VISUAL IMPACT ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED THE DUEL COAL PROJECT, LIMPOPO PROVINCE

Prepared for:

Jacana Environmentals cc

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Prepared by:	**Scientific Aquatic Services**
Report Authors:	**Michelle Pretorius (Pr.Sci.Nat; Pr.L.A.Tech)**
Reviewed by:	**Stephen van Staden (Pr. Sci. Nat)**
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Scientific Aquatic Services CC
CC Reg No 2003/078943/23
Vat Reg. No. 4020235273
PO Box 751779
Gardenview
2047
Tel: 011 616 7893
Fax: 086 724 3132
E-mail: admin@sasenvironmental.co.za

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the environmental assessment and authorisation process for the proposed The Duel Coal Project. The Mining Right Application (MRA) area, which is proposed to be an underground and opencast coal mine, is situated on the remaining extent of the farm The Duel 186 MT and is hereafter referred to as the "study area". The study area is located roughly 12km to the east of the N1 highway between the towns of Louis Trichardt (Makhado), located approximately 33km to the south, and Musina, approximately 45km to the north, within the Limpopo Province. The R525 regional road is located around 6km to the north of the study area, with various local gravel roads, mainly used by local residents, visitors and workers, connecting the smaller villages in the region, also located within the vicinity of the study area. The Nzhelele Nature Reserve is situated immediately to the east of the study area, with the Nzhelele Dam situated roughly 4km further to the east and the Mutamba River located nearby to the west and northwest. The land coverage in the vicinity and within The Duel Coal Project area is mixed between rural settlement, hunting and ecotourism. Some of the properties are also focused on mixed farming, with a mixture of livestock, game and irrigated agriculture.

The topography associated with the study area and the surrounding region is considered to be mountainous, with steep undulating slopes, which form distinguishing topographical features in the form of foothills/ mountains and outcrops, present within the central portion of the study area and to the south thereof.

This report, after consideration and description of the visual integrity and characteristics of the study area and surrounds, must guide the proponent, authorities and Environmental Assessment Practitioner (EAP), by means of recommendations, as to the most appropriate way forward for further assessment of visual and aesthetic impacts associated with the proposed development for the intended mining land use.

Aim and Objectives of the study

The scope and broad aim of the VIA for the proposed The Duel Coal Project is summarised as follows:

- To determine the Category of Development and Level of Assessment as outlined by Oberholzer (2005);
- To describe the receiving environment in terms of regional context, location and environmental and landscape characteristics;
- To describe and characterise the proposed project and the study area in its proposed future state;
- To identify the main viewsheds through undertaking a viewshed analysis, based on the proposed height of infrastructure components and the Digital Elevation Model (DEM), as a mechanism to identify the locations of potential sensitive receptors sites and the distance of these receptor sites from the project;
- To identify and describe potential sensitive visual receptors residing at or utilising receptor sites;
- To establish receptor sites and identify Key Observation Points (KOPs) from which the proposed project will have a potential visual impact;
- To prepare a photographic study and conceptual visual simulation of the proposed project as the basis for the viewshed identification and analysis;
- To assess the potential visual impact of the proposed project from selected receptors sites in terms of standard procedures and guidelines; and
- To describe mitigation measures in order to minimise any potential visual impacts.

Description of the Receiving Environment

- Several dominant land uses have been identified within and in the vicinity of the study area, namely:
  - residential, which includes rural, low-density residential dwellings within villages spaced some distance apart, including educational, health and business facilities;
  - agricultural, including game and livestock farming, subsistence agriculture and informal grazing land, and irrigation downstream;
  - Nature reserves, lodges (including the informally protected Ekland Safaris hunting concession) and game farms within the larger region; and

- Urban areas located up to 30km to the north, south and southeast.

- The dominant land use within the study area itself, is game farming with large sections of the study area, particularly the higher-lying Soutpansberg Mountain Bushveld areas, being largely intact and not directly impacted by anthropogenic activities and development;
- The study area in its present condition is not affected by mining activities and no mining activities are present within the immediate vicinity of the study area at the current time;
- The topography associated with the study area and the surrounding region is considered to be mountainous, with steep undulating slopes, which form distinguishing topographical features in the form of steep hills and outcrops that are interspersed with wide, lower-lying plains. Steep foothills/ mountains, forming part of the northern reaches of the eastern Soutpansberg Mountain range to the south, are present within the central portion of the study area. This topography is characteristic of the larger region to the northeast, east and southwest and is not confined to the study area. The most prominent drainage lines in the region are the Mutamba River to the west and the Nzhelele River and Nzhelele Dam to the east;
- The vegetation associated with the study area is predominantly in a natural condition, with disturbance limited to areas adjacent to the gravel road traversing the southern section of the study area and areas associated with residential development to the southeast. Within the remainder of the study area, vegetation structure is largely intact, with limited occurrence of bare and exposed soils. The various riparian areas and the central, mountainous portion of the study area in particular, have a well-developed, tall woody component and overall vegetation cover throughout the remainder of the study area is high. Vegetative cover and vegetation integrity influence the Visual Absorption Capacity (VAC) of a development site and may also impact on the degree of visibility and visual intrusion of a project through screening;
- This landscape character type can be described as rural, mountainous, closed bushveld, with a number of prominent and eye-catching features present in the form of steep hills and outcrops. Although the landscape character within the larger region is relatively homogeneous, the landscape associated with the study area itself is considered to be diverse as a result of the variety of topographical features;
- Five factors have been considered to determine the VAC of the study area, namely vegetation, soil contrast, visual variety, topographical diversity and recovery time. The VAC for the study area has been determined as medium;
- Due to the nature of the project and its location within a region currently unaffected by mining activity, the proposed project will lead to a high level of visual intrusion on the landscape and is expected to be clearly noticeable in relation to its surroundings. It should however be taken into consideration that the Makhado Colliery, situated directly west of The Duel has been approved and in relation to the Makhado Colliery, The Duel Coal project will be a very small operation. In addition, the medium VAC of the study area, with particular reference to topographical diversity, will serve to somewhat limit such intrusion from certain receptor sites;
- Landscape quality of the study area was determined based on landform, vegetation, the presence of surface water, colour, adjacent scenery, scarcity and cultural modification factors and was determined to have an overall medium scenic quality and is considered to exhibit positive character, with a recognisable landscape structure and sense of place, including some detracting features in the form of disturbance within the southern portion of the study area;
- The study area itself is likely to be most valued by local residents and workers and, as far as is known to the visual consultants at the current time, does not contain value for special interest groups and is not known to be of provincial, national or international cultural historical importance; and
- The sense of place of the study area is somewhat significant when compared to its surroundings and may be considered to be moderate to high with its sense of place largely attributed to its rural, undeveloped character with mostly intact vegetation structure and well-defined topography.

Visual Exposure and Visibility

- From the viewshed analyses, it is evident that the proposed project will be highly visible from within 5km of the study area and visible from a number of villages, including Makushu and Mosholombe that border the study area as well as Pfumembe located within 1km of the study area. Villages within 10km of the study area that may be visually exposed to the project include Mudimeli, Musekwa, Bonjane and Mufongodi towards the east and west of the study area and from various game farms, nature reserves and lodges in the vicinity of the proposed project;

- The project will not be highly visible from the south of the study area. The viewshed analyses indicates that the project will be visible from beyond 10km of the study area, particularly towards the east, north and west of the study area and it is recommended that, as far as possible, the proposed mining infrastructure does not extend above the central mountainous feature within the study area in order to minimise the extent of the viewshed;
- The project will not be visible from any nature reserves other than the adjacent Nzhelele Nature Reserve; and
- From the viewshed and line of sight analyses, it is evident that the proposed waste dump, and to a lesser degree, the proposed discard dump, will contribute the most towards the expected visual impact, while the visibility of the opencast areas will be much lower due to this infrastructure being located at and below ground level.

Receptors

- The main sensitive visual receptors include local residents of settlements in the immediate vicinity of the study area, as well as residents residing further away from the study area within villages from where the proposed project will also be visible. The immediate region associated with the study area is not specifically known to be a tourist area, however game hunters and recreational tourists, including hikers, birders, mountain bikers etc. frequent the various game farms and lodges in the region. The Nzhelele Nature Reserve and Nzhelele Dam may also be visited by tourists, particularly by anglers and day visitors, while the informally protected Ekland Safaris hunting concession is also visited by hunters and tourists. Such tourists are also likely to be affected by the proposed project;
- Less sensitive visual receptors, are likely to be people at their place of work, including local farmers or people engaged in study or similar activities, whose attention may be focused on their work or activity and who will therefore be potentially less susceptible to changes in the view;
- Other potential visual receptors are people travelling on the N1 roadway, passing to the west of the study area and travellers on the R525, passing the study area in the north. The proposed project be only be intermittently visible from these main roads and the duration of visual exposure will be limited. In addition, the distance from these roads and local topography will lower the project's visibility;
- The proposed project will not be visible from larger towns in the region such as Musina, Louis Trichardt (Makhado) and Thohoyandou;
- Key Observation Points (KOPs) were identified based on prominent viewpoints, where uninterrupted views of the proposed development may occur and at points where positive viewshed areas intersect with potential receptors. The majority of KOPs were also selected within 10km of the proposed project, as receptors beyond this distance are unlikely to be significantly affected; and
- From the field assessment and analysis of the KOPs identified, it was determined that the proposed project will be highly visible to moderately visible to receptors up to 7.5km from the project area, while further than 7.5km from the project area, the infrastructure will be marginally visible. Beyond 10km the infrastructure fall within the hardly visible distance class and is unlikely to be noted, unless pointed out.

Night-time Lighting

- Light sources impacting on the study area and its surroundings originate from the adjacent Makushu and Mosholombe villages as well as from game farms and lodges in the region, an vehicular movement on local gravel roads in the vicinity of the study area. Villages in the region have been found to create distinct sky-glow effects that are visible from a distance. The lighting environment of the study area is thus consistent with Environmental Zone E2 – Low District Brightness typically associated with rural agriculture areas and rural villages; and
- The proposed project is expected to contribute to the effects of sky glow and artificial lighting in the region, particularly as a result of stationary lighting sources, including lighting from the plant facilities. Generally, the impacts of vehicle mounted lighting sources in the area will be confined to the local and sub-regional setting (up to 10km from the study area) due to the effects of distance and intervening undulating topography, existing settlements and vegetation which restrict the potential impact on views from more distant regional points.

Impact Assessment Results

- Based on the above assessment it is evident that there are four possible impacts that may affect the visual character of the study area and impact on potential receptors and visually sensitive landscapes.

The tables below summarise the findings of the impact assessment, indicating the significance.

Construction phase

Impact	Unmanaged	Managed
1: Impact on landscape character and sense of place	Medium-High	Medium-Low
2: Visual intrusion and VAC impacts	Medium-High	Medium-Low
3: Visual exposure and visibility impacts	High	Medium-High
4: Impacts due to night time lighting	Medium-High	Medium-Low

Operational phase

Impact	Unmanaged	Managed
1: Impact on landscape character and sense of place	High	Medium-High
2: Visual intrusion and VAC impacts	High	Medium-High
3: Visual exposure and visibility impacts	High	Medium-High
4: Impacts due to night time lighting	High	Medium-High

Closure and Decommissioning Phase

Impact	Unmanaged	Managed
1: Impact on landscape character and sense of place	Medium-High	Medium-Low
2: Visual intrusion and VAC impacts	Medium-High	Medium-Low
3: Visual exposure and visibility impacts	Medium-High	Medium-Low
4: Impacts due to night time lighting	Medium-High	Medium-Low

- Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed project in conjunction with further planned mining activity within the region is likely to be of high significance, even more so due to the fact that no existing mining activities are currently present within the region. The cumulative impact of additional traffic on the local and regional roads as well as combined impacts from night-time lighting will also affect the sense of place of the larger region; and
- It is possible that after all infrastructure have been removed from the study area, scarring of the terrain may remain present after closure. This is of particular significance within the vicinity of the central mountain against which the proposed interim waste dump is to be placed. Material from this dump will be backfilled into the open pit once mining activities have ceased and it is expected that indigenous vegetation against the mountain slope will be permanently lost or altered. The possibility also exists that rehabilitation efforts, including revegetation of impacted areas, including the open pit and the mountain slopes where waste material have been removed, will be unsuccessful, which will lead to a long term or permanent visual impact in the area.

Conclusion and Mitigation

- Should it be deemed appropriate to mine the resource, extensive mitigation measures will have to be implemented in order to minimise the visual impacts, with specific reference to concurrent revegetation and shaping of the waste and discard dumps and effective rehabilitation of the central mountain slope once waste material has been removed to backfill the open pit. The rehabilitation of the infrastructure, including the open pit must take place concurrently as far as possible and must take place in such a way as to ensure that the post closure land use objectives are met and as far as possible, to recreate pre-mining conditions in order to prevent residual and permanent visual impacts. Potential cumulative visual impacts, as a result of mining activities within this area supporting the precedent for further mining development within the region, will further exacerbate the negative visual impact;
- Other management measures that will have to be implemented in order to minimise the visual impact on the local and subregional area, apart from the placement of mining infrastructure, include strict consideration of material selection, screening, management of lighting and implementing good housekeeping measures; and

- It is the opinion of the specialists that this study provides the relevant information required in order to ensure that the best long-term use of the resources on the study area will be made in support of the principle of sustainable development.

DOCUMENT GUIDE

The table below provides the NEMA (2014) Requirements for Specialist Assessments and also the relevant sections in the reports where these requirements are addressed.

NEMA Regulations (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Appendix A
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A
A declaration that the person is independent in a form as may be specified by the competent authority	Appendix A
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4.3
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 4
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 5.5 & 5.6
An identification of any areas to be avoided, including buffers	Section 5.5 & 5.6
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5.4
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
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 6.1
Any mitigation measures for inclusion in the EMPr	Section 6.5
Any conditions for inclusion in the environmental authorisation	Section 6.5
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6.6
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	Section 7
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	Section 6.5
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

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GLOSSARY OF TERMS

Best practicable environmental option	This is the alternative/option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.
Characterisation	The process of identifying areas of similar landscape character, classifying and mapping them and describing their character.
Characteristics	An element, or combinations of elements, which make a contribution to landscape character.
Development	Any proposal that results in a change to the landscape and/ or visual environment.
Elements	Individual parts, which make up the landscape, for example trees and buildings.
Feature	Particularly prominent or eye-catching elements in the landscape such as tree clumps, church towers or wooded skylines.
Geographic Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.
Impact (Visual)	A description of the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.
Key characteristics	Those combinations of elements which are particularly important to the current character of the landscape and help to give an area it particularly distinctive sense of place.
Land cover	The surface cover of the land, usually expressed in terms of vegetation cover or the lack of it. Related to but not the same as Land use.
Land use	What land is used for based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.
Landform	The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.

Landscape	An area, as perceived by people, the character of which is the result of the action and interaction, of natural and/ or human factors.
Landscape Character Type	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Landscape integrity	The relative intactness of the existing landscape or townscape, whether natural, rural or urban, and with an absence of intrusions or discordant structures.
Landscape quality	A measure of the physical state of the landscape. It may include the extent to which typical landscape character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons.
Receptors	Individuals, groups or communities who are subject to the visual influence of a particular project. Also referred to as viewers, or viewer groups.
Sense of place	The unique quality or character of a place, whether natural, rural or urban, allocated to a place or area through cognitive experience by the user. It relates to uniqueness, distinctiveness or strong identity and is sometimes referred to as genius loci meaning 'spirit of the place'.
Sky glow	Brightening of the night sky caused by outdoor lighting and natural atmospheric and celestial factors.
Skylining	Siting of a structure on or near a ridgeline so that it is silhouetted against the sky.
View catchment area	A geographic area, usually defined by the topography, within which a particular project or other feature would generally be visible.

Viewshed	The outer boundary defining a view catchment area, usually along crests and ridgelines.
Visibility	The area from which project components would potentially be visible. Visibility is a function of line of sight and forms the basis of the VIA as only visible structures will influence the visual character of the area. Visibility is determined by conducting a viewshed analysis which calculates the geographical locations from where the proposed power line might be visible.
Visual Absorption Capacity	The ability of an area to visually absorb development as a result of screening topography, vegetation or structures in the landscape.
Visual Character	The overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual Exposure	The relative visibility of a project or feature in the landscape. Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance.
Visual Intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Zone of visual influence	An area subject to the direct visual influence of a particular project.

*Definitions were derived from Oberholzer (2005) and the Institute of Environmental Management and Assessment (2013).

LIST OF ACRONYMS AND ABBREVIATIONS

ARC	Agricultural Research Council
BLM	(United States) Bureau of Land Management
BPEO	Best Practicable Environmental Option
DEM	Digital Elevation Model
DMR	Department of Mineral Resources
DTM	Digital Terrain Model
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
GIS	Geographic Information System
GPS	Global Positioning Systems
IAPs	Interested and Affected Parties
IEMA	Institute of Environmental Management and Assessment
IDP	Integrated Development Plan
KOP	Key Observation Point
MRA	Mining Rights Area
NEMA	National Environmental Management Act (No. 108 of 1997)
NPAES	National Protected Areas Expansion Strategy
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management

1. INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the environmental assessment and authorisation process for the proposed The Duel Coal Project. The Mining Right Application (MRA) area, which is proposed to be an underground and opencast coalmine, is situated on the remaining extent of the farm The Duel 186 MT and is hereafter referred to as the "study area". The study area is located roughly 12km to the east of the N1 highway between the towns of Louis Trichardt (Makhado), located approximately 33km to the south and Musina, approximately 45km to the north, within the Limpopo Province. The R525 regional road is located around 6km to the north of the study area, with various local gravel roads, mainly used by local residents, visitors and workers, connecting the smaller villages in the region, also located within the vicinity of the study area. The Nzhelele Nature Reserve is situated immediately to the east of the study area, with the Nzhelele Dam situated roughly 4km further to the east and the Mutamba River located nearby to the west and northwest. The land coverage in the vicinity and within The Duel Coal Project area is mixed between rural settlement, hunting and ecotourism. Some of the properties are also focused on mixed farming, with a mixture of livestock, game and irrigated agriculture.

The topography associated with the study area and the surrounding region is considered to be mountainous, with steep undulating slopes, which form distinguishing topographical features in the form of hills/ mountains and outcrops, present within the central portion of the study area and to the south thereof.

The purpose of this report is:

- To determine the Category of Development and Level of Assessment as outlined by Oberholzer (2005);
- To describe the receiving environment in terms of regional context, location and environmental and landscape characteristics;
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- To identify the main viewsheds through undertaking a viewshed analysis, based on the proposed height of infrastructure components and the Digital Elevation Model (DEM), as a mechanism to identify the locations of potential sensitive receptors sites and the distance of these receptor sites from the project;

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- To prepare a photographic study and conceptual visual simulation of the proposed project as the basis for the viewshed identification and analysis;
- To assess the potential visual impact of the proposed project from selected receptors sites in terms of standard procedures and guidelines; and
- To describe mitigation measures in order to minimise any potential visual impacts.

A VIA entails a process of data collection, spatial analysis, visualisation and interpretation to describe the quality of the landscape before development takes place and then identifying possible visual impacts after development. Assessing visual impacts are difficult as it is very subjective due to a person's perception being affected by more than only the immediate environmental factors (Oberholzer, 2005). Visual impacts occurring as a result of the proposed The Duel Coal Project, will occur during the construction, operational and decommissioning/ closure phases of the proposed project, with residual visual impact possibly occurring post-closure. Impacts would specifically result from vegetation clearing, construction and operation of the Coal Handling Processing Plant, access roads, discard and waste dumps and associated surface infrastructure, as well as lighting being seen by potential sensitive receptors, and the overall detrimental effect on the visual character and sense of place of the study area and its surrounds.

This report, after consideration and description of the visual integrity of the study area and surroundings, must guide the proponent, authorities and Environmental Assessment Practitioner (EAP), by means of recommendations, as to the suitability of the study area for the intended mining land use, from a visual and aesthetic point of view. This report must furthermore serve to inform the planning, design and decision making process as to the layout and nature of the proposed mining activities.

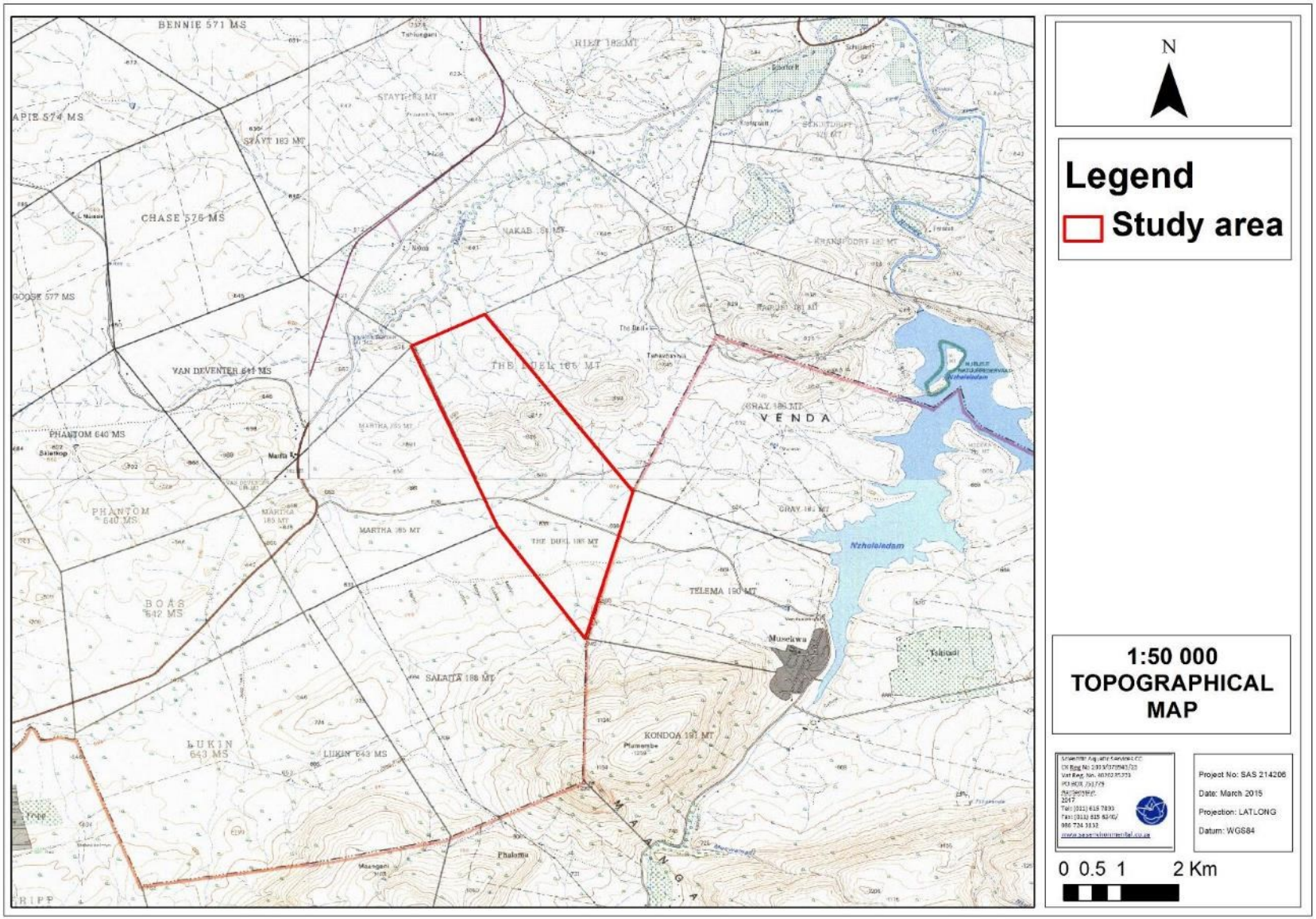


Figure 1: 1:50 000 Topographical map depicting the location of the study area in relation to the surrounding region.

