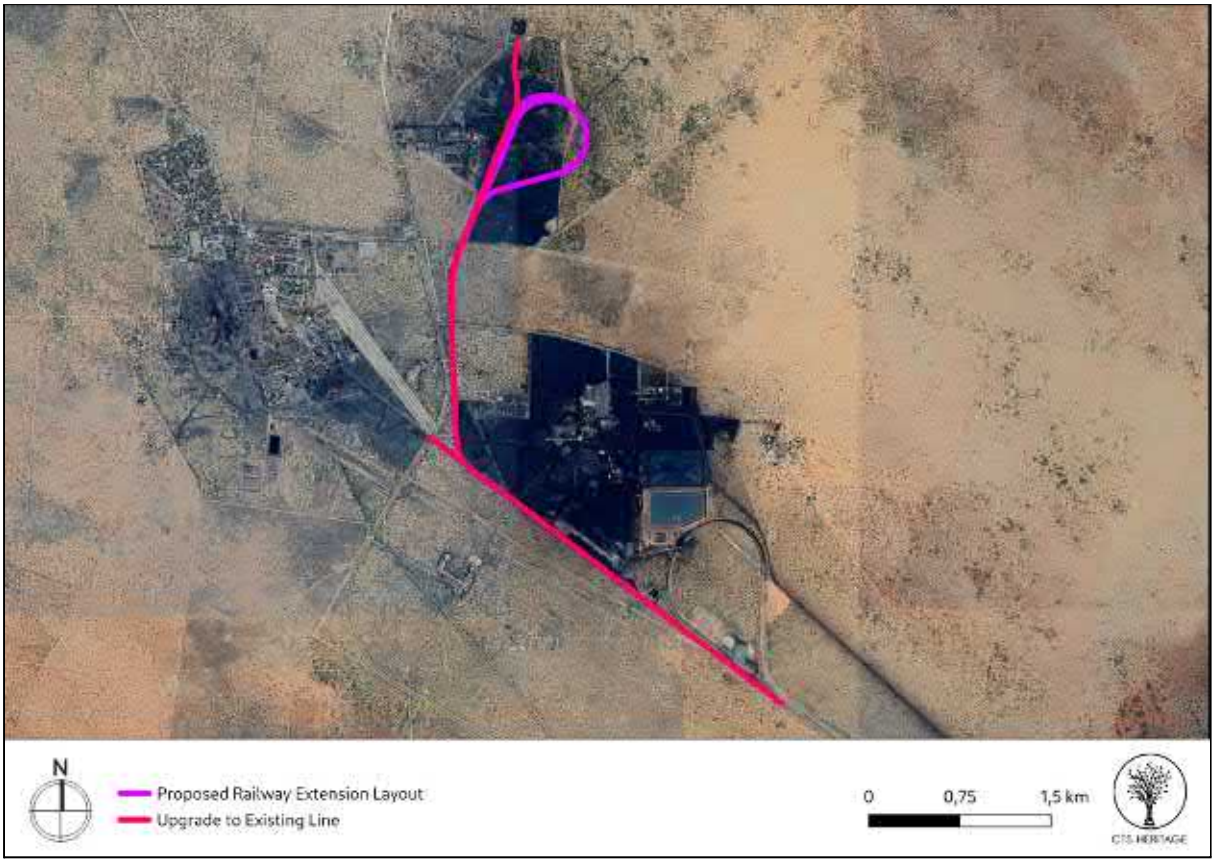

Figure 1: Locality map of the proposed rail line just north of Hotazel, on Wessels Mine with the route shown by the purple and pink lines. Note that most of the route is on highly disturbed mined land or dumps. Map supplied by CTS.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a Desktop PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

- Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
- Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (not applicable to this assessment);
- Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (not applicable to this assessment); and
- Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (not applicable to this assessment).

3. Geology and Palaeontology

3.1 Project location and geological context

The HMM Wessels Mine is on the northeastern margin of the Griqualand West Sequence of Neoarchaean intrusive rocks, in the Prieska Subbasin of the Transvaal Basin that is filled with the sequence of the Transvaal Supergroup (Figure 2). Outcrops of the two main iron and manganese-bearing rocks are exposed to the east of the mine, but below the Kalahari sands are layers of banded iron formation (BIF) that is in primary context in the Kuruman Formation and reworked in the overlying Danielskuil Formation (Beukes et al., 2016). These ancient rocks are the target of the mining operation, but they are non-fossiliferous so will not be considered any further in this palaeontological report.

Overlying much of the area are the Kalahari Group sands. This is the largest and most extensive palaeo-erg in the world (Partridge et al., 2006) and is composed of extensive aeolian and fluvial sands, sand dunes, calcrete, scree and colluvium. Periods of aridity have overprinted the sands, and calcrete and silcrete are common.