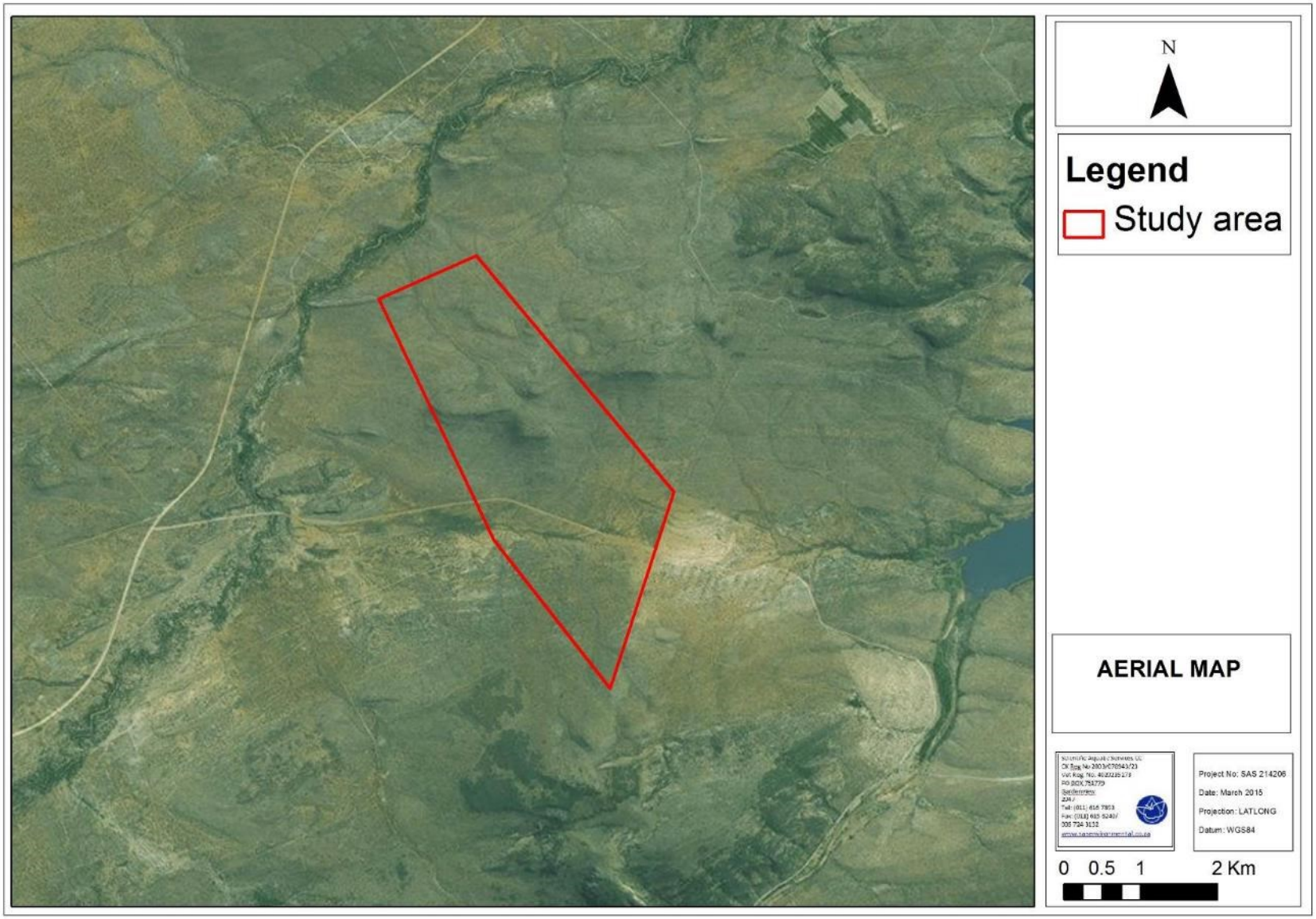


Figure 2: Digital satellite image depicting the location of the study area in relation to the surrounding region.

1.2 Principles and Concepts of VIAs

Visual resources have value in terms of the regional economy and inhabitants of the region. Furthermore, these resources are often difficult to place a value on as they normally also have cultural or symbolic values. Therefore, VIAs are to be performed in a logical, holistic, transparent and consistent manner. Oberholzer (2005) identifies the following concepts to form an integral part of the VIA process:

- Visual resources include the visual, aesthetic, cultural and spiritual aspects of the environment, which contribute toward and define an area's sense of place;
- Natural and cultural landscapes are inter-connected and must be considered as such;
- All scenic resources, protected areas and sites of special interest within a region need to be identified and considered as part of the VIA;
- All landscape processes such as geology, topography, vegetation and settlement patterns that characterise the landscape must be considered;
- Both quantitative criteria, such as 'visibility' and qualitative criteria, such as aesthetic value or sense of place has to be included as part the assessment;
- VIAs must inform the Environmental Impact Assessment (EIA) process in terms of visual inputs; and
- Public involvement must form part of the process.

The guideline furthermore recommends that the VIA process identifies the Best Practicable Environmental Option (BPEO) based on the following criteria:

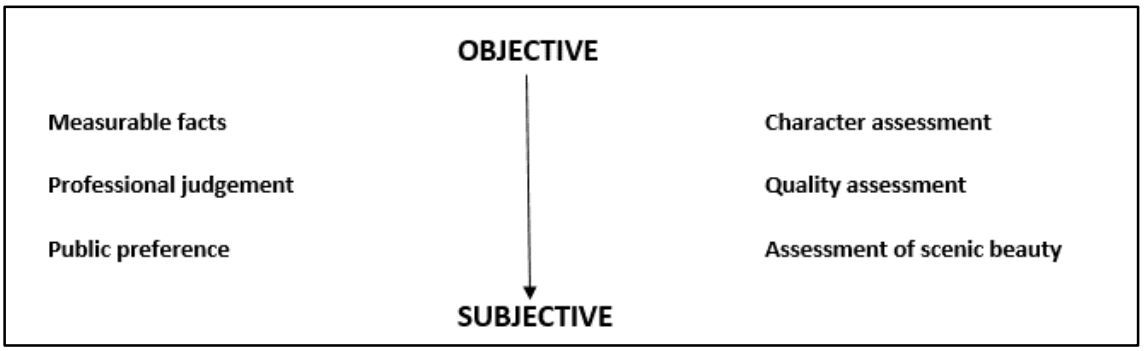
- Long term protection of important scenic resources and heritage sites;
- Minimisation of visual intrusion on scenic resources;
- Retention of wilderness or special areas intact as far as possible; and
- Responsiveness to the area's uniqueness, or sense of place.

1.3 Assumptions and Limitations

- No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts are required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005);
- Due to a lack of visual specialist guidelines within the Limpopo Province, the "Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process"

(Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning was used;

- All information relating to the proposed project as referred to in this report, inclusive of the proposed infrastructure layout, infrastructure height, mining techniques and sequences, etc., is assumed to be the latest available information. No detailed information about building styles, colours and finishes and lighting types and positioning, etc. were available prior to completion of the assessment, and assumptions, relating to industry standards, have been made regarding these elements taking industry standard and best practice guidelines into consideration;
- Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable, as outlined in the diagram below (The Institute of Environmental Management and Assessment (IEMA), 2002); and



- The viewsheds resulting from the DEM and as illustrated in this report, indicate the areas from which the proposed project is likely to be visible and does not take local vegetation cover and man-made structures into account. Potential sensitive receptor sites, indicated to fall within the viewsheds have therefore been groundtruthed during the field assessment.

2. LEGAL, POLICY AND PLANNING CONTEXT FOR VIAs

Oberholzer (2005) indicate that current South African environmental legislation governing the EIA process, which may include consideration of visual impacts if this is identified as a key issue of concern, is the National Environmental Management Act (NEMA) (Act 107 of 1998). This includes the 2014 NEMA EIA regulations (published in General Notice (GN) No. R.982 as well as R 983 Listing Notice 1, R 984 Listing Notice 2 and R 985 Listing Notice 3).

In addition, the following acts and guidelines are applicable (Oberholzer, 2005):

National Environmental Management: Protected Areas Act (Act 57 of 2003)

This act is intended to identify and protect natural landscapes.

National Heritage Resources Act (Act 25 of 1999)

This provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

Advertising on Roads and Ribbons Act (Act 21 of 1940)

Visual pollution is controlled, to a limited extent, by the Advertising on Roads and Ribbons Act (Act 21 of 1940), which deals mainly with signage on public roads.

Municipal Systems Act (Act 32 of 2000)

In terms of the Municipal Systems Act (Act 32 of 2000), it is compulsory for all municipalities to initiate an Integrated Development Planning (IDP) process in order to prepare a five-year strategic development plan for the area under their control. The IDP process, specifically the spatial component is based in certain areas and provinces on a bioregional planning approach to achieve continuity in the landscape and to maintain important natural areas and ecological processes. The study area falls within the Makhado Local Municipality, Ward 21 in the Vhembe District, with the 2014/ 2015 Makhado Local Municipality IDP being the latest available IDP.

Other

- Visual and aesthetic resources are also protected by local authorities, where policies and by-laws relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. have been formulated; and
- Other decision-making authorities such as the Department of Mineral Resources (DMR), or the local authorities, in terms of their particular legislative frameworks, may also require VIAs to support informed decision-making.

3. DESCRIPTION OF THE PROPOSED PROJECT

The Duel Coal Project will be a combination of open pit and underground mining and has a potential Life-of-Mine (LOM) of 24 years. The proposed mine layout, indicating the location of surface infrastructure, is illustrated in Figure 3.

The envisaged mining method for the open pit area is a conventional drill and blast operation with truck and shovel, load and haul. The open pit will be mined through conventional open pit methods, namely truck and shovel. The process for mining method involves stripping, drilling, blasting, loading and hauling of overburden to the waste dump and ROM stockpile or processing plant area and the mine will operate 365 days per annum on a 24-hour basis with shifts rotating on 2- by 12-hour duration for 7 days a week.

Underground mining operations will commence from Year 10 onwards for a period of 5 years, with access being from selected positions in the open pit, with the coal mined through the long-wall methodology. After underground activities have been completed, the access to the underground areas will be closed followed by the final rehabilitation of the open pit.

The proposed infrastructure to be developed includes:

- Coal Handling Processing Plant;
- Overburden Waste Dump;
- Temporary Discard Dump;
- Haul roads;
- Pollution Control Dams;
- Raw water storage facility and distribution systems;
- Access road; and
- Auxiliary infrastructure include a workshop and store, office and change house, electrical power supply and security fencing.

The washed coal will be transported via road to a nearby siding.

The final discard material from the plant will be disposed of in the mined-out open pit. In the event that the pit is unavailable due to existing mining activities, the discard material will be placed on an interim surface discard dump, from where it will be reclaimed and dumped into the mined-out open pit towards the end of the mine life as part of the rehabilitation of the mining site.

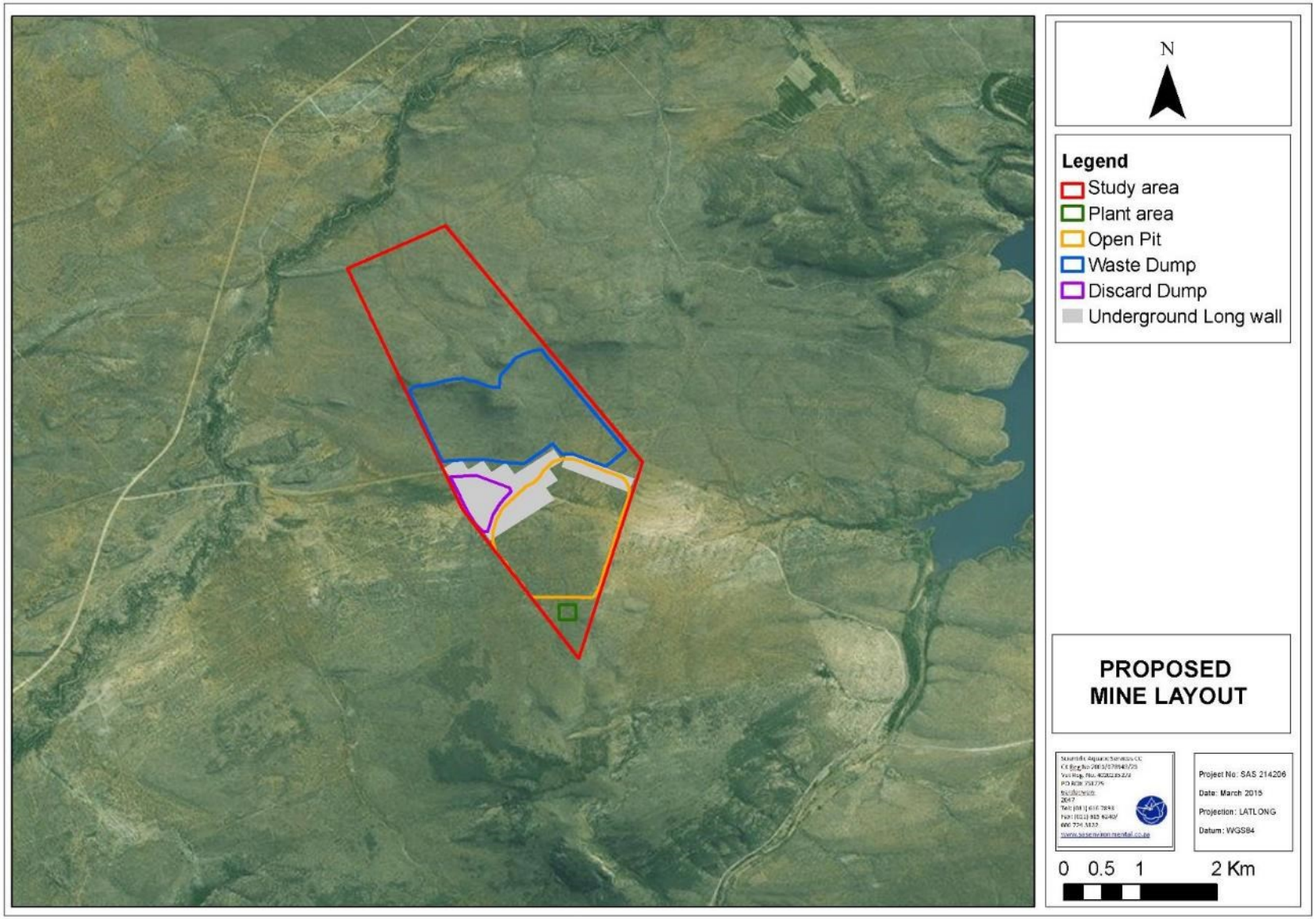


Figure 3: The proposed mining layout.

4. METHOD OF ASSESSMENT

4.1 Level of Assessment

The following methods of assessment for determining the level of detail of the assessment was utilised in this report (Oberholzer, 2005):

Table 1: Categories of development and impact severity.

Type of environment	Category 1 development	Category 2 development	Category 3 development	Category 4 development	Category 5 development
Protected/wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural, historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural, historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural, historical significance/disturbed	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites/run down areas/ wasteland	Little or no visual impact expected, possible benefits	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

The following key provides an explanation to the categories of development:

Category 1 development:
e.g. nature reserves, nature-related recreation, camping, picnicking, trails and minimal visitor facilities.

Category 2 development:
e.g. low-key recreation / resort / residential type development, small-scale agriculture / nurseries, narrow roads and small-scale infrastructure.

Category 3 development:
e.g. low density resort / residential type development, golf or polo estates, low to medium-scale infrastructure.

Category 4 development:
e.g. medium density residential development, sports facilities, small-scale commercial facilities / office parks, one-stop petrol stations, light industry, medium-scale infrastructure.

Category 5 development:
e.g. high density township / residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large scale infrastructure generally. Large-scale development of agricultural land and commercial tree plantations. Quarrying and mining activities with related processing plants.

The following box explains the nature of the impacts:

Very high visual impact expected:
Potentially significant effect on wilderness quality or scenic resources;
Fundamental change in the visual character of the area;
Establishes a major precedent for development in the area.

High visual impact expected:
Potential intrusion on protected landscapes or scenic resources;
Noticeable change in visual character of the area;
Establishes a new precedent for development in the area.

Moderate visual impact expected:
Potentially some effect on protected landscapes or scenic resources;
Some change in the visual character of the area;
Introduces new development or adds to existing development in the area.

Minimal visual impact expected:
Potentially low level of intrusion on landscapes or scenic resources;
Limited change in the visual character of the area;
Low-key development, similar in nature to existing development.

Little or no visual impact expected:
Potentially little influence on scenic resources or visual character of the area;
Generally compatible with existing development in the area;
Possible scope for enhancement of the area.

From the above, the severity of the impact determines the level of the assessment:

Table 2: Impact assessment level of input determination.

Approach	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	Very high visual impact expected
Level of visual input recommended	Level 1	Level 2	Level 3	Level 4	

4.2 Desktop Assessment

The method of assessment for this report is based on a spatial analysis of the study area and the surrounding areas, using Geographic Information Systems (GIS) such as Planet GIS, ArcGIS, Global Mapper as well as digital satellite imagery, photographs, various databases and all available data on the planned infrastructure. The desktop assessment served to guide the field assessment through identifying preliminary areas of importance in terms of potential visual impacts.

The desktop study included an assessment of the current state of the environment of the area including the climate of the area, topography, land uses and land cover with data obtained

from the websites of the South African National Biodiversity Institute (SANBI) and the Agricultural Research Council (ARC).
During the desktop assessment, which took place prior to and in preparation of the field assessment, the 1:50 000 topographical map, as well as high definition aerial photographs were used to identify dominant landforms and landscape patterns. These resources, together with digital elevation data projected in GIS were utilised to generate a visual context map indicating the study area and the cumulative viewshed of the proposed project, based on the maximum height of the various infrastructural components being considered.

The viewshed analysis was conducted on Global Mapper v13 by using ASTER Global DEM Data with a 1 arc-second pixel size. A separate viewshed analysis was conducted for each individual mine infrastructure component through input of the final above ground height of each feature as transmitter elevations. A view radius of 100km was used from the viewshed point of origin and the curvature of the earth was taken into consideration. The results of each viewshed were saved as a shp file, and combined viewsheds were generated for each infrastructure component by overlaying the individual shp files. Eventually all viewsheds were overlaid to generate a composite/ combined viewshed for all proposed mine infrastructure components.

The heights utilised as input data are as follows:

- The height of the plant area was calculated at 20m, which comprises the expected maximum height of individual plant components;
- The interim waste dump has been designed in two levels, each 75m in height, thus obtaining a maximum height of up to 150m in some places;
- The height of the interim discard dump was calculated at 70m above ground level; and
- The open cast pit was calculated at ground level.

Detailed assessment methods used to determine the landscape characteristics of the receiving environment and potential visual impacts of the project are outlined in the relevant sections below.

4.3 Field Assessment

A field assessment to the study area was undertaken during January 2015 and included a drive-around and on-foot survey of the study area and surrounds, in order to determine the visual context within which the proposed project is to be developed. Focus was placed on assessing areas indicated by the preliminary viewshed analysis as being potentially important

observation points and included surrounding settlements and villages, as well as prominent roads within the area. Points from where the proposed mining infrastructure was determined to be visible were recorded (making use of Global Positioning Systems (GPS)) in order to confirm aesthetically sensitive viewpoints and sensitive visual receptors in relation to the proposed project.

High-resolution photographs were taken from areas from where the proposed project will have the highest visual impact and these photographs served as the basis from which representative visual simulations, superimposed onto the development site, were developed, which serves to indicate the visibility of the proposed project in relation to identified Key Observation Points (KOPs). The visual model and photographs were interpreted to provide an accurate indication of the visual impact that the proposed project will have on the aesthetic integrity of the surrounding areas.

4.4 Impact Assessment Methodology

The following box explains the inputs, which must form part of each level of assessment as outlined by the methodology of assessment determination presented in the section above (Oberholzer, 2005):

Level 1 input:
Identification of issues, and site visit;
Brief comment on visual influence of the project and an indication of the expected impacts / benefits.

Level 2 input:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area and receptors;
Brief indication of potential visual impacts, and possible mitigation measures.

Level 3 assessment:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area, view corridors, viewpoints and receptors;
Indication of potential visual impacts using established criteria;
Inclusion of potential lighting impacts at night;
Description of alternatives, mitigation measures and monitoring programmes.
Review by independent, experienced visual specialist (if required).

Level 4 assessment:
As per Level 3 assessment, plus complete 3D modelling and simulations, with and without mitigation.
Review by independent, experienced visual specialist (if required).

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable

comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructures that are possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'1. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/ impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

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

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the tables below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[2].

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

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's NEMA (Act 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table 3: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely: the event will occur only in exceptional circumstances	1
Possible: the event could occur but is not expected to occur	2
Likely: the event could occur	3
Highly likely: the event will probably occur in most circumstances	4
Definite: the event is expected to occur in most circumstances	5
Sensitivity of receiving environment	**RATING**
Visually not sensitive or important	1
Visually with limited sensitivity and/or importance	2
Visually moderately sensitive and/or important	3
Visually highly sensitive and/or important	4
Visually critically sensitive and/or important	5

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

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant: changes to visual landscape do not adversely affect surrounding landscapes; insignificant effect on surrounding important landscapes	1
Small: changes to visual landscape affect a low number of visual receptors (residents, tourists, etc.); noticeable change to important surrounding landscapes	2
Significant: changes to visual landscape affect a moderate number of visual receptors; moderate change to significant and/or important surrounding landscapes	3
Great: changes to visual landscape affect a large number of visual receptors; large changes to significant and/or important surrounding landscapes	4
Disastrous: significant changes to visual landscape affect visual receptors across the entire region; severe changes to significant and/or important surrounding landscapes	5
Spatial scale of impact	**RATING**
Activity specific: visible within the immediate vicinity of activity only	1
Development specific: visible from within the project boundary or up to 1km from the project boundary only	2
Local area: visible from within 5 km of the project boundary	3
Subregional: visible from within 10 km of the project boundary	4
Regional: visible from significant distances beyond 10km of the project boundary	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table 4: Significance rating matrix

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

Table 5: Positive/ Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very High	126-150	Very strict measures to be implemented to mitigate impacts.	Actively promote the project.
High	101-125	Ensure designs take visual sensitivities into account and ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Promote the project and monitor performance.
Medium High	76-100	Ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Implement measures to enhance the positive aspects of the project while managing any negative impacts.
Medium Low	51-75	Ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Implement measures to enhance the positive aspects of the project while actively managing any negative impacts.
Low	26-50	Promote the project and ensure management and housekeeping is maintained.	Monitor project performance and pay attention to minimising potential negative environmental impacts.
Very Low	1-25	Promote the project.	Actively seek measures to implement impact minimisation and identify positive ecological aspects to be promoted.

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the project's area of influence encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/ Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction;
  - Operational; and
  - Closure and Rehabilitation
- Residual and post-closure impacts were also considered;
- If applicable, transboundary or global effects were assessed;

- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed; and
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

4.4.1 Mitigation Measure Development

The following points present the key concepts considered in the development of mitigation measures for the proposed construction.

- Mitigation and performance improvement measures and actions that address the risks and impacts[3] 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; and
- 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 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 during all project phases throughout the life of the operation from planning, through to construction and operation through to after care and maintenance.

5. RESULTS OF INVESTIGATION

5.1 Public Involvement

A public involvement process has been initiated as part of the EIA process by the EAP, whereby stakeholders are invited to provide input concerning the proposed development. No specific comments by Interested and Affected Parties (IAPs) relating to visual and aesthetic impacts have been received.

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

5.2 Development Category and Level of Impact Assessment

Through application of the VIA methods of assessment as presented in the sections above, it was determined that the proposed project can be defined as a Category 5 development, due to the proposed project involving the development of mining facilities, including related processing plants within an area not previously or currently affected by mining. The proposed project may support a precedent for mining development in the region and will create a noticeable change in visual character within the area, which is currently considered to be of some scenic significance.

Table 6 below indicates the visual impact categorisation of the proposed project.

Table 6: Categories of development and impact severity.

Type of environment	Category 1 development	Category 2 development	Category 3 development	Category 4 development	Category 5 development
Protected/wild areas of international, national or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural, historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural, historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural, historical significance/disturbed	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected
Disturbed or degraded sites/run down areas/ wasteland	Little or no visual impact expected, possible benefits	Little or no visual impact expected, possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

A Level 4 assessment is therefore required for the project:

Table 7: Impact assessment level of input determination.

Approach	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	Very high visual impact expected
Level of visual input recommended	Level 1	Level 2	Level 3	**Level 4**	

5.3 Description of the Receiving Environment

In order to holistically describe the receiving environment, this section of the report aims to determine the intrinsic value of the receiving landscape including aspects of the natural, cultural and scenic landscape, taking both tangible and intangible factors into consideration.

This section furthermore aims to describe the particular character, uniqueness, intactness, rarity, vulnerability and representivity of the study area within its existing context. General views of the landscape associated with the study area and surrounds are indicated in Figure 4 below.

Figure 4: General views of the study area and the surrounding region.

5.3.1 Climate

The study area is located within a region characterised by summer rainfall and dry winters, including the months of May and September. The mean annual precipitation is about 388mm, with the area receiving the least amount of rainfall in August (with an average monthly rainfall of 3mm per month) and the most in November (with an average monthly rainfall of 101 mm per month) (LEDET, 2012). The monthly average for maximum temperatures in the region ranges from 21°C in July to 29°C in February. The region is coldest in July, when temperatures drop to an average of 7°C at night. The region is generally not affected by frost (Mucina & Rutherford, 2006).

As a result of climate variations throughout the year, the appearance and perception of the landscape within and surrounding the study area change with the seasons. The study area and its surroundings are expected to appear muted during the winter months, when dominant tree species such as *Colophospermum mopane* (Mopane), *Terminalia prunoides, T. sericea*, *Burkea africana, Combretum apiculatum, Dombeya rotundifolia, Peltophorum africanum* shed their foliage, while it appears more vibrant and green during the summer months. Seasonal variation may have an effect on the area from where project components would potentially be visible, with visibility expected to be higher during the winter months when seasonal screening effects such as vegetation density and relative cover, is lower.

5.3.2 Land Use

Several dominant land uses have been identified in the vicinity of the study area, namely:

- Residential, which includes rural, low-density residential dwellings, within villages spaced some distance apart, including educational, health and business facilities. Three villages are located within 5km of the study area, namely Makushu and Mosholombe which borders the study area in the southeast and Pfumembe, which is located 2km further to the south east. Settlements located within a 10km of the study area are Bonjane, Mufongodi, Maranikhwe, Musekwa, Mudimeli, and Maangani;
- Agricultural, in the form of subsistence agriculture and sporadic cultivated areas as well as game and livestock farming and downstream irrigated land;
- Informal grazing areas, including former cultivated land;
- According to the National Biodiversity Assessment (2011), formally Protected Areas in the larger vicinity of the study area, in the form of provincial and local nature reserves, include Nzhelele Nature Reserve (bordering the study area in the east), Nzhelele Nature Reserve (25km to the south of the study area), Honnet Nature Reserve (17km northeast of the study area), Happy Rest Nature Reserve (39km southwest of the study area) and Nwanedi Nature Reserve (34km northeast of the study area);
- Other protected areas include the Hanglip Forest Reserve and the Entabeni State Forest located approximately 22km and 35km to the southeast and southwest respectively;
- The informally protected Kuduland Conservancy is located 18km to the northeast of the study area and Ekland Safari hunting concession, also informally protected,

is located 6km to the southeast of the study area and covers a surface area of 15 000ha;

- Areas earmarked as part of the National Protected Areas Expansion Strategy (NPAES) focus areas include the Blouberg and the Langjan Nature Reserves, located 27km southwest and 23km north of the study area respectively;
- The extent of the study area falls within the extensive Vhembe Biosphere Reserve, situated in northeastern Limpopo and covering an area of about 30 701km². This biosphere is recognised internationally for its wildlife and unique biological and cultural diversity. There are a number of mining projects proposed in the area and one of the challenges faced by the biosphere reserve is to ensure that development is not at the expense of the long-term sustainable conservation of the natural and cultural assets of the area (www.morningsun.co.za/vhembe-biosphere-reserve/);
- Various game farms and lodges, including hunting camps in the region;
- Outdoor activities are present in the region, specifically associated with the Soutpansberg to the south, including mountain biking and various hiking trails; and
- Urban residential areas located further from the study area, including Musina to the north, Louis Trichardt (Makhado) to the south and Thohoyandou to the southeast.

The dominant land use within the study area itself is game farming, with large sections of the study area, particularly the Soutpansberg Mountain Bushveld areas, being largely intact and not directly impacted by anthropogenic activities and development.

A number of main roads are present in the vicinity of the study area, including:

- The N1 highway located approximately 12km to the west. This road travels from Makhado to Musina at the Zimbabwe border, the traffic consists out of a large number of trucks using the road and small vehicles;
- The R525 roadway approximately 6km to the north; and
- Numerous local gravel roads, one road passing immediately to the west of the study area (N1 to Mudimeli Village) and the other traversing the southern portion of the study area (Mudimeli to Nzhelele Dam).

No mining or industrial activities have yet occurred within the study area or the region surrounding the study area and the proposed mining activities will therefore result in a significant change in the land use within the study area. It is however known that another mining activity within the vicinity of the study area has recently been approved namely the Makhado Colliery (Baobab Mining and Exploration (Pty) Ltd), but has not yet commenced with

operations. The Greater Soutpansberg Generaal Project (Kwezi Mining Exploration (Pty) Ltd) has applied for a mining, the decision which is still pending.

5.3.3 Topography

The topography associated with the study area and the surrounding region is considered to be mountainous, with steep undulating slopes, which form distinguishing topographical features in the form of steep hills and outcrops that are interspersed with wide, lower-lying plains. Steep hills/ mountains, forming part of the northern reaches of the eastern Soutpansberg Mountain range to the south, are present within the central portion of the study area. This topography is characteristic of the larger region to the northeast, east and southwest and is not confined to the study area.

The most prominent drainage lines in the region are the Mutamba River to the west and the Nzhelele Dam and Nzhelele River to the east.

The elevation and slopes as occurring within the study area are indicated in Figures 5 & 6 below, while the general topographic character of the study area and surrounds is illustrated in Figures 7 & 8 as depicted by Google Earth (2015). Views were taken at ground level from the north, south, east and west respectively.

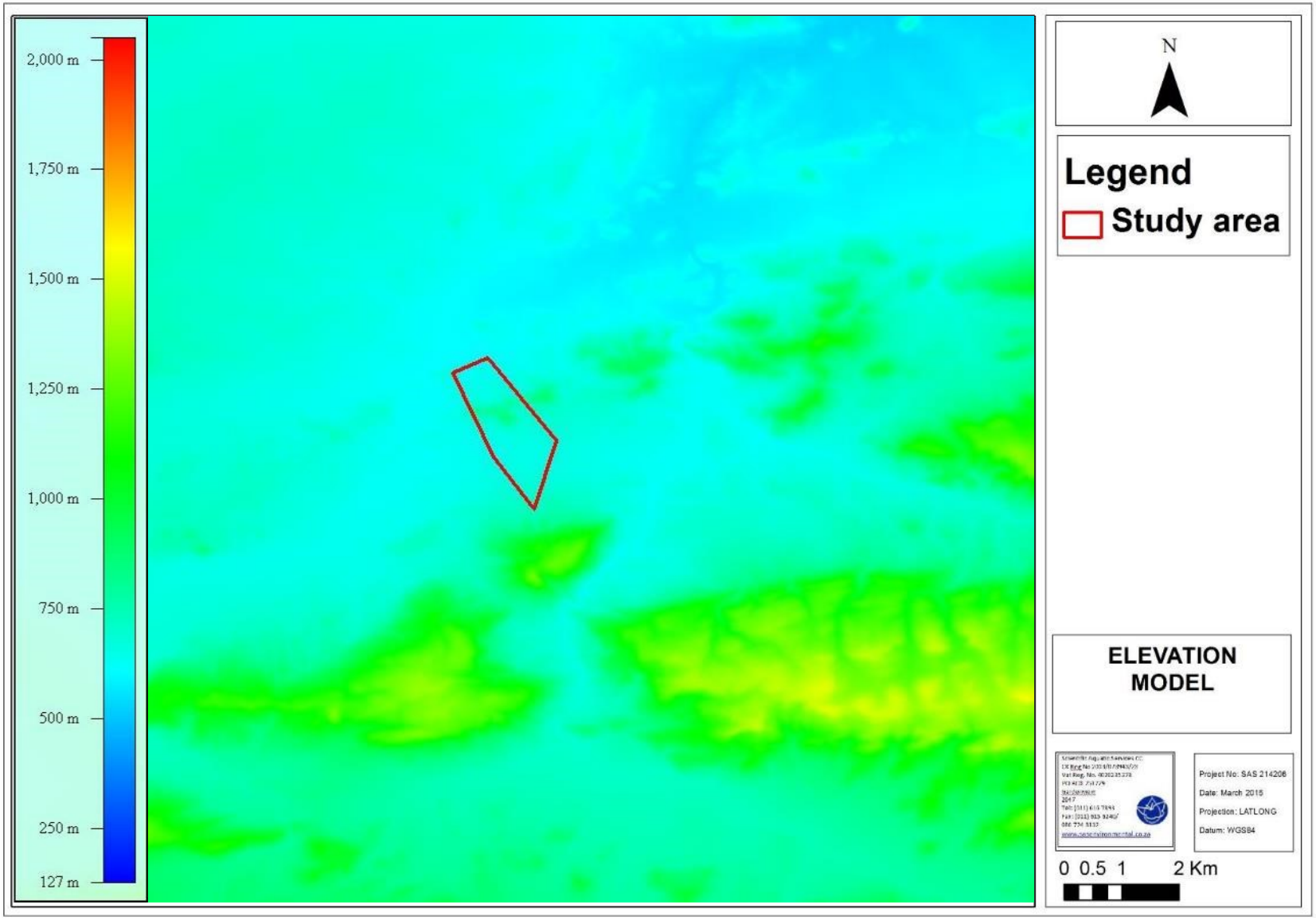


Figure 5: Elevation rendering depicting the topographical character of the study area.

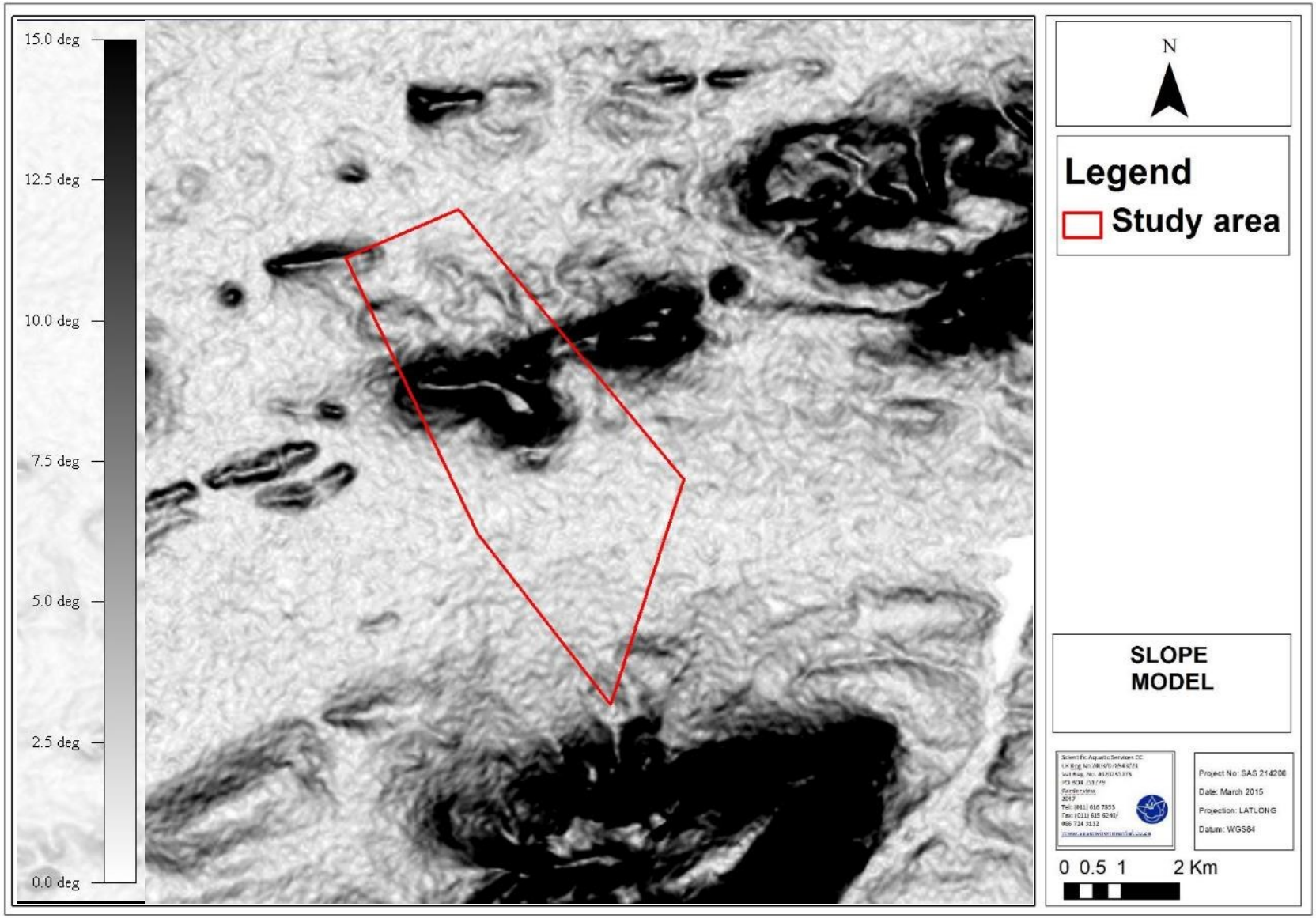


Figure 6: Map indicating areas with increased slopes (Darker areas).

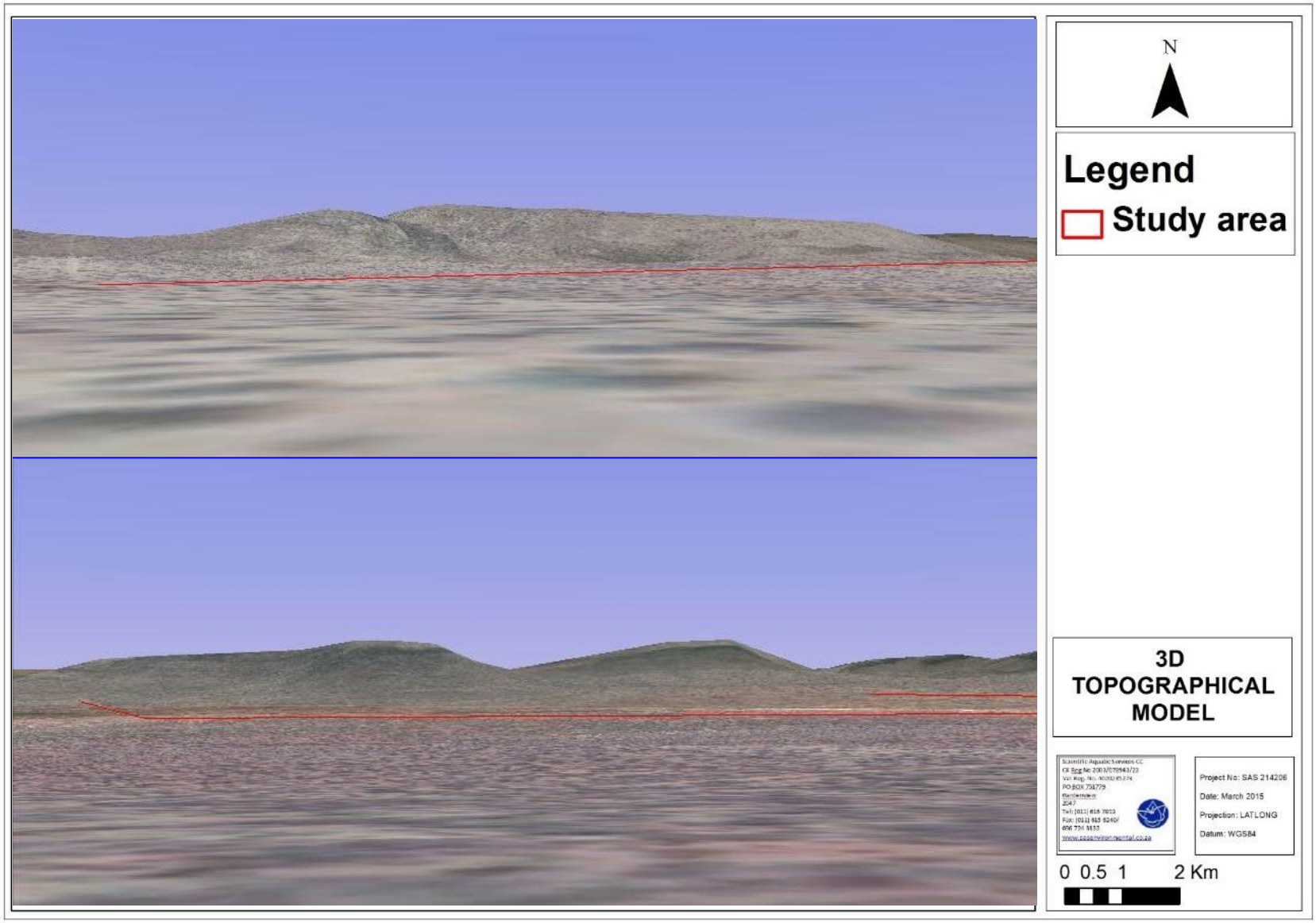


Figure 7: Topographical depiction of the study area in relation to the surrounding environment (top: view from the north, bottom: view from the south) (Google Earth, 2015).

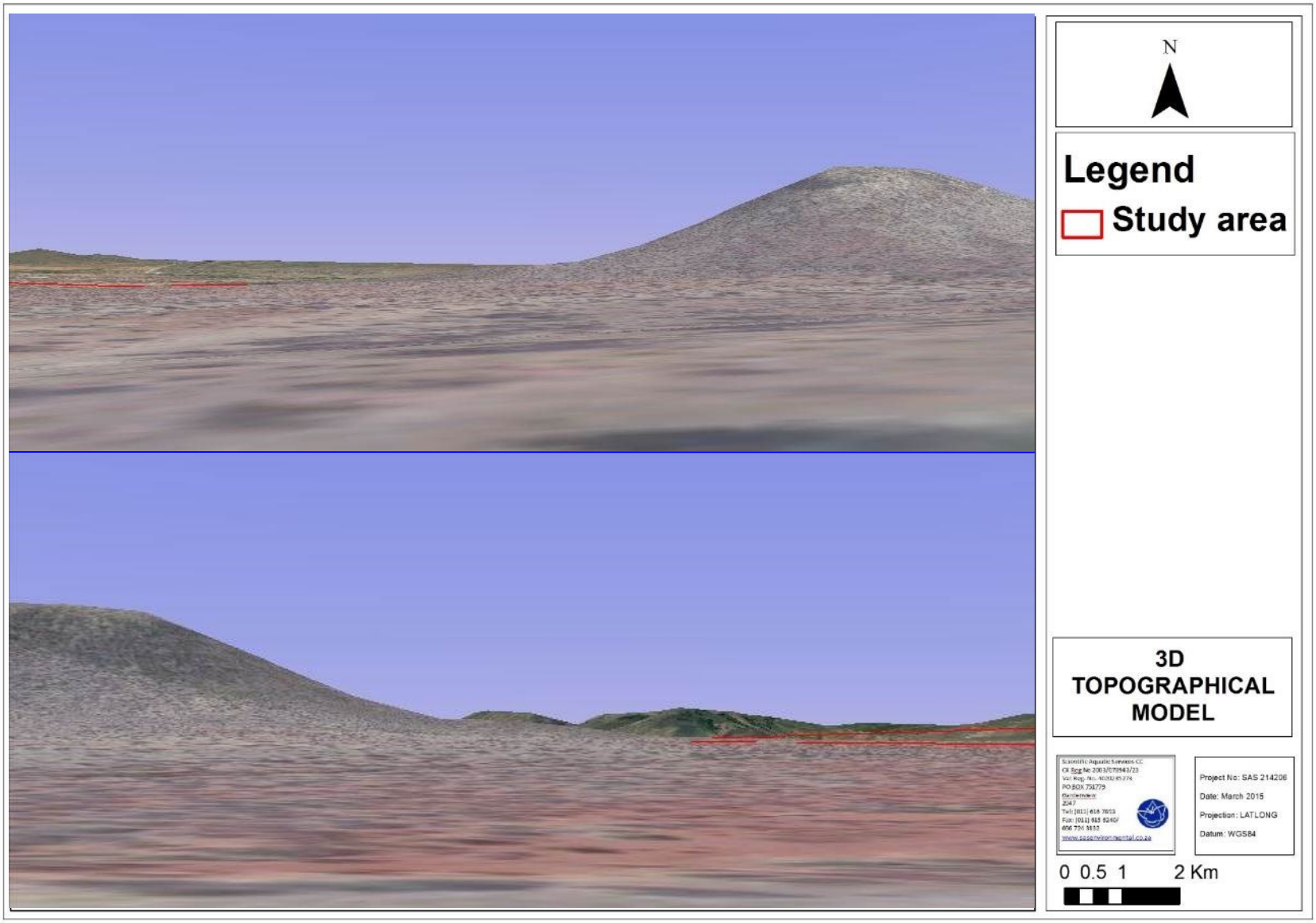


Figure 8: Topographical depiction of the study area in relation to the surrounding environment (top: view from the east, bottom: view from the west) (Google Earth, 2015).

5.3.4 Vegetation Cover

The study area falls within the Savanna Biome and within the Central Bushveld Bioregion. Two vegetation types are present within the study area, namely Musina Mopane Bushveld and Soutpansberg Mountain Bushveld.

Musina Mopane Bushveld

This vegetation type, present within the lower-lying areas of the study area, is characterised by moderately closed shrubveld dominated by *Colophospermum mopane* and *Terminalia prunoides*, while more open bushveld dominated by *C. mopane*, *Terminalia sericea, Grewia flava* and *Combretum apiculatum* occur in areas with deep sandy soils. The herbaceous layer is generally well developed and is open during the dry season due to the deciduous nature of the dominant species. The shrub layer is dominated, amongst others, *Grewia flava* and *Sesamothamnus lugardii* with the grass layer dominated by *Schmidtia pappophoroides*, amongst others (Mucina & Rutherford, 2006).

Soutpansberg Mountain Bushveld

Soutpansberg Mountain Bushveld, present within the higher-lying and mountainous portions of the study area, comprises a dense tree layer with a poorly developed graminoid component. The tree and shrub layers within these areas are dominated by *Catha edulis, Englerophytum magalismontanum, Mimusops zeyheri, Syzygium legatii, Searsia magalismontana* subsp. *coddii* and *Parinari capensis* subsp. *capensis*. The grass and herbaceous layers are dominated by *Coleochloa setifera, Setaria sphacelata* and *Fadogia homblei* (Mucina & Rutherford, 2006).

The vegetation associated with the study area is predominantly in a natural condition, with disturbance limited to Mopane Bushveld areas adjacent to the gravel road traversing the southern section of the study area and areas associated with residential development to the southeast. Within the remainder of the study area, vegetation structure is largely intact, with limited occurrence of bare and exposed soils. The various riparian areas and the central, mountainous portion of the study area in particular, have a well-developed, tall woody component and overall vegetation cover throughout the remainder of the study area is high.

Vegetative cover and vegetation integrity influence the Visual Absorption Capacity (VAC) of a development site and may also impact on the degree of visibility and visual intrusion of a project.

5.3.5 Landscape Character

Landscape character, from an aesthetic perspective, is mainly defined by natural determinants, such as vegetation, geology and topography, as well as cultural factors including land use, settlement patterns and the manner in which humans have transformed their natural surroundings. According to Swanwick (2002), landscape character may be defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes it unique and provides it with a particular sense of place. Individual "landscape elements" that contribute to landscape character include hills, rolling plains, valleys, woods, trees, water bodies, as well as buildings and roads. "Landscape features" are those elements that are prominent or eye-catching.

Figure 9: Landscape character of the study area, indicating the steep hills and central mountainous feature, which is the most prominent landscape feature within the study area.

Landscapes may be divided into landscape character types, which are defined as distinct types of landscape that are relatively homogeneous in character. Such landscape character types are generic in nature and may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation, land use and settlement patterns (Swanwick, 2002).

The landscape associated with the study area and its immediate surroundings exhibit a common, discernible pattern, is considered to have broadly similar landforms, vegetation and settlement configurations, and thus comprise a single landscape character type. This landscape character type can be described as rural, mountainous, closed bushveld (Figure 9), with a number of prominent and eye-catching features present in the form of steep hills and outcrops. Although the landscape character within the larger region is relatively homogeneous, the landscape at a finer scale, associated with the study area itself is considered to be diverse as a result of the variety of topographical features. Other prominent landscape features in the region include Mutamba River immediately to the northwest of the study area and the Nzhelele River and Nzhelele Dam towards the east.

Key aesthetic aspects of the landscape are described in the table below, according to the method prescribed by Swanwick (2002).

Table 8: Aesthetic aspects of landscape character.

Aspect	Characteristics				Motivation
Scale	Intimate	Small	Large	Vast	The scale of the landscape is considered to be **large** due to significant vistas visible as one approaches the study area from the southwest and northeast, particularly when viewed from higher-lying areas.
Enclosure	Tight	Enclosed	Open	Exposed	The study area is **enclosed**, with steep hills present within the centre and to the south of the study area
Diversity	Uniform	Simple	Diverse	Complex	The landscape is considered to be **diverse**, with variations in vegetation pattern, structures and type, as well as varying topography being present.
Texture	Smooth	Textured	Rough	Very rough	The texture associated with the landscape is **rough**, textured and coarse, which can mainly be attributed to the bushveld vegetation dominating the region.
Form	Vertical	Sloping	Rolling	Horizontal	The dominant form of the landscape is **sloping**, due to the relatively steeply undulating topography with steep slopes present.
Line	Straight	Angular	Curved	Sinuous	When considering the larger area, the line landscape element is mostly **curved** with limited linear man-made elements present and due to the steeply undulating and mountainous nature of the general region.

Aspect	Characteristics				Motivation
Colour	Monochrome	Muted	Colourful	Garish	The colours associated with the landscape are **muted**, with vegetation forming the dominant colour palette of shades of green. Limited seasonal effects due to formal farming activities are evident, however seasonal colour displays from vegetation, during spring and autumn are expected.
Balance	Harmonious	Balanced	Discordant	Chaotic	The landscape is considered to be **balanced** in terms of the relationship between the vertical and horizontal landscape elements.
Pattern	Random	Organised	Regular	Formal	The landscape pattern is **regular**, with elements being evenly spaced and well-balanced.
Movement	Dead	Still	Calm	Busy	The level of movement within the majority of the study area is very low and **still**, with low levels of pedestrian and vehicular movement limited to the southern portion of the study area.

In addition to the above, other aspects of landscape perception, such as perception of beauty and scenic attractiveness also play a role in defining landscape character. These aspects are more subjective and responses thereto are personal and based on the experience and preference of the observer. Factors simultaneously perceived by senses other than sight, such as noisiness, tranquillity, exposure to the elements and sense of safety, further influence landscape character. Although these aspects are hard to quantify, it can be said that the landscape in its current state provides a positive and highly scenic viewing experience and mining within the study area will result in partial loss of this landscape character type within the region.