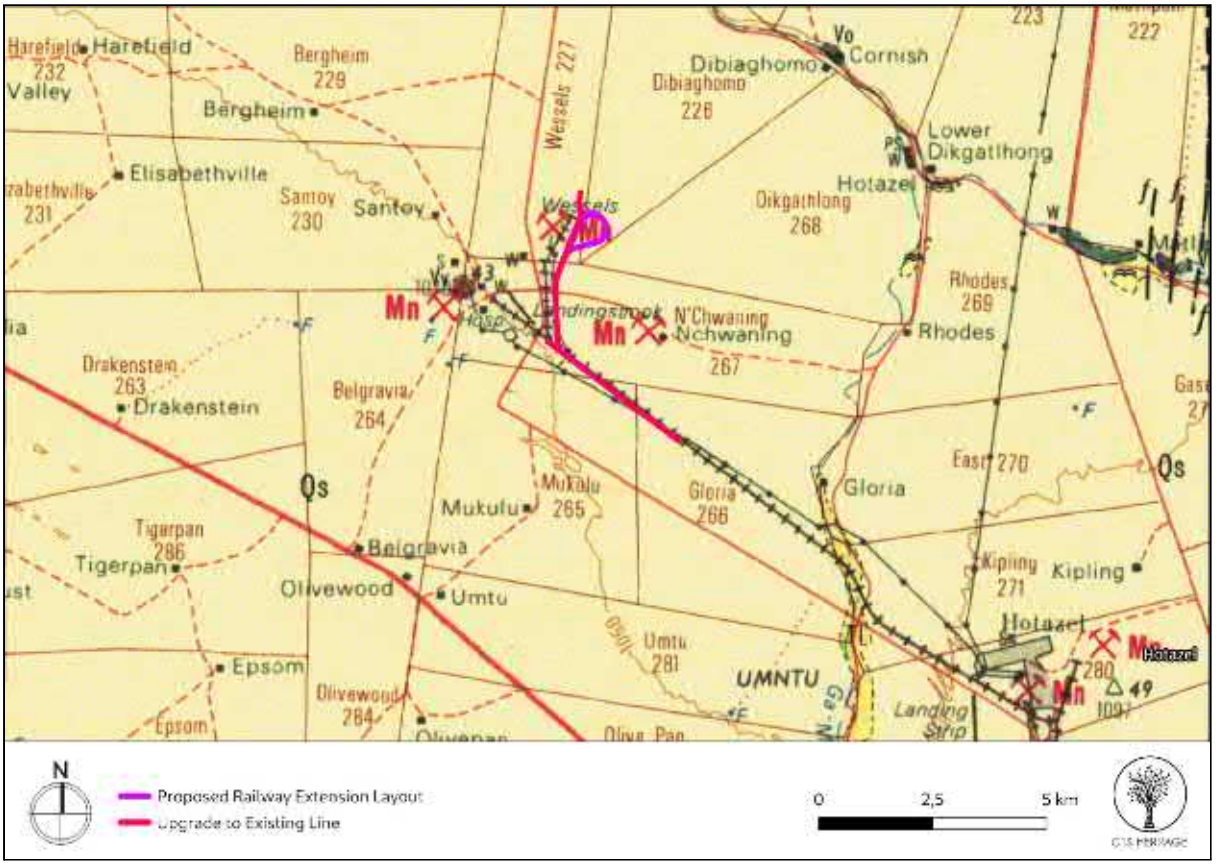

Figure 2: Geological map of the area around Hotazel, Northern Cape Province. The location of the proposed rail balloon is indicated by the purple line and the upgrade of the existing line by the red line. Abbreviations of the rock types are explained in Table 2. Map enlarged from the Geological Survey 1: 250 000 map 2722 Kuruman.

Table 2: Explanation of symbols for the geological map and approximate ages (Partridge et al., 2006; Schröder et al., 2016). SG = Supergroup; Fm = Formation; Ma = million years; grey shading = formations impacted by the project.

Symbol	Group/Formation	Lithology	Approximate Age
Qs	Kalahari Group	Aeolian sand,	Quaternary ca 2.5 Ma to present
Tl	Tertiary limestone	Sand and limestone	Quaternary ca 2.5 Ma to present
Vad	Danielskuil Fm, Asbestos Hills Subgroup, Ghaap Group, Griqualand West Sequence	Banded or massive jaspilite or crocidilite	Ca 2440 -2460 Ma
Vak	Kuruman Fm, Asbestos Hills Subgroup, Ghaap Group, Griqualand West Sequence	Banded iron formation	Ca 2440 -2460 Ma

3.2. Palaeontological context

The palaeontological sensitivity of the project area under consideration is presented in Figure 3. The route of the existing rail line, as well as the proposed balloon rail line are covered by aeolian Kalahari sands that were derived from farther to the northwest (Goudie and Wells, 1995) and finally deposited in this region during the Quaternary. Since they are windblown the sands are not in primary context, nor do they preserve any fossils.