5.3.6 Visual Absorption Capacity (VAC)

Visual Absorption Capacity (VAC) refers to the inherent ability of a landscape to accommodate change without degeneration of the visual quality and without resulting in an overall change of the identified landscape character type. A high VAC rating implies a high ability to absorb visual impacts and manmade structures and the ability of natural features such as trees or higher-lying areas to screen or hide an object where it would have visible otherwise (Oberholzer, 2005), while a low VAC rating implies a low ability to absorb or conceal visual impacts.

The factors that have been considered during the VAC analysis are listed and explained in the table below, according to the methodology prescribed by the United States Bureau of Land

Management (BLM, 2004) and as adapted to the South African context (Table 9). Five factors have been considered, namely vegetation, soil contrast, visual variety, topographical diversity and recovery time.

Table 9: VAC Factors and Rating table.

Factors	Rating Criteria and Score		
Vegetation	Low, uniform vegetation or sparse vegetative cover, typically less than 1m in height, lacking in variety, uniform colour, minimal screening capability, typically low scrub or grass type vegetation. **Score: 1**	Vegetation of moderate height (1 – 2m), some species variety (2 to 3 types), some variation in colour, mostly continuous vegetative cover, effectively screens low-profile projects such as low-profile surface disturbance, scrub/grass, and intermingled shrubs. **Score: 2**	Higher vegetation (>2m height), lush, continuous vegetative cover; some variety of vegetative types is typical but not mandatory, provides significant screening capability of projects up to 4 – 6m in height, woodlands. **Score: 3**
Soil contrast	Surface disturbance would expose a high degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 1**	Surface disturbance would expose a medium degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 2**	Surface disturbance would expose only a low degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 3**
Visual variety	Rating unit exhibits a low degree of visual variety in terms of the landscape character elements of form, line and texture and may also exhibit minimal variety in landforms, vegetation, or colour. **Score: 1**	Rating unit exhibits a medium degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit medium variety in landforms, vegetation, or colour. **Score: 2**	Rating unit exhibits a high degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit high degree of variety in landforms, vegetation, or colour. **Score: 3**
Topographical diversity	Landform has low amount of topographic diversity and variety. **Score: 1**	Landform has moderate amount of topographic diversity and variety. **Score: 2**	Landform has high amount of topographic diversity and variety. **Score: 3**
Recovery time	Long-term recovery time (greater than 5 years) **Score: 1**	Medium recovery time (3 to 5 years) **Score: 2**	High (rapid) recovery time (1 to 2 years) **Score: 3**

Through applying the scoring categories as outlined above, the following scores have been calculated for the study area:

Table 10: VAC Scores achieved.

Factor	Score obtained	Motivation
Vegetation	**3**	Vegetation within the majority of the study area comprises closed bushveld with a high cover and a large proportion of tall trees. Bare soils are mostly limited to the low-lying southern portion of the study area.
Soil contrast	**2**	Further surface disturbance within areas where soils are already exposed would further contribute to the degree of contrast with surrounding vegetation, while soil exposure within areas where soils have not yet been exposed would lead to significant contrast.
Visual variety	**2**	The vegetation within study area is largely homogeneous when viewed from a distance, but visual variety is present due to local landforms and steep slopes.

Factor	Score obtained	Motivation
Topographical diversity	**3**	Plains as well as steep slopes are present within the study area, with an overall high level of topographic variety.
Recovery time	**1**	The recovery time of the environment is considered to the greater than 5 years after closure due to a high degree of natural vegetation loss expected.
Total	**11**	**Medium**

Scores, when added, amounting to between 5 and 7 are categorised as Low, scores between 8 and 11 as Medium and between 12 and 15 as High. The total score for the study area added to 11, which defines the VAC of the study area as being medium.

VAC is further closely related to visual intrusion, which refers to the physical characteristics and nature of the contrast created by a project on the visual aspects of the receiving environment. It is also, as with VAC, a measure of the compatibility or conflict of a project with the existing landscape and surrounding land use. The visual intrusion ratings are listed in the table below.

Table 11: Visual intrusion ratings.

Rating	Explanation
High visual intrusion	Results in a noticeable change or is discordant with the surroundings.
Moderate visual intrusion	Partially fits into the surroundings, but clearly noticeable.
Low visual intrusion	Minimal change or blends in well with the surroundings.

Due to the nature of the project and its location within a region currently unaffected by mining activity, the proposed project will lead to a high level of visual intrusion on the landscape and is expected to be clearly noticeable in relation to its surroundings. The medium VAC of the study area, with particular reference to topographical diversity, will however serve to somewhat limit such intrusion from certain receptor sites.

5.3.7 Landscape Quality

Landscape visual quality, integrity or ‘scenery beauty’ relates primarily to human impact on a landscape and the physical state of the landscape in terms of intactness from visual, functional and ecological perspectives (Swanwick, 2002). It also serves as an indication of the condition of landscape elements and features (as outlined in Section 5.3.5), which in turn depends largely on an observer’s visual perception through either increasing or reducing the visual quality of a landscape. Visual quality is thus a factor of an observer’s emotional response to physical landscape characteristics and therefore assigning values to visual resources is a subjective process.

According to the BLM Visual Resource Management (VRM) system (1984), a system specifically developed for minimising the visual impacts of surface-disturbing activities and maintaining scenic values for the future, landscape, visual and scenic quality evaluation may be determined based on seven key factors, as outlined in the tables below and adapted to the South African environment. It is important to note that there may be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area, however within the context of the proposed project, this method of assessment is deemed suitable as an indication of landscape quality.

Table 12: Landscape Quality - Explanation of Rating Criteria.

Factor	Definition
Landform	Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental or they may be exceedingly artistic and subtle.
Vegetation	Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Consider also smaller scale vegetation features, which add striking and intriguing detail elements to the landscape.
Water	That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.
Colour	Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.
Adjacent Scenery	Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units that would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.
Scarcity	This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.
Cultural Modifications	Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. Rate accordingly.

Table 13: Scenic Quality - Rating Criteria and Scoring system.

Factor	Rating Criteria and Score		
Landform	High vertical relief as expressed in prominent cliffs, spires, massive rock outcrops, areas of severe surface variation, highly eroded formations, dune systems or detail features that are dominant and exceptionally striking and intriguing. **Score: 5**	Steep canyons, mesas, buttes, interesting erosional patterns, landforms of variety in size and shape or detail features, which are interesting though not dominant or exceptional. **Score 3**	Low rolling hills, foothills, or flat valley bottoms or few or no interesting landscape features. **Score: 1**

Factor	Rating Criteria and Score		
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **Score: 5**	Some variety of vegetation, but only one or two major types. **Score: 3**	Little or no variety or contrast in vegetation. **Score: 1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **Score: 5**	Flowing, or still, but not dominant in the landscape. **Score: 3**	Absent, or present, but not noticeable. **Score: 0**
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **Score: 5**	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. **Score: 3**	Subtle colour variations, contrast, or interest; generally mute tones. **Score: 1**
Adjacent Scenery	Adjacent scenery greatly enhances visual quality **Score: 5**	Adjacent scenery moderately enhances overall visual quality. **Score: 3**	Adjacent scenery has little or no influence on overall visual quality. **Score: 0**
Scarcity	One of a kind, unusually memorable or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. **Score: 5**	Distinctive, though somewhat similar to others within the region. **Score: 3**	Interesting within its setting, but fairly common within the region. **Score: 1**
Cultural Modifications	Modifications add favourably to visual variety while promoting visual harmony. **Score: 2**	Modifications add little or no visual variety to the area, and introduce no discordant elements **Score: 0**	Modifications add variety but are very discordant and promote strong disharmony. **Score: -4**

Table 14: Scenic Quality – Results and motivation.

Factor	Score obtained	Motivation
Landform	**5**	The study area contains prominent hills, slopes and vertical areas, leading to high visual interest.
Vegetation	**3**	The majority of vegetation within the study area is intact, with good levels of diversity present.
Water	**1**	Very limited surface water is present within the study area and although the Mutamba River is present immediately to the north and northwest, these features do not visually dominate the study area.
Colour	**3**	The colours associated with the landscape are, although somewhat muted, considered to be vibrant with seasonal colour present.
Adjacent Scenery	**3**	Adjacent scenery, with the same landscape character results in a cumulatively greater landscape viewing experience. Views across the study area and beyond are large from higher-lying areas.
Scarcity	**3**	The landscape character type is representative of the larger region and is not considered a rare landscape type, however characteristic slopes and hills make the area distinctive.
Cultural Modifications	**0**	Cultural modifications and modern, man-made structures are largely absent from the study area.
Total	**18**	Medium

Scores, when added, amounting to less than 11, are categorised as Low, scores between 12 and 18 as Medium and scores more than 19 as High. The total score for the study area calculated as 18, and thus the overall landscape is considered to have medium scenic quality and is considered to exhibit positive character, with a recognisable landscape structure and sense of place, including some detracting features.

5.3.8 Landscape Value

Landscape value is concerned with the relative value that is attached to different landscapes. Landscape values are described as the environmental or cultural benefits, including services and functions that are derived from various landscape attributes (Department of the Environment and Local Government, Ireland (DOE), 2000). A landscape may be valued by different communities for many different reasons without any formal designation, recognising, for example, perceptual aspects such as scenic beauty, tranquillity or wildness, special cultural associations, the influence and presence of other conservation interests, or the existence of a consensus about importance, either nationally or locally (DOE, 2000). These attributes include the components and image of the landscape as already established in the assessment of landscape character, including aesthetic and ecological components, but also includes historical and socio-cultural associations, as well as religious and mythological dimensions.

In determining landscape value, the people or groups of people who could be affected by the proposed development should be considered, due to landscapes being valuable to people in different ways. In this regard, consideration is given to:

- People who live and work in an area may have a different perception of the landscape to that held by visitors because of their more regular contact with the landscape and the ongoing changes within it;
- Special interest, for example the ecological, cultural or historic value of the landscape, as knowledge of these issues can often affect people's perception and appreciation of a landscape; and
- Landscapes valued by a public wider than the local population, because they have a strong image or are well known and valued nationally and internationally.

With reference to the above, the study area itself is likely to be most valued by local residents and workers and does not contain value for special interest groups and is not known to be of provincial, national or international cultural historical importance (R & R Cultural Resource Consultants, 2014). The proposed project may however lower the landscape value of the study area through the direct loss of natural vegetation and other biological resources.

5.3.9 Sense of Place

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. It is created by the land use, character and quality of a landscape, as well as by the tangible and intangible value assigned thereto. The landscape character type, defined as rural mountainous, closed bushveld, containing mostly intact vegetation, is not unique to the study area and can also be found within the larger region. However, a number of landforms and topographical features are present within the study area that distinguishes the study area from the surrounding areas, which have similar landscape character type. The sense of place of the study area is therefore somewhat significant when compared to its surroundings and may be considered to be moderate to high with its sense of place largely attributed to its rural, undeveloped character with intact vegetation structure and well-defined topography.

5.4 Visual Receptors

The number of observers and their perception of the proposed project will have an impact on the VIA and also on the perceived sensitivity of the landscape. The perception of viewers is difficult to ascertain as there are many variables to consider, such as cultural background, state of mind, reason for the sighting and how often the project is viewed within a set period. It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the project. It is also necessary to generalise the viewer sensitivity to the proposed project to some degree (Oberholzer, 2005).

The IEMA (2002) identifies a number of potential sensitive receptors that may be affected by a proposed development, namely:

- Users of recreational landscapes/ public footpaths and bridleways, including tourists and visitors;
- Residents;
- Users of public sports grounds and amenity open space;
- Users of public roads and railways;
- Workers; and
- Views of or from within valued landscapes.

The sensitivity of visual receptors and views will depend on:

- The location and context of the viewpoint;
- The expectation and occupation or activity of the receptor; and
- The importance of the view.

The most sensitive receptors may include:

- Users of outdoor recreational facilities, including public rights of way, whose attention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; and
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscape of acknowledges importance or value);
- People travelling through or past the affected landscape in cars on trains or other transport routes;
- People at their place of work.

With reference to the study area, the main visual receptors include local residents of settlements in the immediate vicinity of the study area, as well as residents residing further away from the study area within villages from where the proposed project will also be visible. The immediate region associated with the study area is not specifically known to be a tourist area, however game hunters and recreational tourists, including hikers, birders, mountain bikers etc. frequent the various game farms and lodges in the region. The Honnet and Nzhelele Nature Reserves and Nzhelele Dam may also be visited by tourists, particularly by fishermen and day visitors. Such tourists are also likely to be affected by the proposed project.

Less sensitive receptors, who will be visually affected to a lesser degree, are likely to be people at their place of work, including local farmers or people engaged in study or similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view. Other potential sensitive receptors are people travelling on the N1, passing to the west of the study area and travellers on the R525, passing the study area in the north. The proposed project be only be intermittently visible from these main roads and the duration of visual exposure will be of a limited duration. In addition, the distance from these roads and local topography will lower the project's visibility.

Figure 10 indicates the receptors located within 10 to 15km of the proposed mining infrastructure and operations. The proposed project is expected to be highly visible to receptors present within 5km thereof, as these areas fall within the high visibility zone and the proposed project will form part of the foreground – middleground of their viewing experience. The proposed project will be moderately visible to receptors within 5 – 10 kilometres of the study area, particularly from areas with a clear line of sight towards the study area.

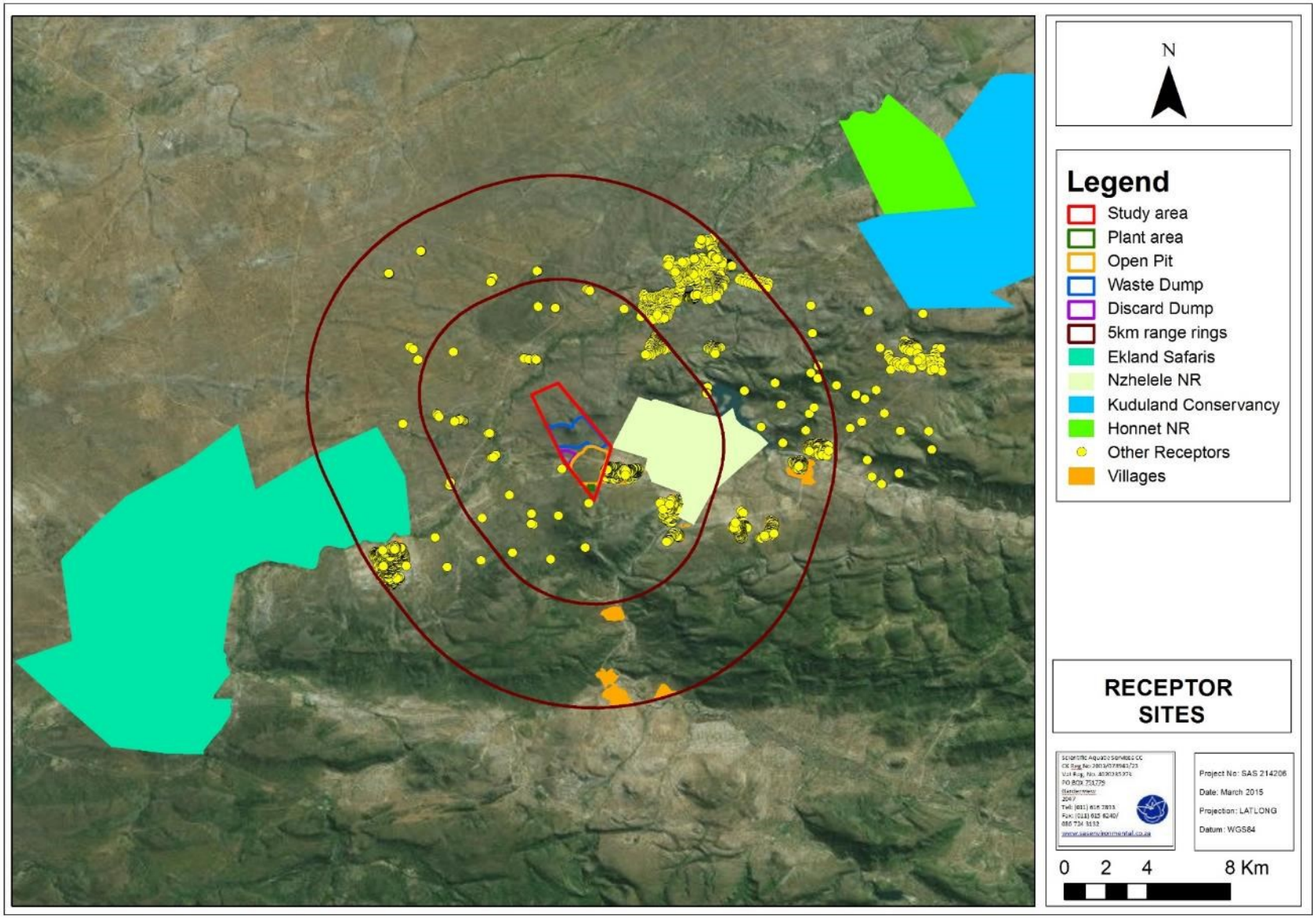


Figure 10: Aerial map indicating identified receptor sites in relation to the study area.

5.5 Visual Exposure and Visibility

Visual exposure refers to the geographic area from which the proposed project will be visible and is defined by the degree of visibility of a proposed project from various receptors sites (refer to Section 5.5 and 5.6). Visibility, in turn, is determined by distance between the components of a proposed project and the viewer.

Visual exposure is determined by the zone of visual influence or the "viewshed". A viewshed is the topographically defined area that includes all the major observation sites from where a proposed development will be visible. The boundary of the viewshed tends to connect high points in the landscape through following ridgelines and demarcates the zone of visual influence. The zone of visual influence usually fades out beyond 5km distance and the further away from an observer the project is, the less visible it would be. It is also important to note that the actual zone of visual influence of the proposed project may be smaller than indicated because of screening by existing vegetation and infrastructure, which may partially or totally obscure a view.

General visibility classes are indicated in the table below.

Table 15: General visibility classes.

Class	Description
Highly visible	Clearly noticeable within the observer's view frame 0 to 5km
Moderately visible	Recognisable feature within observer's view frame 5 to 7.5km
Marginally visible	Not particularly noticeable within observer's view frame 7.5 to 10km
Hardly visible	Practically not visible unless pointed out to observer 10 to 15km+

Three distance zones have been identified (BLM, 1984) based on visibility from travel routes and observation points. These have been determined and confirmed through field verification:

- Foreground – Middleground - includes local and sub-regional areas visible from highways, rivers, or other viewing locations which are less than 5 kilometres away.
- Background – includes distant sub-regional areas visible past the foreground-middleground zone and usually between 5 and 10 kilometres away.
- Seldom seen – includes areas that are not part of the foreground-middle ground or the background and that are generally hidden from view and is usually further than 10km away.

5.5.1 Line of Sight Analysis

A line of sight and elevation profile analysis was conducted through drawing of a graphic line between two points on a surface that shows where along the line the view is obstructed. In Google Earth Pro a series of cross-sections were evaluated, extending from the centre of the study area, where the proposed mine infrastructure is at its highest, towards possible receptor site. The visibility of each point along the cross section was the calculated though the use of the Google Earth Pro Elevation Profile function. The function only evaluates the topography of the area with land cover and vegetation not taken into account. To ensure the line of sight is fully assessed the height of the proposed infrastructure have been incorporated through the use of conceptual block models based on the site layout and the heights provided by the project professional team.

The locations of the elevations are shown in Figure 11 below, with the results of the line of sight analyses illustrated in Figures 12 – 19.

From the line of sight analyses it was determined that a clear line of sight is present from the prominent mountain within the Honnet Nature Reserve in the vicinity of the town of Tshipise towards the proposed mine dump. It is however unlikely that the mine dump will be highly visible from this area due to the significant distance (over 20km) between this location and the study area (Figure 12).

The Nzhelele Nature Reserve, located immediately to the east of the study area and the Mufungodi village, located a distance of approximately 9km from the study area, will also have a clear line of sight towards the proposed waste dump. The waste dump is therefore expected to be highly visible from the Nzhelele Nature Reserve and somewhat visible in the background to residents of the west-facing Mfungodi village (Figure 13). This is further supported by Figure 14, which also shows that residents of the Makushu and Mosholombe villages will have a clear line of sight towards the proposed waste dump, with the open cast pit also potentially being visible.

From Figure 15, it is evident that local topography prevents visibility of the mine from the Maangani village and other villages further to the south, while Figure 16 illustrates a clear line of sight from Mudimeli towards the mine, over a distance of approximately 10km.

Figures 17 - 19 indicates that a clear line of sight from the N1 and R525 roadways toward the mine will mostly be prevented by local topography and it is expected that the proposed project will only be intermittently visible from these areas.

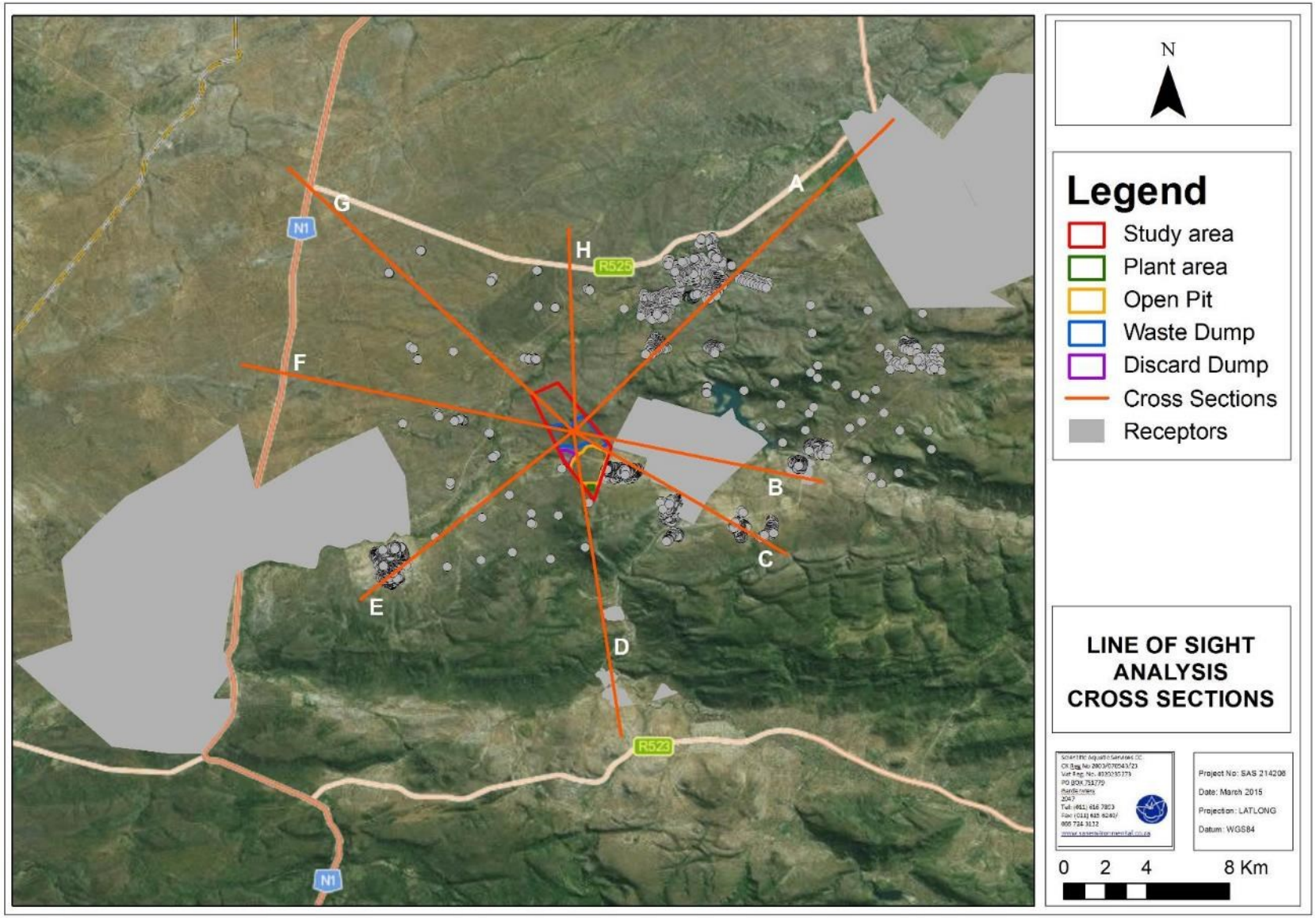


Figure 11: Location of cross sections from potential receptor sites towards the study area for the Line of Sight analyses.

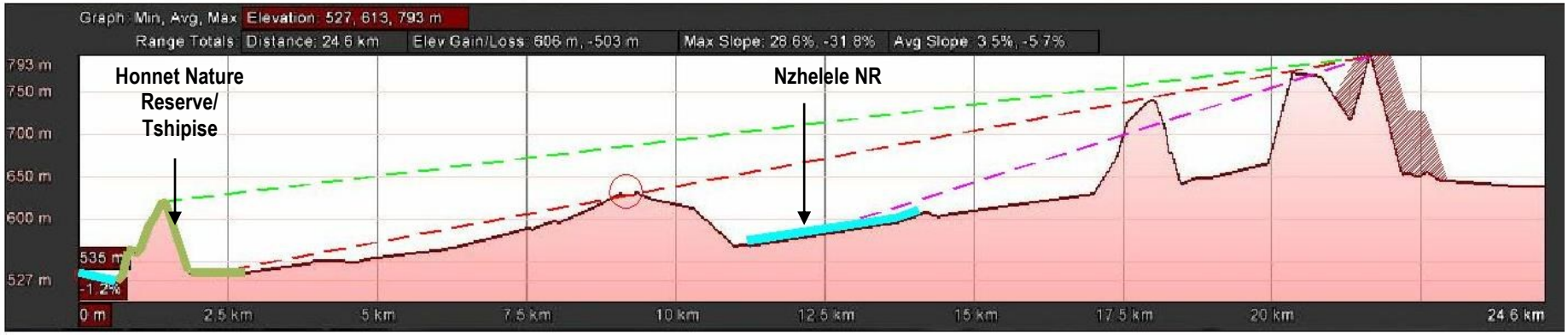


Figure 12: Cross Section A conceptually illustrating the proposed waste dump (hatched area) in relation to surrounding topography and potential receptor sites.

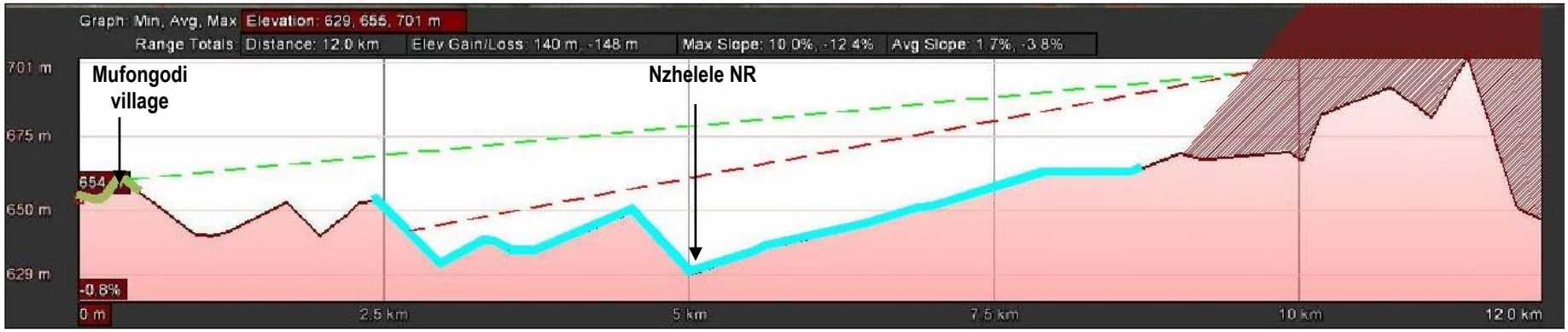


Figure 13: Cross Section B conceptually illustrating the proposed waste dump (hatched area) in relation to surrounding topography and potential receptor sites.

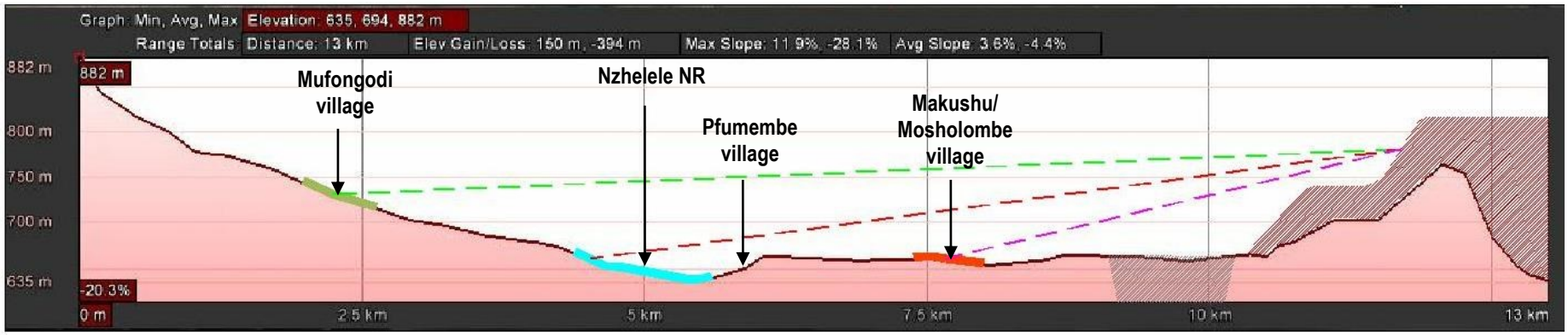


Figure 14: Cross Section C conceptually illustrating the proposed waste dump and open cast pit (hatched areas) in relation to surrounding topography and potential receptor sites.

Figure 15: Cross Section D conceptually illustrating the proposed plant (indicated in red) and the proposed waste dump and open cast pit (hatched areas) and in relation to surrounding topography and potential receptor sites.

Figure 16: Cross section E conceptually illustrating the proposed waste dump (hatched area) in relation to surrounding topography and potential receptor sites.

Figure 17: Cross Section F conceptually illustrating the proposed waste dump (hatched area) in relation to surrounding topography and potential receptor sites.

Figure 18: Cross Section G conceptually illustrating the proposed infrastructure in relation to surrounding topography and potential receptor sites.

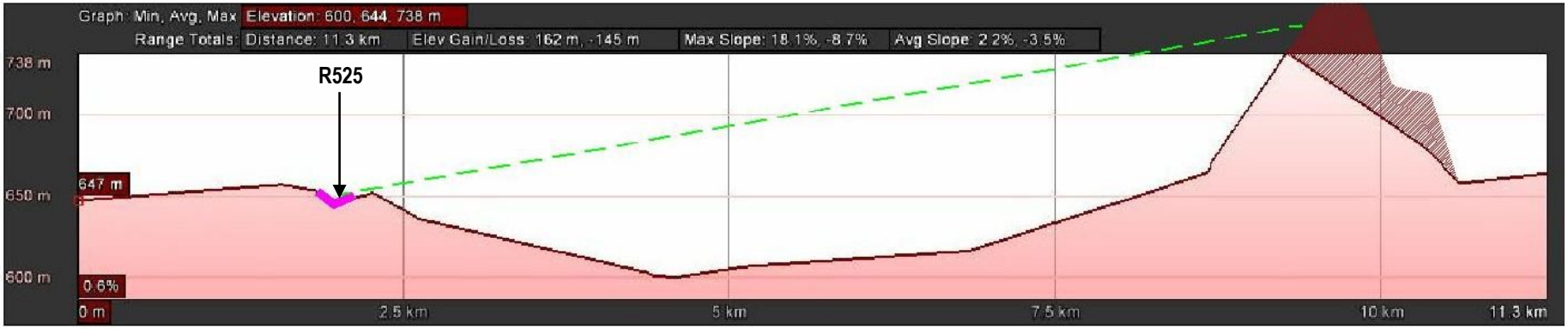


Figure 19: Cross Section H conceptually illustrating the proposed infrastructure in relation to surrounding topography and potential receptor sites.

5.5.2 Viewshed Analysis

The viewshed analysis calculates the geographical locations from where the proposed project might be visible. This potential visual exposure of the project has been modelled by creating a Digital Terrain Model (DTM) from available contour data, and applying a viewshed analysis using GIS software, whereby all areas with a line of sight towards the proposed project is indicated. It must be noted that the heights of existing infrastructure and vegetation are not included in the calculation of the viewshed and it is, therefore, important to bear in mind that the proposed project will not be visible from all points within the viewshed, as views may be obstructed by visual elements, whereby such intervening objects will modify the viewshed at ground level. It is also important to note that the visual impact from mining infrastructure is not expected to be permanent, provided that effective rehabilitation of impacted areas takes place, as the waste and discard dumps will be utilised as backfill within the open pit.

The viewsheds created by the proposed project infrastructure are illustrated in Figures 20 – 24 below, with distance radii or range rings also indicated at 5km intervals. Figure 20 indicates the viewshed analysis of the proposed open pit area, with Figure 21 showing the viewshed of the proposed mining plant area in the south. The viewshed of the proposed discard dump, with an expected height of 70m, is indicated in Figure 22 and the combined viewshed of the waste dump, to be constructed in two levels of 75m each, with a cumulative height of around 150m, is shown in Figure 23. The combined viewshed, including all proposed mining infrastructure with a vertical dimension, is indicated in Figure 24. Heights used for the calculations are as set out in Section 4.2.

From the viewshed analyses, it is evident that the proposed waste dump, and to a lesser degree, the proposed discard dump and plant area, will contribute the most towards the expected visual impact, while the visibility of the opencast areas will be much lower to this infrastructure being located at and below ground level. The extent of the combined viewshed (Figure 24) is mainly attributed to the cumulative height of the waste dump and it is recommended that, as planned, the proposed mining infrastructure does not extend above the central mountainous feature within the study area.

From the analyses (which does not take into account vegetation and local man-made structures), it is evident that the proposed project, with specific reference to the proposed waste dump, will be highly visible from within 5km of the study area and visible from a number of locations such as settlements, including Makushu, Mosholombe, Pfumembe, Mudimeli, Musekwa, Bonjane and Mufongodi towards the east and west of the study area and from

various game farms and lodges in the vicinity of the proposed project. Conservation areas and protected areas from where the project will be visible include the Nzhelele Nature Reserve and portions of Ekland Safaris, while the Kuduland Conservancy and Honnet Nature Reserve, with the exception of the prominent mountain included in boundaries of the Honnet Nature Reserve south of Tshipise, will not have unobstructed views towards the project (Figures 25 and 26) and the mine will not be visible from these areas. The project will furthermore not be highly visible from the south of the study area. The viewshed analyses indicate that the project will be visible from beyond 10km of the study area, particularly towards the east and west of the study area, although it is important to note that at a distance further than 10km from a development, visual exposure and visibility is expected to significantly decrease due to objects being difficult to distinguish from the background at such significant distances.

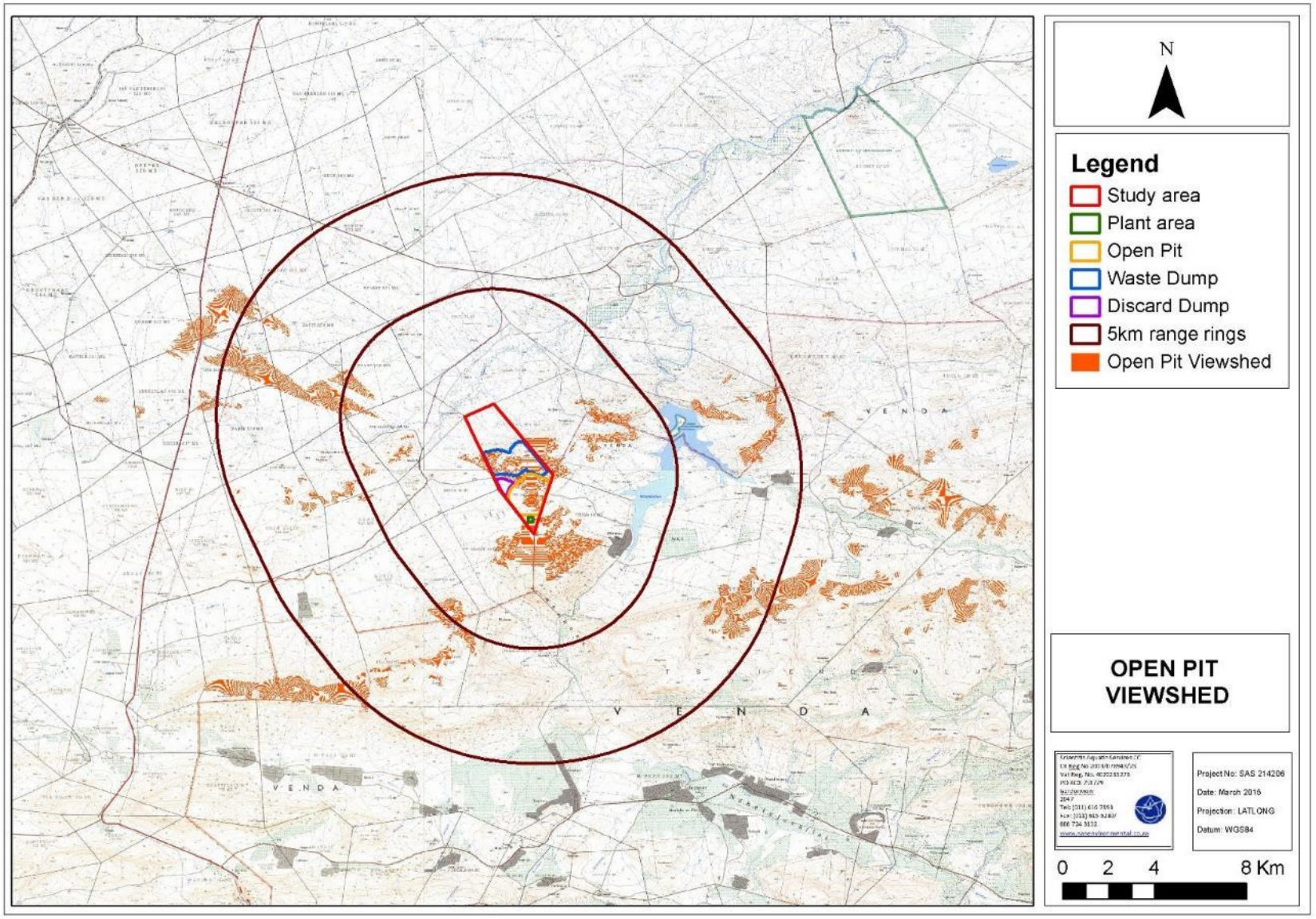


Figure 20: Viewshed (indicated as shaded areas) of the proposed opencast areas (ground level) overlaid onto the 1:50 000 topographic map.

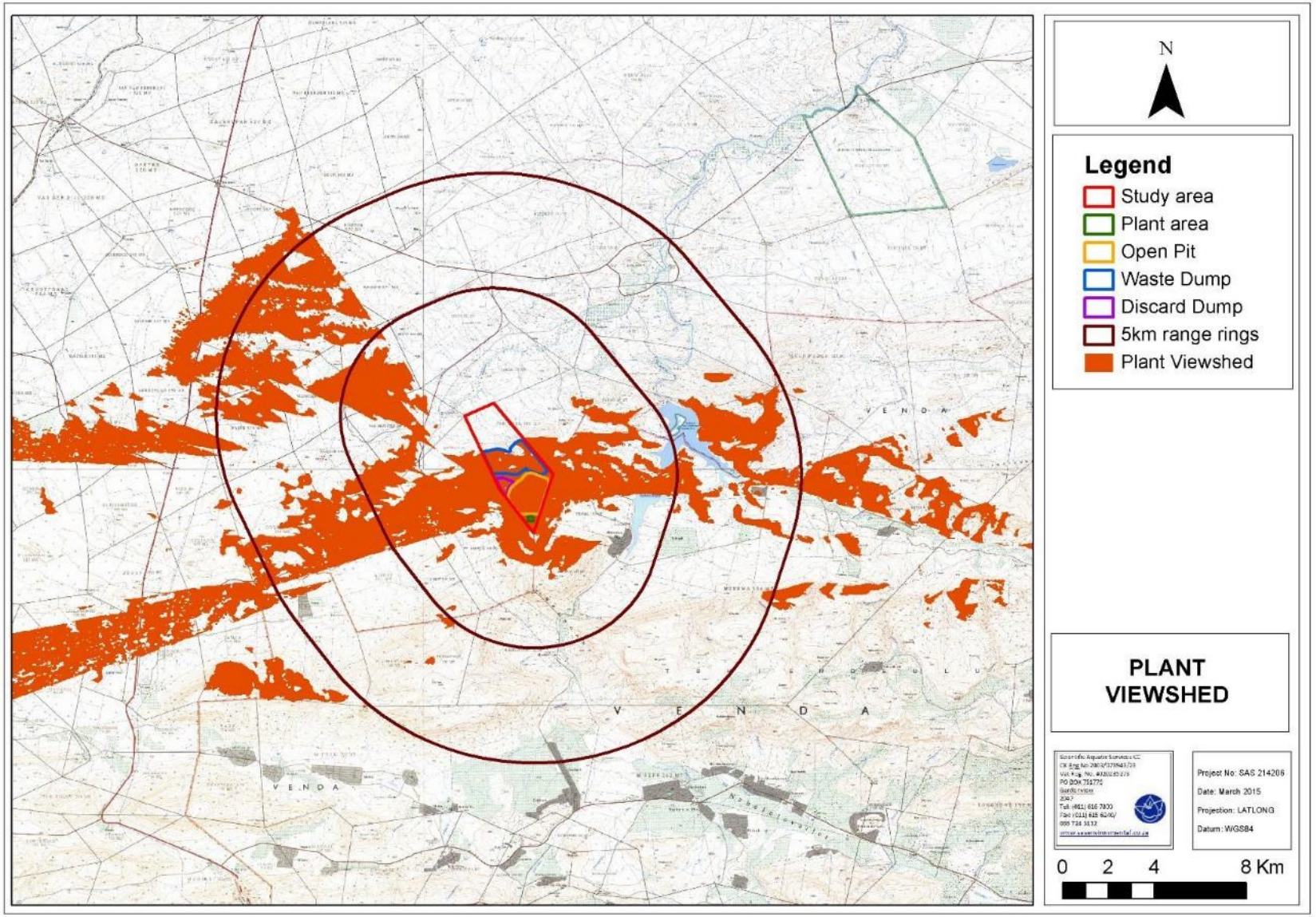


Figure 21: Viewshed (indicated as shaded areas) of the proposed plant area (20m in height) overlaid onto the 1:50 000 topographic map.

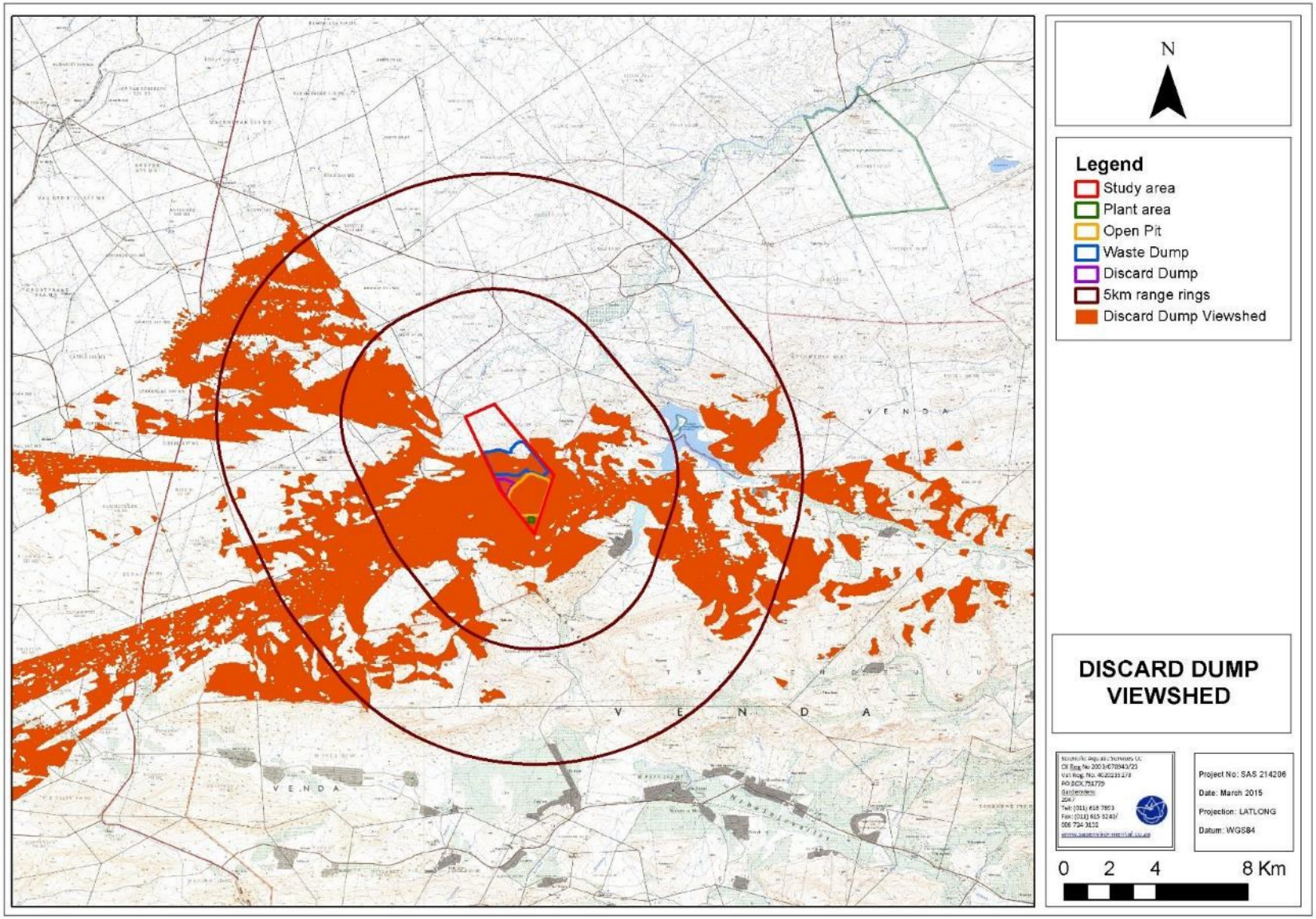


Figure 22: Viewshed (indicated as shaded areas) of the proposed discard dump (70m in height) overlaid onto the 1:50 000 topographic map.

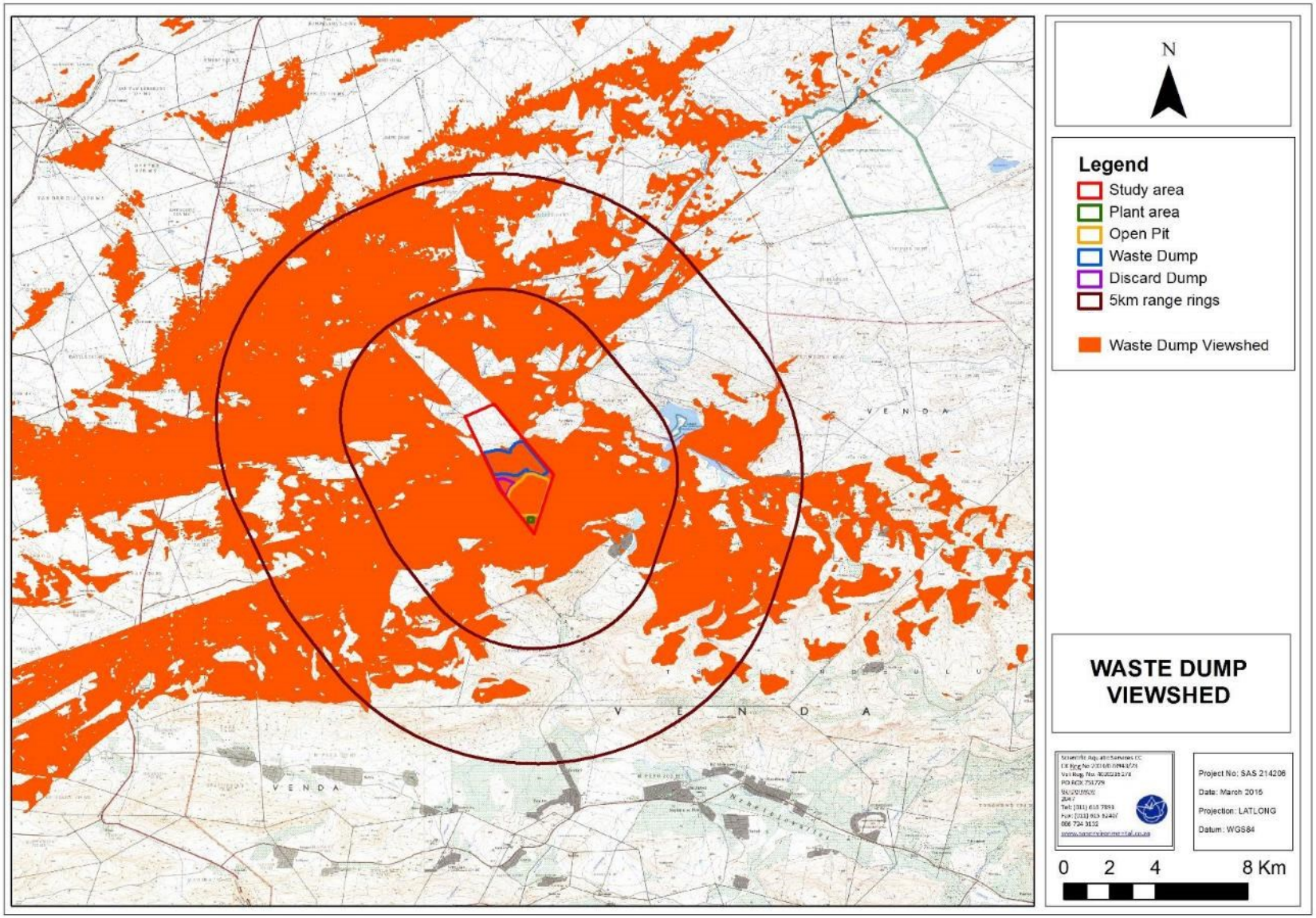


Figure 23: Viewshed (indicated as shaded areas) of the proposed waste dump (150 m in height) overlaid onto the 1:50 000 topographic map.