Fossils can only be preserved if there are palaeo-spring or palaeo-pan deposits where wood, plants or bones can be entrapped and preserved in the calcrete or silcrete that occasionally forms in such settings. No such deposits have been recorded from this site, and the Google Earth imagery does not show any pan or spring deposits. According to Goudie and Wells (1995) three factors are required for the formation of pans, namely a setting where the fluvial system is not fully integrated, and where salt weathering and aeolian deflation occur. The latter two conditions apply to this environmental setting, but the first does not as the site is on a slope and is far from any major river or drainage system. Therefore, it is extremely unlikely that there are any pans in the site or any fossils in the sands. Since most of the area has been disturbed by previous mining operations it is unlikely that any pan or spring features remain (refer to Figure 1).

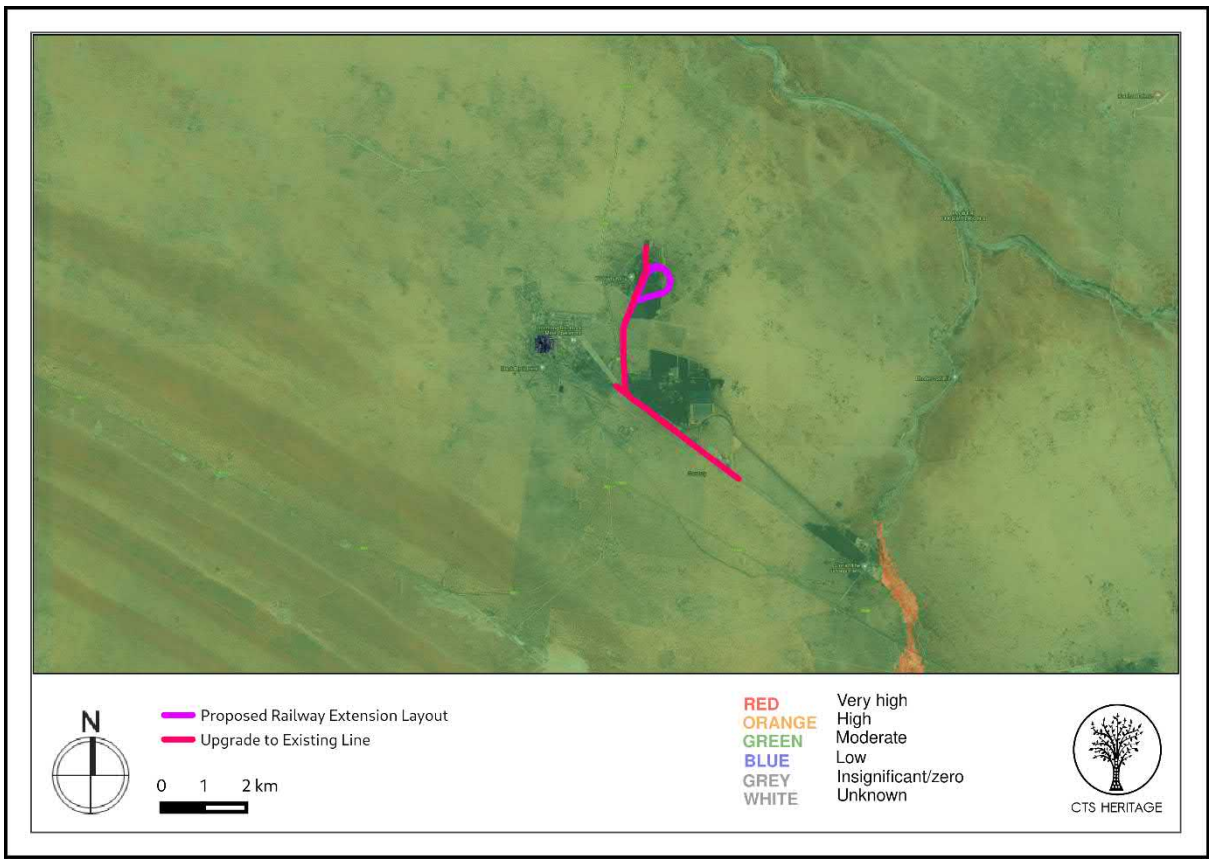

Figure 3: SAHRIS palaeosensitivity map for the Wessels Mine rail lines, shown by the red and purple lines. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS palaeosensitivity map above (Figure 3) the area is indicated as moderately sensitive (green) and this applies to the Kalahari sands.

4. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the banded iron formation, jaspilite and crocidolite, sandstones and aeolian sands are typical for the country and do not contain fossil plant, insect, invertebrate and vertebrate material. The aeolian sands of the Quaternary period would not preserve fossils.

5. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria according to the SLR impact Rating Method in Annex 1 (not reproduced here).

Table 3: Outcomes of the Impact Consequence and Significance Ratings

Category	Pre – mitigation	Post mitigation = site visit and removal of any fossils (if present)	Justification
Intensity	Low	Zero – very low	Negligible change, disturbance or nuisance. The impact affects the environment in such a way that natural functions and processes are not affected. People / communities are able to adapt with relative ease and maintain pre-impact livelihoods
Duration	Very long term	Very long term	
Extent	Local	Local	Only fossils in the project area would be affected
Probability	Medium	Very low	Fossils would only occur in palaeo-pans or palaeo-springs
Degree	Low	High	> 70% sure of impact prediction
Confidence	High	High	If pans were present they would be visible in the satellite imagery
Mitigation	Low	Very low	The occurrence of fossils is unlikely but if they were present and removed there would be no impact
Loss of Resources	Low	Low	Fossils are not considered a resource
Reversibility	Irreversible	Partly reversible	If fossils are removed the impact is reduced
Consequence	Low	Very low	Pre-mitigation: of low intensity at a local level in the long term; With mitigation: Zero to very low intensity with any combination of extent and duration.
Significance	Very low	Insignificant	

The significance to the local population is very low because the presence or absence fossils does not affect their livelihood, income or health. The significance to science and society is higher because the loss of fossils might mean a loss to knowledge.

Mitigation

There would be no loss to our national heritage and science if fossils are collected and preserved in a recognised institution (museum or university with a palaeontology department) where they can be studied.

It is very unlikely that any fossils would be present in the aeolian sands unless there are palaeo-pans or palaeo-springs that could entrap fossils but no such feature is evident from

the satellite imagery. Furthermore, much of the area is already highly disturbed by mining activities.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks below the surface are much too old to contain fossils and of the wrong kind, and aeolian sands do not preserve fossils. Only if there are palaeo-pans or palaeo-springs in the area, and none is visible from the Google Earth imagery, is there a very small chance of fossil wood or bone fragments occurring in the footprint. Furthermore, the material to be targeted does not preserve fossils. Since there is an extremely small chance that fossils from the Quaternary Kalahari sands may have entrapped fossils, a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the aeolian sands of the Quaternary. There is a very small chance that fossils from pans or springs may have been entrapped in the sands of the Kalahari Group (Quaternary). Therefore, a Fossil Chance Find Protocol should be added to the EMPr. If fossils are found once drilling and excavations have commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations activities begin.

- The following procedure is only required if fossils are seen on the surface and when excavations commence.
- When excavations begin the rocks must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, bone, coal) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
- Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 4). This information will be built into the EMP's training and awareness plan and procedures.
- Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
- If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project,

should visit the site to inspect the selected material and check the dumps where feasible.

- Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
- If no good fossil material is recovered then no site inspections by the palaeontologist will not be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
- If no fossils are found and the excavations have finished then no further monitoring is required.

8. References

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Beukes, N.J., Swindell, E.W.P., Wabo, H., 2016. Manganese Deposits of Africa. Episodes, 39(3), 1-33. DOI: 10.18814/epiiugs/2016/v39i2/95779

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Appendix A – Examples of fossils from the Quaternary Aeolian sands

Figure 4: Examples of robust fossils that might be preserved in Kalahari sands, pans or springs.

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
July 2021

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+
Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative

ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees
All at Wits University

Degree	Graduated/completed	Current
Honours	7	0
Masters	11	4
PhD	12	5
Postdoctoral fellows	10	3

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 – 2021

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics
- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells

- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
- Remhoogte PR 2019 for A&HAS
- Bospoort Agriculture 2019 for Kudzala
- Overlooked Quarry 2019 for Cabanga
- Richards Bay Powerline 2019 for NGT
- Eilandia dam 2019 for ACO
- Eastlands Residential 2019 for HCAC
- Fairview MR 2019 for Cabanga
- Graspan project 2019 for HCAC
- Lieliefontein N&D 2019 for Enviropro
- Skeerpoort Farm Mast 2020 for HCAC
- Vulindlela Eco village 2020 for 1World
- KwaZamakhule Township 2020 for Kudzala
- Sunset Copper 2020 for Digby Wells

xi) Research Output

Publications by M K Bamford up to July 2021 peer-reviewed journals or scholarly books: over 150 articles published; 5 submitted/in press; 8 book chapters.
Scopus h-index = 29; Google scholar h-index = 36; -i10-index = 95
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)