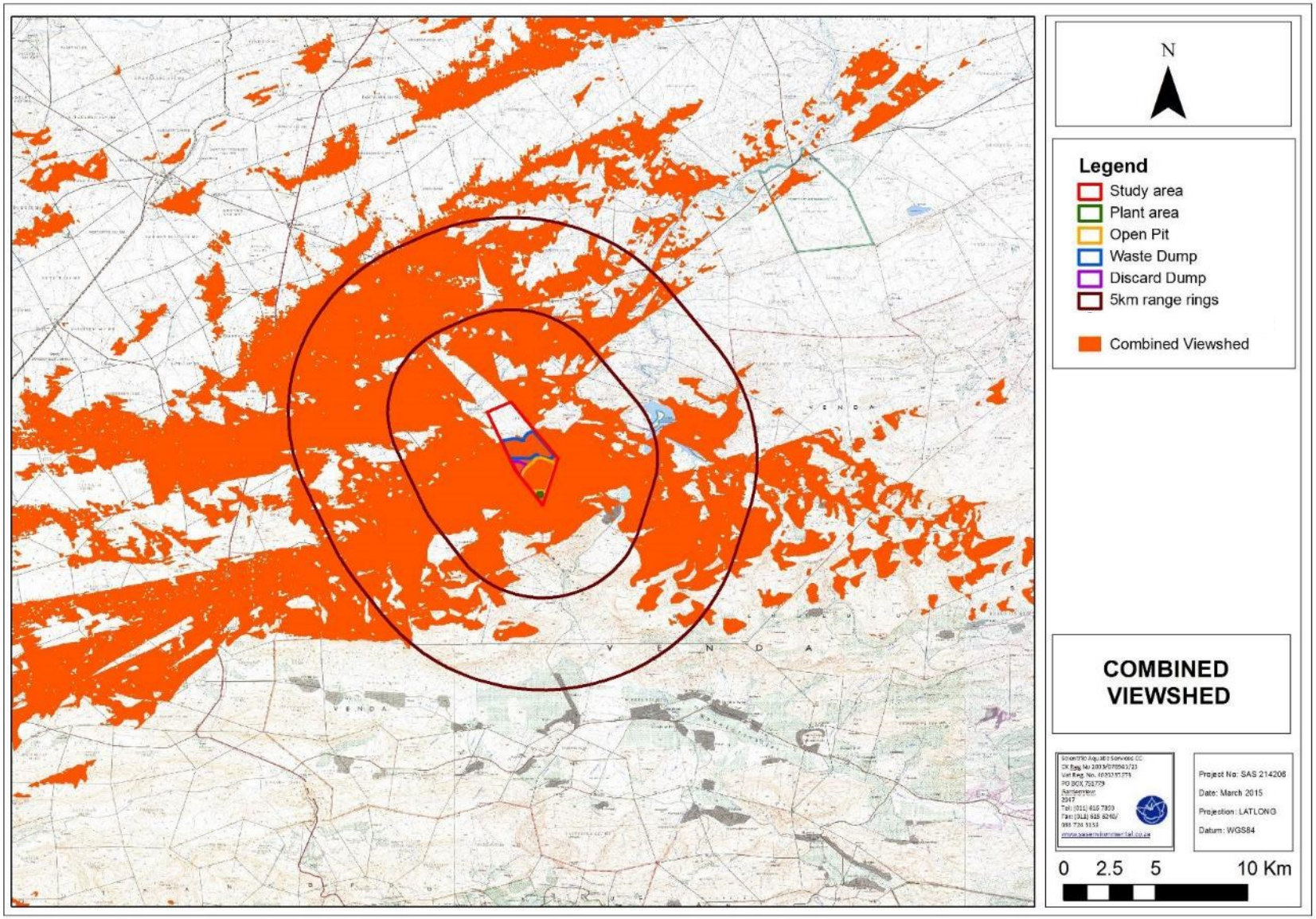


Figure 24: Combined viewshed (indicated as shaded areas) of all proposed mining infrastructure overlaid onto the 1:50 000 topographic map.

5.6 Key Observation Points

Key Observation Points (KOPs) were identified based on prominent viewpoints, where uninterrupted views of the proposed project may occur and at points where positive viewshed areas intersect with potential receptors (Figure 25). From the viewshed analysis it was found that no formally protected areas, with the exception of the Nzhelele Nature Reserve are likely to be affected, and these areas were therefore excluded as KOPs (Figure 26). The analysis was conducted by investigating the visual influence of proposed structures as per the available site layout (Figure 27). Major routes, such as the N1 and the R525, which carry increased amounts of traffic, as well as various smaller roads, were also considered during the assessment through its inclusion in the field assessment.

Visual simulations were rendered from six of the eight key locations and are shown in Figures 28 to 33 in the section below. Viewpoints are mostly representative of a larger number of houses within a village or chosen to represent views from public roads and surrounding nature reserves/ conservancies (IEMA, 2013). All visual simulations are presented as the project is envisioned in its pre-mitigated state. With appropriate mitigation and management measures put in place as outlined at the end of this report, the visual impact may be reduced.

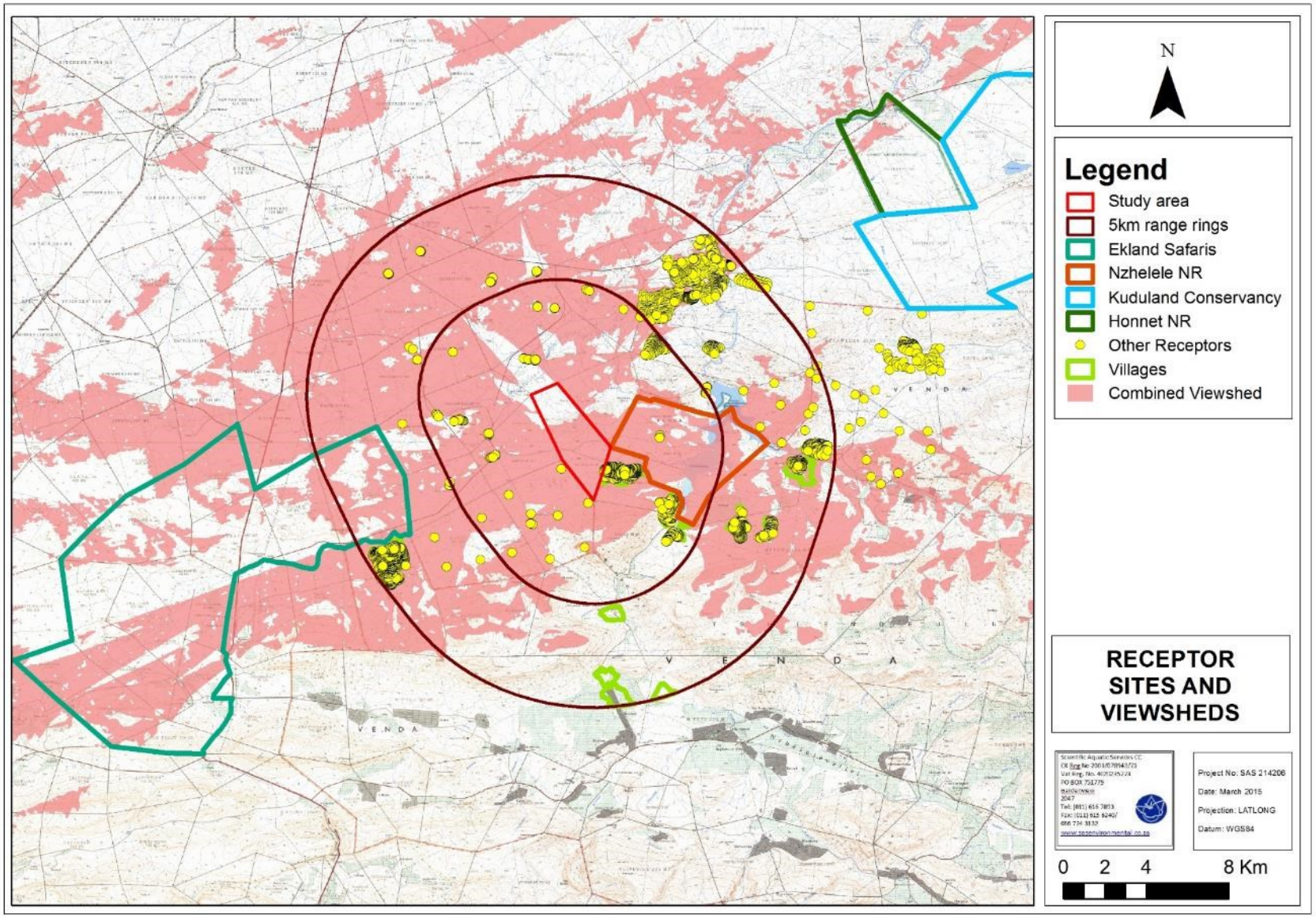


Figure 25: Combined viewshed (indicated as shaded areas) of all proposed mining infrastructure overlaid onto the map of potential visual receptors.

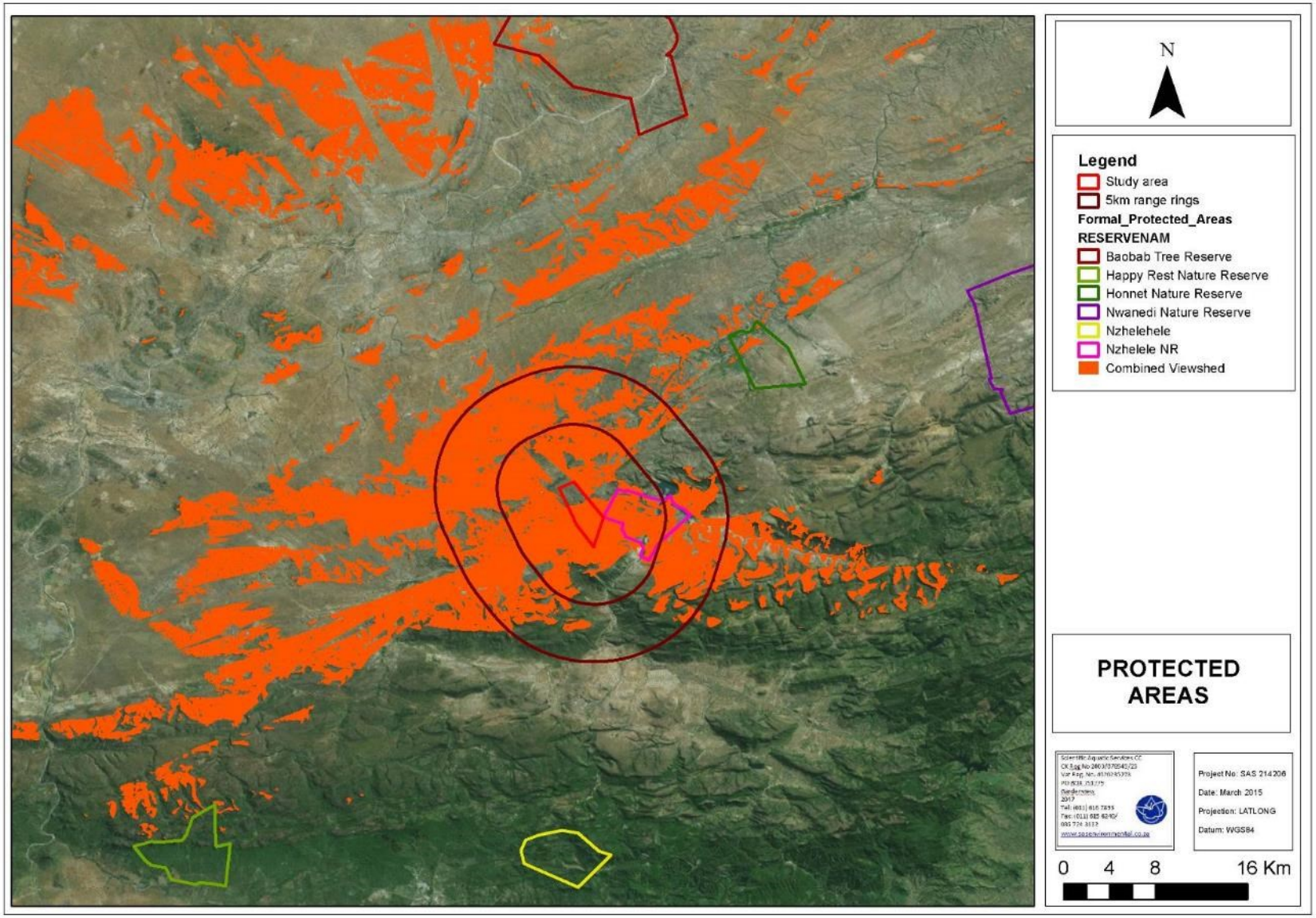


Figure 26: Combined viewshed (indicated as shaded areas) of all proposed mining infrastructure overlaid onto protected areas.

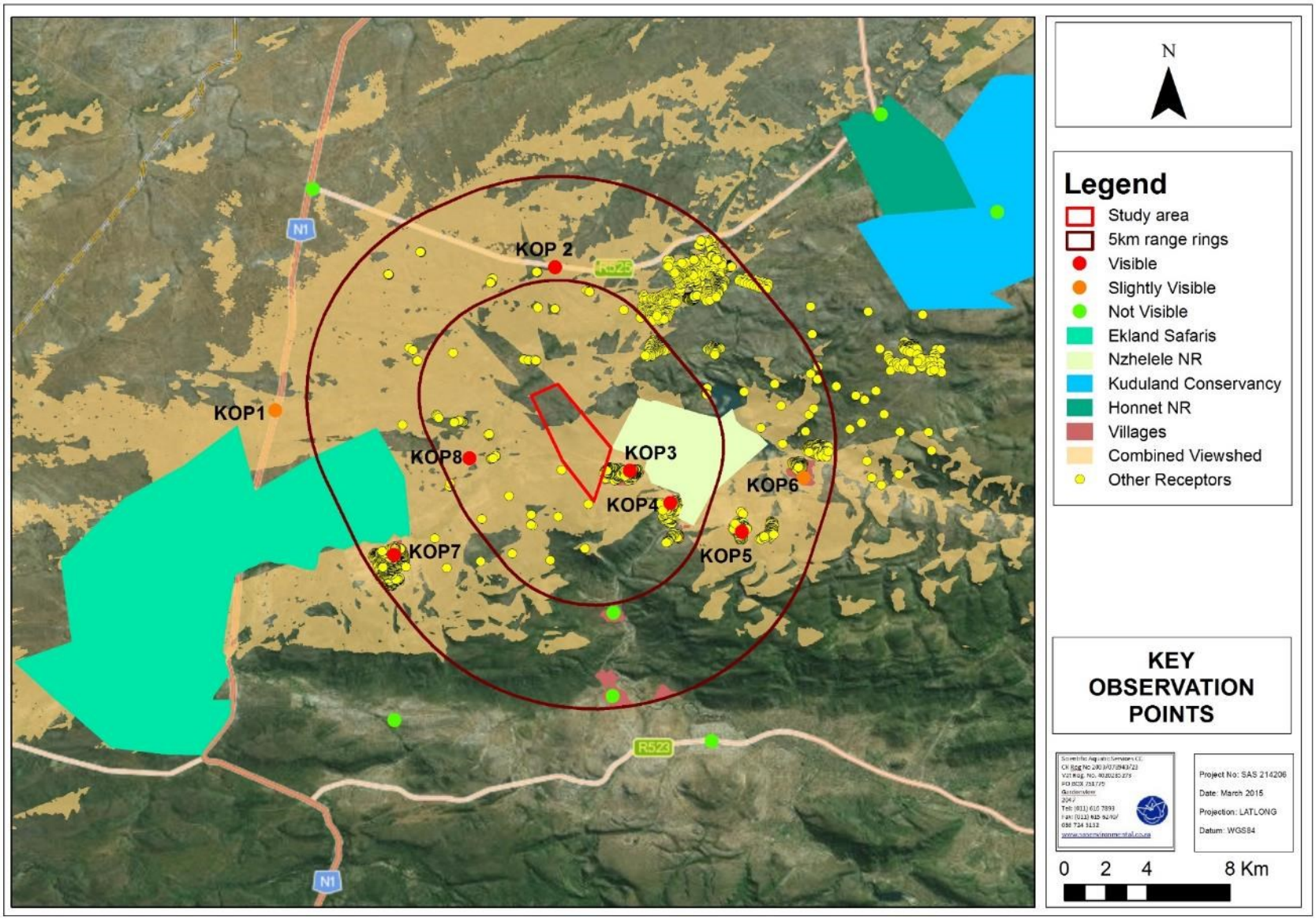


Figure 27: Location of Key Observation Points (KOPs), as well as areas from which the project will be slightly visible and areas from where the project will not be visible.

5.6.1 Key Observation Point 1: N1 Highway

KOP 1 is located approximately 13km to the west of the study area in the vicinity of the N1 highway. This distance of the KOP to the study area, the undulating landscape and the vegetation cover between roadway and the project serves to obscure the majority of the mining infrastructure from KOP1, with higher waste dumps possibly being marginally visible at intermittent points along the N1. The proposed project is unlikely to have a significant impact on road users along this roadway.

5.6.2 Key Observation Point 2: R525 Roadway

KOP 2 is located approximately 7km to the north of the proposed mining infrastructure. From this KOP only the proposed interim waste dump will be visible in areas where the dump protrudes over the ridge of the central mountain within the study area. This impact will not be immediate, but will only occur as the mining progresses and the height of the waste dump increases. The proposed waste dump will also not be visible along the entire length of the R525 to the north of the study area, due to the undulating landscape and the screening effect of existing vegetation. However, in places where the waste dump will be visible it will have a moderately significant impact on road users, also due to the expected alteration of the skyline (Figure 28).

5.6.3 Key Observation Point 3: Makusha/ Mosholombe

KOP 3 is representative of the Makushu and Mosholombe villages that is located adjacent to the proposed open cast pit and within approximately 1 km of the proposed waste dump and other mining structures. Receptors residing within these villages will note the mining infrastructure clearly within the foreground and very high visual contrast from mining infrastructure is expected in this area (Figure 29). These receptors can therefore be viewed as highly sensitive.

5.6.4 Key Observation Point 4: Pfumembe/ Nzhelele Nature Reserve

KOP 4 is located in the vicinity of the Pfumembe village and in close proximity to the Nzhelele Nature Reserve at a distance of 3km southeast of the study area. Residents of the Pfumeme village and visitors to the Nzhelele Nature Reserve will be able to see the waste dump within the foreground and high visual contrast and visual intrusion is expected and these receptors are considered to be highly sensitive (Figure 30). It is important to note that the plant

infrastructure is located on a west-facing slope, which will largely screen it from the Pfumembe village and Nzhelele Nature Reserves.

5.6.5 Key Observation Point 5: Musekwa

KOP 5 represents views from Musekwa, located approximately 7km to the east of the study area. Clear lines of sight are present towards the study area from this location and the waste dump and the top portion of the discard dump will be visible in the middle- to background, with the open cast pit and plant areas obscured from view by local topography (Figure 31). Due to the above, these receptors can be viewed as being moderately sensitive.

5.7.6 Key Observation Point 6: Mufongodi

KOP 6 is located approximately 9km towards the east of the study area at the Mufongodi village. The proposed waste dump will be visible in the background from the western, west-facing portion of the village, with the view extending across the Nzhelele Nature Reserve. These views are expected to be large obscured from the eastern portion of the village, and these receptors are therefore regarded as being moderately sensitive. The open pit and plant area, being located on a west-facing slope is not expected to be visible from this KOP.

5.7.7 Key Observation Point 7: Mudimeli

KOP 7 is located approximately 9km to the southeast of the study area in the vicinity of the Mudimeli village. The waste and discard dump and possibly portions of the open pit will be visible from this location in the background, and receptors are therefore considered to be moderately sensitive, with the proposed mine being significantly less visible than from closer proximities to the mine infrastructure (Figure 32).

5.7.8 Key Observation Point 8: Unnamed gravel road

KOP 8 is located on the unnamed gravel road in the vicinity of the Mudimeli village where this road intersects another gravel road linking Mudimeli with the Nzhelele Dam. KOP 8 is located approximately 4km from the study area and the proposed waste dump and discard dump will be visible in the foreground (Figure 33). Any users of both the north-south and east-west running gravel roads are regarded as being highly sensitive receptors.

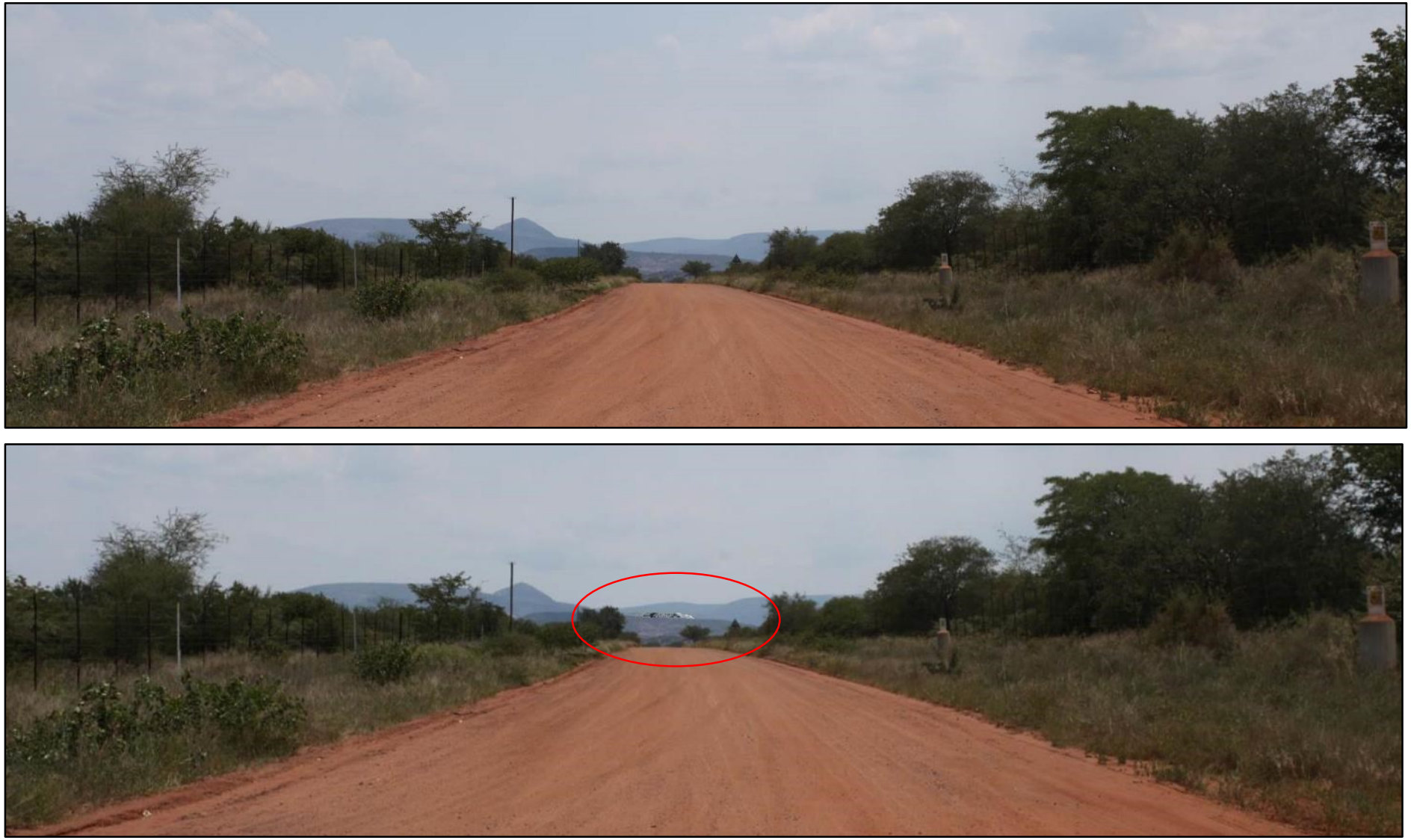


Figure 28: KOP 2 – visibility of the proposed project before and after development.

Figure 29: KOP 3 – visibility of the proposed project before and after development.

Figure 30: KOP 4 – visibility of the proposed project before and after development.

Figure 31: KOP 5 - visibility of the proposed project before and after development.

Figure 32: KOP 7 - visibility of the proposed project before and after development (Google Earth Pro, 2015).

Figure 33: KOP 8 - visibility of the proposed project before and after development.

5.7 Night Time Lighting

In order to understand the potential visual impacts from night lighting, it is important to understand the existing lighting levels. The Institute of Lighting Engineers (ILP) (2011) identifies five environmental zones for exterior lighting control and with which to describe the existing lighting conditions within the landscape (Table 16). These environmental zones are supported by design guidance for the reduction of light pollution, which can then inform proposed mitigation measures and techniques. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

Table 16: Environmental zones.

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low District Brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium District Brightness	Small town centres or suburban locations
E4	Urban	High District Brightness	Town/city centres with high levels of night-time activity

Light sources impacting on the study area and its surroundings originate from the adjacent Makushu and Mosholombe villages as well as from game farms and lodges in the region, an vehicular movement on local gravel roads in the vicinity of the study area. Villages in the region have been found to create distinct sky-glow effects that are visible from a distance. The lighting environment of the study area is thus consistent with Environmental Zone E2 – Low District Brightness typically associated with rural agriculture areas and rural villages. Overall, however, the night time lighting currently impacting on the study area and surrounds is low and the impact from the mining project and potential 24-hour mining operations is therefore expected to increase brightness in the region during night time hours. The ILP (2011) recommend that, in order to maintain the night time setting, lighting within the identified zone should have minimal illumination into the sky as well as to adjacent viewpoints.

Two types of lighting are associated with the proposed project, namely stationary lighting sources and vehicle mounted lighting sources. Stationary lights facing upward are significant contributors to light pollution and causes sky glow and glare, while light facing in a horizontal direction can be visible for long distances, lead to light trespass (light falling outside the desired area of illumination) and be disturbing to viewers and vehicles. Sky glow refers to the night

time brightening of skies, caused by the scattering and redirecting of light in the atmosphere, by water droplets and dust in the air, back towards the ground. Such stray light mostly comes from poorly designed and improperly aimed light, and from light reflected from over-lit areas. This effect is very noticeable at night and in the early morning at mining operations (ASSA, 2012). Lighting from vehicles within rural areas will generally be more intrusive than in urban settings and, therefore, will have a potentially greater impact due the general lack of existing ambient light.

The proposed project is expected to further contribute to the effects of sky glow and artificial lighting in the region, particularly as a result of stationary lighting sources, including lighting from the beneficiation plant facilities. Generally, the impacts of vehicle mounted lighting sources in the areas will be confined to the local and sub-regional setting (up to 10km from the study area) due to the effects of distance and intervening undulating topography, existing settlements and vegetation which restrict the potential impact on views from more distant regional points.

The images below indicate lighting associated with a typical mining operation from a distance of 500m and from a distance of 100m. From these images, it is evident that the night time lighting impact will be significant from this range.

Figure 34: Typical night time lighting associated with a mineral processing plant. The image on the left was recorded from a distance of approximately 1km from the plant from an elevated position, while the image on the right was recorded from a distance of approximately 100m from the plant.

5.8 Alternatives

5.8.1 No-Go Option

Should the No-Go Option take place, no additional visual impacts will take place.

5.8.2 Alternative land use options

The following alternative land use options have been identified (Jacana Environmentals, 2015):

- Commercial farming: The northern and southern sections of the study area mainly comprise shallow or rocky soils that fall into the wilderness and grazing land capability classes. However, the mid-section of the site comprises deep soils of the Augrabies, Hutton and Brandvlei soil forms. These are potentially low to medium potential arable land if irrigation water is available.
- Grazing: Grazing by both game and domestic animals (cattle, goats) is a viable alternative to mining, however, this relates back to the No-Go Option which indicated substantial losses in respect of economic benefits and employment.
- Eco-tourism: Improved accommodation and tourist activities (4x4 tracks, walking trails, bird watching) could be a viable alternative to the existing game farming operation.
- Communal land: The area may be utilized by the land claimants for housing and subsistence farming / grazing land.

None of the abovementioned alternative land uses will lead to a visual impact of the same high significance level as mining, in terms of changes to landscape character, visual intrusion, visual exposure and night time lighting. In addition, the abovementioned alternative land uses will not impact on as many receptors as the proposed mining land use nor is it likely to impact on receptors other than in the immediate vicinity of the study area. Some impacts may arise from clearing of land for commercial farming which will affect the VAC of the study area.

6. IMPACT ASSESSMENT

The tables below serve to summarise the significance of potential visual impacts that may occur as a result of the proposed project. The sections below present the results of the findings for each potential impact identified.

6.1 Impact Discussion

Potential impacts on the visual environment associated with the region surrounding the study area as a result of the proposed project are discussed in the section below that present an assessment of the significance of the impacts prior to mitigation and management measures being put in place and taking into consideration the available mitigatory measures, assuming that they are fully implemented.

After consideration of the findings of this assessment, recommendations and mitigation measures have been developed which will assist in minimising the proposed project's visual impact throughout the various development phases of the project. The mitigation measures outlined in Section 6.5 would serve to minimise a number of or all of the potential visual impacts identified and, in order to avoid repetition, are listed separately.

6.1.1 Impact 1: Impact on Landscape Character and Sense of Place

The character of the landscape in the region of the project is currently dominated by game farming and hunting activities, with natural grazing primarily used for game ranching. Irrigation farming is present to the northwest and northeast of the study area along the banks of the Mutamba and Nzhelele Rivers. The character and sense of place of the study area is associated with of the rural, mountainous character thereof, and although this landscape type and the vegetation types associated with the study area is not unique to the region, the central mountainous feature within the study area does serve to distinguish the study area from its surroundings. The proposed project will alter this topographic feature through the placement of the interim waste dump against the mountain ridge, which in turn will impact on the overall landscape character.

As no other planned mining activities have yet commenced in the vicinity of the study area, the proposed project is highly likely to contribute to changes in the visual character of the study area and its surroundings, and will also affect the sense of place associated with the larger region.

Activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Planning and placement of mining infrastructure where it will be visible for significant distances	Site clearing, including the ongoing removal of topsoil and vegetation	On-going mining activities, including removal of coal and increasing height of various stockpiles and operation of the plant	Demolition and removal of infrastructure leading to further dust generation, erosion and changes in the visual character of the study area
Failure to initiate a biodiversity action plan, rehabilitation plan and alien floral control plan during the pre-construction phase	Construction of general surface infrastructure, including transportation of materials and stockpiling	Increased introduction and proliferation of alien plant species and further transformation of natural habitat leading to a change in landscape character	Rehabilitation, spreading of soil, re-vegetation and re-profiling enhancing the visual character through restoration and greening
Removal of vegetation, particularly within higher-lying areas	Topographically altering the characteristic central mountainous feature within the study area through the creation of a waste dump up to 150m in height	Drilling, blasting, ground excavation and ongoing movement of vehicles leading to dust	Ineffective rehabilitation leading to poor vegetation cover, the open pits not being backfilled and surface infrastructure remaining
	Construction of access roads beyond the boundaries of study area	On site water use and storage and distribution, handling and treatment of hazardous and waste material	
	Erosion and loss of topsoil as a result of the proposed mining project leading to high visual contrast	Disturbance of soils and ongoing erosion due to operational activities	
	An increase in construction vehicular and pedestrian traffic	An increase in vehicular traffic as well as the use and maintenance of roads and infrastructure	
	Drilling, blasting and development of infrastructure and adits for underground mining leading to dust	The placement of creation of temporary stockpiles	
	Temporary storage of hazardous products and waste material		

The significance of the impact is assessed in the table below.

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	4	4	4	4	8	11	88 (Medium-High)
Operational phase	5	4	4	5	4	9	12	108 (High)
Decommissioning and closure	4	4	3	4	4	8	11	88 (Medium-High)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	4	4	3	2	3	8	8	64 (Medium-Low)
Operational phase	4	4	3	4	4	8	11	88 (Medium-High)
Decommissioning and closure	3	4	2	3	3	7	8	56 (Medium-Low)

The landscape character and sense of place of the study area is considered to be moderate to high, and as such is indicated as being of moderate to high visual sensitivity and importance.

From the above tables it is clear that prior to mitigation, the impact on the overall visual character and sense of place of the area is considered to be Medium-High during the construction and decommissioning phases of the project and High during the operational phase. During the construction and operational phases of the proposed project an alteration of landscape character and sense of place will definitely occur as these activities will change the land use of the area, while during the decommissioning phase, the probability of this impact will be slightly lower.

Through mitigation, the severity of the impact may be lowered during all development phases, and the spatial scale of the impact may also be slightly reduced. Should suitable mitigation and effective rehabilitation not be implemented during the decommissioning and close phase of the project, the duration of the impact is likely to be long-term with the visual character of the region permanently altered.

Post mitigation, should management measures be effectively implemented, the overall impact significance during the construction and decommissioning phases may be lowered to Medium-

Low levels and the overall significant of the impact during the operational phase may be lowered to a Medium-High level.

6.1.2 Impact 2: Visual Intrusion and VAC impacts

The altered visual environment during the various development phases of the proposed project may lead to undesirable levels of visual intrusion, with high levels of incompatibility with surrounding land uses as well as visual contrast and discord between the study area and its surroundings. This in turn will negatively impact on the VAC (the ability of an area to visually absorb development) of the study area.

Activities register

Pre-Construction	Construction	Operational	Decommissioning and Rehabilitation
Siting of mining infrastructure within a rural area dominated by mostly intact natural vegetation, rural settlements and subsistence agricultural activities	Construction of mining infrastructure	Ongoing mining activities and increasing heights of waste and discard dumps	Ineffective rehabilitation including to poor vegetation cover, erosion being present, infrastructure remaining, and the open pit not being backfilled and revegetated
Siting of mining infrastructure in an area where limited mining activity is currently taking place	Site clearing, including the removal of topsoil and vegetation	Increased traffic and increased presence of mining vehicles on the local roads	Ineffective decommissioning and rehabilitation leading to permanent presence of mining infrastructure
	Construction of mining infrastructure including offices and plant areas	Ongoing vegetation and damage, scarring of the terrain, and altering of landforms or contours	
	Creation of waste and discard dumps	Change in landscape morphology, with specific reference to skylining	
	Presence of drill rigs, Increased amount of human activity, vehicles, and other equipment		
	Vegetation damage, scarring of the terrain, and altering of landforms or contours		

The significance of the impact is assessed in the table below:

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	4	3	4	4	8	11	88 (Medium-High)
Operational phase	5	4	4	4	5	9	13	117 (High)
Decommissioning and closure	4	4	3	3	4	8	10	80 (Medium-High)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	4	4	3	3	3	8	9	72 (Medium-Low)
Operational phase	4	4	4	3	3	8	10	80 (Medium-High)
Decommissioning and closure	4	4	3	2	3	8	8	64 (Medium-Low)

The expected level of visual intrusion through the development of a mine within the study area, is considered to be moderate, in line with the medium VAC determined for the study area and its immediate surroundings and the ability of the area to absorb or conceal some visual impacts. The VAC of the Mining Footprint Area will however be lowered during the mining process, due to clearing of vegetation and alteration of landforms, in addition to the significant height of the proposed waste dump.

Prior to mitigation measures being implemented, this impact is expected to be Medium-high during the construction and decommissioning phases and High during the operational phase. During the construction and operational phases of the project, visual intrusion and loss of VAC will occur, while further loss of VAC may also take place during the closure and decommissioning phases. These significance ratings may be lowered through the implementation of mitigation measures, although the impact will still have a Medium-High significance rating during the operational phase of the project, while the impact during the construction and decommissioning phases. The severity of the perceived impact is expected to be great prior to mitigation and to remain as such or slightly reduced once mitigation measures have been put in place. The duration of the impact, should mitigation measures not be implemented, may be long term, but should mitigation be effective and the recovery of the landscape be actively sought after closure and through concurrent rehabilitation, may be lowered.

6.1.3 Impact 3: Visual Exposure and Visibility Impacts

This impact relates directly to the perception of sensitive visual receptors towards the project. Highly sensitive visual receptors have been determined to primarily comprise of residents living within 5km of the mining area, potential visitors to the Nzhelele Nature Reserve as well as game hunters and recreational tourists within 5km of the study area, while moderately sensitive receptors are those residents and visitors residing between 5km and 10km of the study area. Visual exposure will take place directly as a result of mining infrastructure (and associated lighting) being visible and indirectly through fugitive dust generated by construction and operation related activities, such as construction vehicles driving on dirt roads as well as blasting and earthwork activities which will alter the visual environment. In addition to mining infrastructure, impacts from clearing of vegetation, potential erosion as a result of bare soils, alteration of landforms and access road and mining construction activities will also create noticeable contrast in the landscape and will be visible to a number of receptors.

Activities register

Pre-Construction	Construction	Operational	Decommissioning and Rehabilitation
Preparing and planning of site	Construction of infrastructure	Dust generation during mining activities	Ineffective rehabilitation including poor vegetation cover which will contribute to dust generation
Placement and design of infrastructure leading to the mining infrastructure and activities being visible over significant distances and by sensitive receptors	Dust generation due to movement of vehicles	Earthworks and increasing height of waste and discard dumps	
	Loss of vegetation cover	Presence and movement of vehicles, particularly coal transport trucks utilising local roads	
	Blasting and earthworks activities	Ongoing mining activities, blasting and earthworks	
	Erosion and loss of topsoil as a result of the proposed mining project leading to high visual contrast	Ongoing construction activities repairs, and maintenance activities	

The significance of the impact is assessed in the table below:

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	5	4	4	4	4	9	12	108 (High)
Operational phase	5	4	4	4	5	9	13	117 (High)
Decommissioning and closure	4	4	3	3	4	9	10	90 (Medium-High)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	4	4	3	3	4	8	10	80 (Medium-High)
Operational phase	5	4	3	3	4	9	10	90 (Medium-High)
Decommissioning and closure	3	4	3	3	3	7	9	63 (Medium-Low)

The proposed mining activities are expected to visually impact on a number of sensitive receptors, particularly residents in the immediate vicinity of the study area within the Makushu, Mosholombe and Pfumembe villages, as well as within villages located between 5km and 10km of the study area such as Musekwa (Ngundu), Maranikhwe, Mudimeli and Maangaani. In addition, other sensitive receptors such as tourists, game farmers and hunters utilise the region and therefore the sensitivity of the receiving environment surrounding the Mining Footprint Area in terms of this impact is therefore considered to be high.

Prior to mitigation this impact has High and Medium-High significance during the construction/ operational and decommissioning phase of the project respectively with residents of some of the above-mentioned villages will definitely being directly affected by the proposed project. Should mitigation measures be implemented, this impact is still highly likely to occur with a Medium-High significance determined during the construction and operational phases of the project. During the decommissioning phase, this impact is expected to have a Medium-Low impact significance after mitigation.

6.1.4 Impact 4: Impacts due to Night Time Lighting

Lighting associated with the proposed project may be visible during both day and night, but lighting is more likely to have a visual impact during the night time. Lighting may be visible for significant distances and indirect lighting impact, such as sky glow (the scattering of light in

the sky) and glare may reduce the night sky quality at locations some distance from the light sources.

Night time lighting as a result of the 24 hour operations associated with the proposed project may reduce the appearance of starry skies within the low brightness landscape.

Activities register

Pre-Construction	Construction	Operational	Decommissioning and Rehabilitation
Preparing and planning of site and siting of infrastructure	Use of security lighting during the construction phase	Exterior lighting around buildings, parking areas, and other work areas	Stationary and vehicle mounted lighting during the decommissioning and rehabilitation phase
Planning of light placement and overall lighting strategy		Lighting at night from operational vehicles	
		Security and other lighting around and on support structures could also contribute to light pollution	
		Maintenance activities conducted at night, such as mirror or panel washing, might require vehicle-mounted lights which could also contribute to light pollution	

The significance of the impact is assessed in the table below:

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	4	3	4	3	8	10	80 (Medium-High)
Operational phase	5	4	4	4	5	9	13	117 (High)
Decommissioning and closure	4	4	3	4	3	8	10	80 (Medium-High)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	4	4	2	3	3	8	8	64 (Medium-Low)
Operational phase	4	4	3	3	5	8	11	88 (Medium-High)
Decommissioning and closure	4	4	2	3	3	8	8	64 (Medium-Low)

From the above tables it is clear that before mitigation, the impact on visual resources through light pollution, particularly at night, is highly likely to occur during all development phases. Due to the area being rural with a low lighting level, together with the possibility that skyglow and light trespass may reduce the visual quality of this environment, the landscape is considered to be visually sensitive. The severity of light pollution impacts on the area is considered to be somewhat substantial, with night lights expected to be visible for significant distances. The duration of the impact will last for the life of the mining operation.

From the above tables it is clear that before mitigation, the impact on visual resources through light pollution, particularly at night, is Medium-High during the construction and decommissioning phases, and High during the Operational Phase. The effective implementation of mitigation measures pertaining to lighting, with particular reference to lighting design and placement, may lead to this impact being reduced to Medium-Low and Medium-High significance levels.

6.2 Impact Summary

Based on the above assessment it was found that there are four possible impacts that may affect the visual character of the study area and impact on potential sensitive receptors and visually sensitive landscapes.

Table 17 below summarises the findings of the impact assessment, indicating the significance of the various impacts before mitigation takes place and the likely impact if effective management and mitigation takes place.

Table 17: Summary of the results obtained from the assessment of visual impacts.

Construction phase		
Impact	**Unmanaged**	**Managed**
1: Impact on landscape character and sense of place	Medium-High	Medium-Low
2: Visual intrusion and VAC impacts	Medium-High	Medium-Low
3: Visual exposure and visibility impacts	High	Medium-High
4: Impacts due to night time lighting	Medium-High	Medium-Low
Operational phase		
Impact	**Unmanaged**	**Managed**
1: Impact on landscape character and sense of place	High	Medium-High
2: Visual intrusion and VAC impacts	High	Medium-High
3: Visual exposure and visibility impacts	High	Medium-High
4: Impacts due to night time lighting	High	Medium-High
Closure and Decommissioning Phase		
Impact	**Unmanaged**	**Managed**
1: Impact on landscape character and sense of place	Medium-High	Medium-Low
2: Visual intrusion and VAC impacts	Medium-High	Medium-Low
3: Visual exposure and visibility impacts	Medium-High	Medium-Low
4: Impacts due to night time lighting	Medium-High	Medium-Low

6.3 Cumulative Impacts

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed project in conjunction with further planned mining activity within the region is likely to be of high significance, even more so due to the fact that no existing mining activities are currently present within the region. The cumulative impact of additional traffic on the local and regional roads as well as combined impacts from night time lighting will also affect the sense of place of the larger region.

6.4 Residual Impacts

It is possible that after all infrastructure have been removed from the study area, scarring of the terrain may remain present after closure. This is of particular significance within the vicinity of the central mountain against which the proposed interim waste dump is to be placed. Material from this dump will be backfilled into the open pit once mining activities have ceased and it is expected that indigenous vegetation against the mountain slope will be permanently lost or altered. The possibility also exists that rehabilitation efforts, including revegetation of impacted areas, including the open pit and the mountain slopes where waste material have been removed, be unsuccessful, which will lead to a long term or permanent visual impact in the area.

6.5 Mitigation Measures

The sections below indicate the required mitigatory, management and monitoring measures required to minimise potential visual impacts.

General housekeeping

- The construction site must be kept in a neat and orderly condition at all times;
- The construction period must be reduced as far as possible through careful planning;
- Fires within the study area are to be prohibited;
- All operational facilities should be actively maintained;
- Areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities must be designated and screened off as far as is considered feasible.

Development footprint

- The development footprint and disturbed areas are to be kept as small as possible and the areas cleared of natural vegetation and topsoil must be kept to a minimum;
- The extent of all surface infrastructure footprint areas and permanent structures must be minimised to what is absolutely essential;
- As far as possible, existing roads are to be utilised, also for construction purposes, to prevent cumulative impacts from roads and traffic;
- The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint. Figures 35 illustrates the combined viewsheds where the waste dump is developed at a height of 110m, 40m lower than the current planned height of 150m and Figure 36 illustrates the viewshed should the height be at 75m, half the expected current height. From Figures 35 and 36 it is evident that should the height of the waste dump be decreased, the visual impact may be minimised particularly from the north. This will however lead to an increased infrastructure footprint area, which may lead to increased ecological and other impacts.

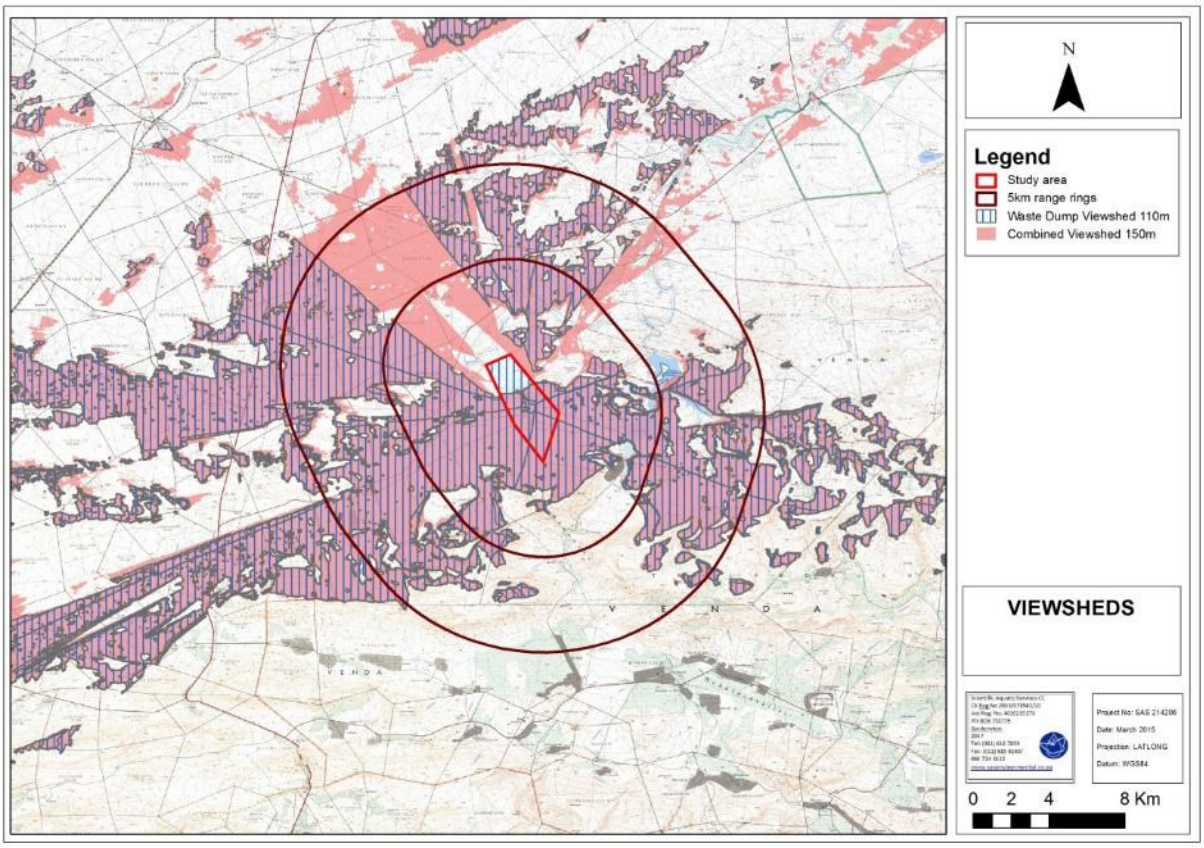


Figure 35: Viewshed (indicated as shaded areas) of the waste dump at 110m in height compared to the viewshed of the current planned height of 150m.

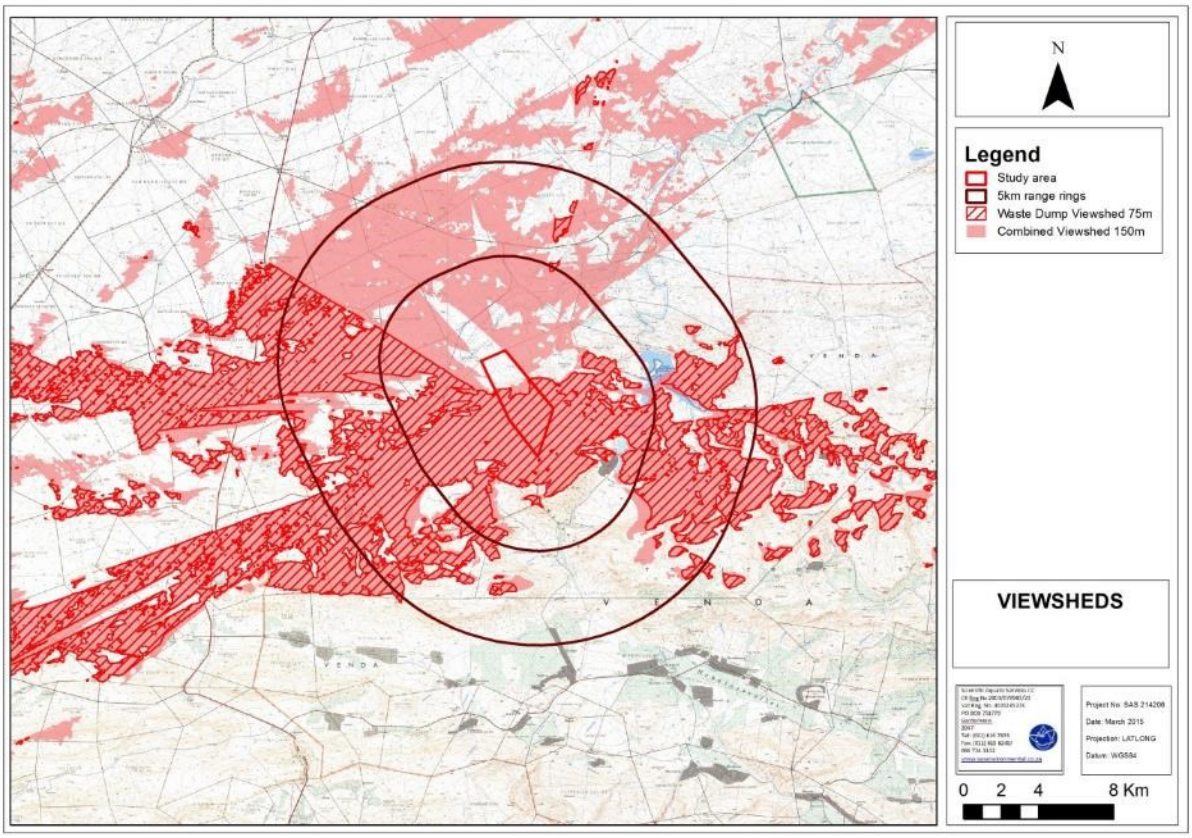


Figure 36: Viewshed (indicated as shaded areas) of the waste dump at 75m in height compared to the viewshed of the current planned height of 150m.

Infrastructure placement

- As far as possible, infrastructure should not be placed on ridgelines or other locations where they would be silhouetted against the sky. In this regard it is important to, as far as possible, structure the proposed interim waste dump in such a manner that it does not extend over the crest of the mountain against which it is constructed as this will assist greatly in minimising the visual instruction and exposure of the project to the north of the mining footprint area;
- Waste and discard dumps must be shaped and rounded to blend in with the surrounding undulating landscape, especially the waste dump which will eventually protrude over the mountain crest and alter the skyline. All stockpiles should be shaped to fit in with the surrounding hills and mountains and revegetated to blend with the surroundings and to minimise visual contrast;
- Where mining infrastructure is sited within view of visually sensitive areas, it must be placed as far away as possible or within lower-lying areas where it may be screened by topography. Where full screening of infrastructure components is not possible, siting should take advantage of partial screening opportunities;

- Where possible, placing of mining infrastructure in front of visually prominent landscape features, that naturally draw an observer's attention;
- As far as possible, surface infrastructure should be placed in areas that have already been disturbed;
- New roads are to follow the undulating contours of the landforms in order to make it less visually prominent and to reduce the need for cut and fill activities. Siting of roads should avoid steep side slopes and ridge faces.

Infrastructure appearance

- It must be ensured that all buildings fit its surroundings through the appropriate use of colour and material selection in order to lower the visibility of the proposed project;
- Natural colours should be used in all instances and the use of highly reflective material should be avoided. Any metal surfaces should be painted to fit in with the natural environment in a colour that blends in effectively with the background. White structures are to be avoided as these will contrast significantly with the natural surroundings;
- The identification of appropriate colours and textures for facility materials should take into account both summer and winter appearance;
- Where a paved road surfaces are required, the colours of paving materials should complement the natural colour and texture of soils in the area;
- The use of permanent signs and project construction signs should be minimised and visually unobtrusive.

Screening

- It must be ensured that existing vegetation, especially along the main access roads to the mine, the boundary between the Nzhelele Nature Reserve and the study area and the periphery of the project footprint area, is retained during the construction phase to act as visual screens; It must be ensured, wherever possible, that existing natural vegetation is to be retained and incorporated into the site rehabilitation especially in line of sight from sensitive receptors;
- Where possible, screening of the mining operations should be implemented through, for example, planting the project boundaries with indigenous vegetation. In this regard planting of additional large trees on the site boundaries should be considered to screen
- nearby views, with smaller trees or large shrubs utilised as an additional mitigation measure;
- An ecological approach to any proposed landscaping is recommended. Should plants be introduced for this purpose, choice should be guided by ecological rather than horticultural principles;
- Stockpiles should be placed to screen the open cast mining activities from the potential viewers;

- Painting or coating infrastructure components to match darker colours in the natural surroundings may reduce the distance required for effective screening;
- Visually cluttered material storage yards and laydown areas should be screened through the use of material fencing, which will result in a more unified and tidy appearance.

Erosion

- Erosion, which may lead to high levels of visual contrast and further detract from the visual environment must be prevented throughout the lifetime of the project by means of putting soil stabilisation measures in place and concurrent rehabilitation.

Dust

- Internal roads should be surfaced to minimise dust;
- During the construction phase all dirt and haul roads will require effective dust suppression such as regular watering;
- An effective dust management plan taking into account stockpile areas, the plant infrastructure area (stockpiles and transfer points), as well as haul/ access roads must be designed and implemented in order to mitigate the impact of dust on sensitive receptors throughout all mining phases;
- Soil stockpiles must be kept wet during the dry season in order to minimise the potential for dust generation;
- Access roads must be suitably maintained to limit erosion and dust pollution;
- Vehicle speed on unpaved roads must be reduced to limit dust creation.

Lighting

- A lighting engineer may be consulted to assist in the planning and placement of light fixtures for the mining facility and all ancillary infrastructures in order to reduce visual impacts associated with glare and light trespass;
- Outdoor lighting must be strictly controlled;
- The use of high light masts and high pole top security lighting should be avoided along the periphery of the study area. Any high lighting masts should be covered to reduce glow;
- Construction activities should be restricted to daylight hours as far as possible, in order to limit the need to bright floodlighting and the potential for skyglow;
- Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surrounding of the mining infrastructure, thereby minimising the light spill and trespass;
- Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only “full

cut-off" light fixtures that direct light only below the horizontal must be used on the building (Figure 37);

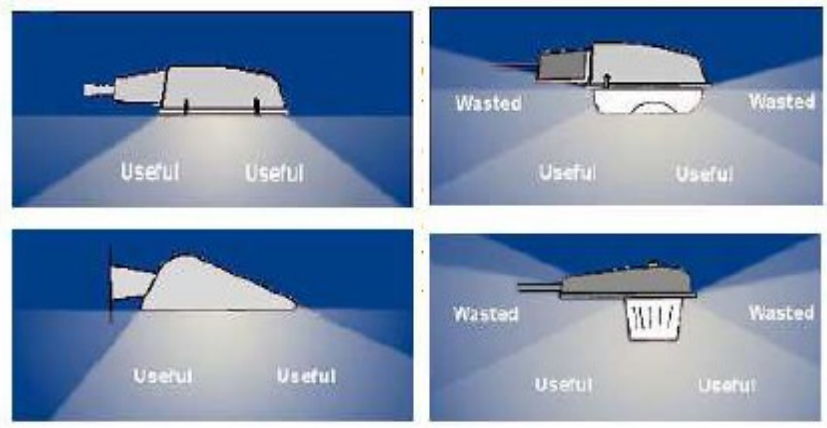


Figure 37: Illustration of full cut off light fixtures (left) and semi-cut-off fixtures (right) (ASSA, 2012)

- Censored and motion lighting may be installed at office areas and workshops to prevent use of lights when not needed;
- Selective lighting must be used for the construction camps and other secured areas;
- Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose;
- Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013);
- The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. Bluish-white lighting is more likely to cause glare and attract insects, and is associated with other human physiological issues (BLM, 2013);

Rehabilitation

- Concurrent/ progressive rehabilitation must be implemented and disturbed areas must be rehabilitated as soon as possible and as soon as areas become available;
- The waste dump adjacent to the central mountain within the study area, as well as other dumps and stockpiles should be concurrently revegetated throughout the operational phase to reduce the visual impact;
- Upon final rehabilitation when waste material has been removed from this area and used as backfill within the open pit, it is vital that vegetation on the mountain slope be reinstated to blend with the natural environment. It is recommended that a site nursery

be operated throughout the lifetime of the mine for this purpose and to ensure that trees and other vegetation is available.

6.6 Monitoring

A visual monitoring programme, to ensure that mitigation measures regarding visual impacts are implemented and maintained, must be designed for implementation throughout all development phases. This programme would largely be based on visual reconnaissance at ground level and it must be noted that the monitoring plan must be continually updated and refined for site-specific requirements. The following points aim to guide the design of the monitoring plan:

- Develop and implement of a decommissioning and site revegetation plan in order to ensure that the area's pre-development scenic quality and integrity are restored and that the project area is visually integrated into the surrounding landscape setting. Important aspects addressed should include requirements that most aboveground and near-ground structures be removed, that the project site be re-graded, and that indigenous vegetation be re-established to be consistent with the surrounding landscape;
- The plan should include provisions for monitoring the effectivity of the proposed mitigation measures and determining compliance with the project's visual impact mitigation requirements;
- The method of monitoring must be designed to be subjective and repeatable in order to ensure consistent results;
- The selected KOPs should be used over the life of the project to review the success of the mitigation plan;
- Predevelopment visual conditions and the inventoried visual quality rating and scenic integrity should be reviewed after construction;
- The visual monitoring programme should be based on the following parameters:
  - Airborne dust (in line with air quality assessment)
  - Visibility of lights at night from surrounding receptors;
  - Number of lights visible;
  - Vegetation cover and height; and
  - Disturbance to receptors.
- Vegetation must be monitored annually in terms of vegetation growth, density, height, species analysis and soil fertility for a period of five years after closure and in line with the vegetation monitoring plan, to ensure that concurrent rehabilitation is taking place and that mine structure are revegetated;

- At closure the success of rehabilitation would be based on the rate and percentage of vegetation recovery. Monitoring is to continue beyond mine closure to ensure that the rehabilitation is successful and that the vegetation is self-sustaining. The success of rehabilitation will also largely be dependent upon the invasion of alien species;
- Maintenance of mining infrastructures and operations must be monitored;
- Results of the monitoring activities must be taken into account during all phases of the proposed mining development and action must be taken to mitigate impacts as soon as negative effects from mining related activities become apparent.

7. CONCLUSION

Scientific Aquatic Services (SAS) was appointed to undertake a VIA as part of the environmental assessment and authorisation process for the proposed The Duel Mining Project, located around 12km to the east of the N1 highway between the towns of Louis Trichardt (Makhado), approximately 33km to the south and Musina, approximately 45km to the north, in the vicinity of the Soutpansberg Mountains within the Limpopo Province.

Based on the findings from both the desktop and the field assessments it is evident that the proposed mining project is located within a region with steeply undulating, mountainous topography, with a number of distinguishing landforms present. The VAC of the study area has been determined as being medium, with largely intact, tall vegetation and high visual and topographical diversity being present within the extent of the study area. The overall quality value and sense of place of the landscape is considered to be of some significance.

The topography, vegetation cover and medium VAC of the study area serves to somewhat obscure some of the mining infrastructure from a number of visual receptors to the north and south and from villages further than 10km to the east and northeast of the study area, where the proposed project will only be marginally or hardly visible. It is also unlikely that any formally protected areas with the exception of the Nzhelele Nature Reserve and the will be impacted due to the mountainous topography associated with the region and the distance of the proposed project from other protected areas, such as the Honnet Nature Reserve.

Highly sensitive visual receptors identified include residents of local villages (with particular reference to the Makushu and Mosholombe villages bordering the study area and Pfumembe village located within 3km of the proposed mining operations), potential visitors to the Nzhelele Nature Reserve, residents and visitors of lodges and game farms, as well as users of local gravel roads within 5km of the study area. Moderately sensitive visual receptors include

visitors to certain portions of Ekland Safari, as well as residents, workers and potential tourists to game farms and lodges in the region between 5 and 10km of the study area. Users of the N1 and R525 roadways are likely to be less affected due to screening of infrastructure by vegetation and local topography. Beyond 10km, the proposed project infrastructure is unlikely to be highly visible, however night lighting and resultant skyglow, may be visible for significant distances.

Should it be deemed appropriate to mine the resource, extensive mitigation measures will have to be implemented in order to minimise the visual impacts, with specific reference to concurrent revegetation and shaping of the waste and discard dumps and effective rehabilitation of the central mountain slope once waste material has been removed to backfill the open pit. The rehabilitation of the infrastructure, including the open pit must take place concurrently as far as possible and must take place in such a way as to ensure that the post closure land use objectives are met and as far as possible, to recreate pre-mining conditions in order to prevent residual and permanent visual impacts. Potential cumulative visual impacts, as a result of mining activities within this area supporting the precedent for further mining development within the region, will further exacerbate the negative visual impact.

Other management measures that will have to be implemented in order to minimise the visual impact on the local and subregional area, apart from the placement of mining infrastructure, include strict consideration of material selection, screening, management of lighting and implementing good housekeeping measures.

It is the opinion of the specialists that this study provides the relevant information required in order to ensure that the best long-term use of the resources on the study area will be made in support of the principle of sustainable development.

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APPENDIX A – Declaration and Specialists CV's

Declaration

Declaration that the specialist is independent in a form as may be specified by the competent authority.

I, Michelle Pretorius, 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

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist, Aquatic Ecologist
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust

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

EDUCATION

Qualifications

MSc (Environmental Management) (University of Johannesburg)	2002
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2000
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	1999

COUNTRIES OF WORK EXPERIENCE

South Africa – All Provinces

Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe

Eastern Africa – Tanzania

West Africa – Ghana, Liberia, Angola, Guinea Bissau

Central Africa – Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES OUT OF OVER 2000 PROJECTS WORKED ON

Development compliance studies

- Project co-leader for the development of the EMP for the use of the Wanderers stadium for the Ubuntu village for the World Summit on Sustainable Development (WSSD).
- Environmental Control Officer for Eskom for the construction of an 86Km 400KV power line in the Rustenburg Region.
- Numerous Environmental Impact Assessment (EIA) and EIA exemption applications for township developments and as part of the Development Facilitation Act requirements.
- EIA for the extension of mining rights for a Platinum mine in the Rustenburg area by Lonmin Platinum.
- EIA Exemption application for a proposed biodiesel refinery in Chamdor.

- Compilation of an EIA as part of the Bankable Feasibility Study process for proposed mining of a gold deposit in the Lofa province, Liberia.
- EIA for the development of a Chrome Recovery Plant at the Two Rivers Platinum Mine in the Limpopo province, South Africa.
- Compilation of an EIA as part of the Bankable Feasibility Study process for the Mooihoek Chrome Mine in the Limpopo province, South Africa.
- Mine Closure Plan for the Vlakfontein Nickel Mine in the North West Province.

Specialist studies and project management

- Development of a zero discharge strategy and associated risk, gap and cost benefit analyses for the Lonmin Platinum group.
- Development of a computerised water balance monitoring and management tool for the management of Lonmin Platinum process and purchased water.
- The compilation of the annual water monitoring and management program for the Lonmin Platinum group of mines.
- Analyses of ground water for potable use on a small diamond mine in the North West Province.
- Project management and overview of various soil and land capability studies for residential, industrial and mining developments.
- The design of a stream diversion of a tributary of the Olifants River for a proposed opencast coal mine.
- Waste rock dump design for a gold mine in the North West province.
- Numerous wetland delineation and function studies in the North West, Gauteng and Mpumalanga Kwa-Zulu Natal provinces, South Africa.
- Hartebeespoort Dam Littoral and Shoreline PES and rehabilitation plan.
- Development of rehabilitation principles and guidelines for the Crocodile West Marico Catchment, DWAF North West.

Aquatic and water quality monitoring and compliance reporting

- Development of the Resource quality Objective framework for Water Use licensing in the Crocodile West Marico Water management Area.
- Development of the Resource Quality Objectives for the Local Authorities in the Upper Crocodile West Marico Water management Area.
- Development of the 2010 State of the Rivers Report for the City of Johannesburg.
- Development of an annual report detailing the results of the Lonmin Platinum groups water monitoring program.
- Development of an annual report detailing the results of the Everest Platinum Mine water monitoring program.
- Initiation and management of a physical, chemical and biological monitoring program, President Steyn Gold Mine Welkom.
- Aquatic biomonitoring programs for several Xstrata Alloys Mines and Smelters.
- Aquatic biomonitoring programs for several Anglo Platinum Mines.
- Aquatic biomonitoring programs for African Rainbow Minerals Mines.
- Aquatic biomonitoring programs for several Assmang Chrome Operations.
- Aquatic biomonitoring programs for Petra Diamonds.
- Aquatic biomonitoring programs for several coal mining operations.
- Aquatic biomonitoring programs for several Gold mining operations.
- Aquatic biomonitoring programs for several mining operations for various minerals including iron ore, and small platinum and chrome mining operations.
- Aquatic biomonitoring program for the Valpre bottled water plant (Coca Cola South Africa).
- Aquatic biomonitoring program for industrial clients in the paper production and energy generation industries.
- Aquatic biomonitoring programs for the City of Tshwane for all their Waste Water Treatment Works.
- Baseline aquatic ecological assessments for numerous mining developments.
- Baseline aquatic ecological assessments for numerous residential commercial and industrial developments.
- Baseline aquatic ecological assessments in southern, central and west Africa.
- Lalini Dam assessment with focus on aquatic fish community analysis.
- Musami Dam assessment with focus on the FRAI and MIRAI aquatic community assessment indices.

Wetland delineation and wetland function assessment

- Wetland biodiversity studies for three copper mines on the copper belt in the Democratic Republic of the Congo.

- Wetland biodiversity studies for proposed mining projects in Guinea Bissau, Liberia and Angola in West Africa.
- Terrestrial and wetland biodiversity studies for developments in the mining industry.
- Terrestrial and wetland biodiversity studies for developments in the residential commercial and industrial sectors.
- Development of wetland riparian resource protection measures for the Hartbeespoort Dam as part of the Harties Metsi A Me integrated biological remediation program.
- Priority wetland mammal species studies for numerous residential, commercial, industrial and mining developments throughout South Africa.

Terrestrial ecological studies and biodiversity studies

- Development of a biodiversity offset plan for Xstrata Alloys Rustenburg Operations.
- Biodiversity Action plans for numerous mining operations of Anglo Platinum throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plans for numerous mining operations of Assmang Chrome throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plans for numerous mining operations of Xstrata Alloys and Mining throughout South Africa in line with the NEMBA requirements.
- Biodiversity Action plan for the Nkomati Nickel and Chrome Mine Joint Venture.
- Terrestrial and wetland biodiversity studies for three copper mines on the copperbelt in the Democratic Republic of the Congo.
- Terrestrial and wetland biodiversity studies for proposed mining projects in Guinea Bissau, Liberia and Angola in West Africa.
- Numerous terrestrial ecological assessments for proposed platinum and coal mining projects.
- Numerous terrestrial ecological assessments for proposed residential and commercial property developments throughout most of South Africa.
- Specialist Giant bullfrog (*Pyxicephalus adspersus*) studies for several proposed residential and commercial development projects in Gauteng, South Africa.
- Specialist Marsh sylph (*Metisella meninx*) studies for several proposed residential and commercial development projects in Gauteng, South Africa.
- Project management of several Red Data Listed (RDL) bird studies with special mention of African grass owl (*Tyto capensis*).
- Project management of several studies for RDL Scorpions, spiders and beetles for proposed residential and commercial development projects in Gauteng, South Africa.
- Specialist assessments of terrestrial ecosystems for the potential occurrence of RDL spiders and owls.
- Project management and site specific assessment on numerous terrestrial ecological surveys including numerous studies in the Johannesburg-Pretoria area, Witbank area, and the Vredefort dome complex.
- Biodiversity assessments of estuarine areas in the Kwa-Zulu Natal and Eastern Cape provinces.
- Impact assessment of a spill event on a commercial maize farm including soil impact assessments.

Fisheries management studies

- Tamryn Manor (Pty.) Ltd. still water fishery initiation, enhancement and management.
- Verlorenkloof Estate fishery management strategising, fishery enhancement, financial planning and stocking strategy.
- Mooifontein fishery management strategising, fishery enhancement and stocking programs.
- Wickams retreat management strategising.
- Gregg Brackenridge management strategising and stream recalibration design and stocking strategy.
- Eljira Farm baseline fishery study compared against DWAF 1996 aquaculture and aquatic ecosystem guidelines.

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF MICHELLE PRETORIUS

PERSONAL DETAILS

Position in Company	Visual specialist, Ecologist, Botanist
Date of Birth	5 October 1982
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for the Landscape Architectural Profession (SACLAP)

Professional member of the South African Council for Natural Scientific Professions (SACNASP)

Member of the Botanical Society of South Africa

EDUCATION

Qualifications

BSc (Hons) Plant Science (University of Pretoria)	2009
BSc (Landscape Architecture) (University of Pretoria)	2006
BSc (Botany) (University of Pretoria)	2003

Short Courses

Global Mapper Training – Blue Marble Training	2014
Rehabilitation of Mine-impacted Land – Africa Land Use Training	2011
Mine Closure and Rehabilitation Conference – ITC	2011
Rehabilitation of Degraded Land – Africa Land Use Training	2009

COUNTRIES OF WORK EXPERIENCE

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

Tanzania

Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES

Visual Impact Assessments

- Visual Impact Assessment as part of the environmental assessment and authorisation process for the proposed Argent Colliery, Mpumalanga.
- Visual Impact Assessment as part of the EIA process for the proposed upgrade of the Zonderwater Prison Waste Water Treatment Works in the vicinity of Cullinan, Gauteng.

- Visual Impact Assessment as part of the EIA process for the proposed Springboklaagte Colliery, Mpumalanga.
- Visual Impact Assessment as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed Harriet's Wish Mining Project, Limpopo Province;
- Visual Impact Assessment Scoping Report as part of the EIA Process for the Proposed Pan Palladium PGE Project, Limpopo Province
- Visual Impact Assessment as part of the environmental assessment process for the proposed Tjate Platinum Mine, Limpopo Province;
- Visual Impact Assessment as part of the EIA process for the proposed Moabsvelden Colliery, Mpumalanga;
- Visual Impact Assessment as part of the Environmental Assessment and Authorisation Process for the Proposed Leandra Mining Project, Gauteng and Mpumalanga Provinces;

Floral Assessments

- Floral assessment as part of the environmental assessment and authorisation process for the proposed Vandyksdrift project at the Wolvekrans Colliery, Mpumalanga.
- Floral assessment as part of the environmental authorisation process for the proposed Tharisa North eastern waste rock dump, North West Province.
- Terrestrial ecological scan as part of the environmental authorisation process for the proposed Olievenhoutbosch linkage road, Gauteng.
- Floral assessment as part of the proposed Lekutung hotel, residential and golf estate development, North West Province.
- Phytosociological description, PES and function assessment of the floral resources in the vicinity of the Musonoi project in Kolwezi, Democratic Republic of Congo.
- Vegetation management plan for input into the closure planning process of the Tulawaka Gold Mine, Tanzania.
- Habitat evaluation in terms of floral integrity and PES in order to determine whether the grassland on the proposed Gillimead Agricultural Holdings development site has high conservation value, Gillimead, Gauteng.

Wetland Assessments

- Consideration of potential wetland features on the proposed Lanseria Extension 57 development site, Sunrella A.H, Gauteng.
- Riparian Vegetation Index determination and wetland delineation for the proposed Libertas Road upgrades, Gauteng.
- Wetland assessment along the proposed alignment of the bus rapid transit line 2a and 2b in the City of Tshwane, Gauteng.
- Wetland delineation in the vicinity of a proposed open pit development site, Modikwa Platinum Mine, Limpopo Province.

Rehabilitation Projects

- Wetland and watercourse rehabilitation plan for the river crossing in the vicinity of the Olifants River on Kleinfontein Mine, Mpumalanga
- Thaba Mall terrestrial rehabilitation plan – guideline document for landscape rehabilitation, Thabazimbi, Limpopo Province.
- Rehabilitation plan for a portion of a borrow pit in the vicinity of Soshanguve, Gauteng
- Rehabilitation and management plan for the Mamelodi Hatherley 132 kv Power Line, City of Tshwane, Gauteng.

Environmental and Ecological Management Plans

- Environmental Management Plan for the Montana Tuine Erf 1611 & 1673 development, City of Tshwane, Gauteng.
- Ecological Management plan for the South Hills Mixed-use development, situated on Erf 1202 South Hills, Holding 88 of the Farm Klipriviersberg Estate Small Holding A.H. and Portion 65 (a portion of Portion 7) of the Farm Klipriviersberg 106-IR, South Hills (Moffat Park), Johannesburg, Gauteng.
- Environmental management plan for Erf 275, Meerhof township, Hartbeespoort dam, North West Province.

Environmental Control Officer

- Monthly specialist Environmental Control Officer (ECO) function to oversee the implementation of the wetland and watercourse rehabilitation plan for the river crossing in the vicinity of the Olifants River on Kleinfontein Mine, Mpumalanga.

- Monthly specialist Environmental Control Officer (ECO) for the monitoring of wetland and ecological impacts on Portion 16 of the Farm Zondagsvlei 9-IS, Ogies, Mpumalanga.
- Monthly specialist Environmental Control Officer (ECO) function to oversee the implementation of the rehabilitation and management plan for the Klipkruisfontein development site, Shoshanguwe, Gauteng.

Plant Rescue and Relocation

- Report on the rescue and relocation of Hypoxis hemerocallidea adjacent to Lanseria Airport, Johannesburg, Gauteng.
- Report on the rescue of Hypoxis hemerocallidea, Boophane disticha and various other floral species at the mall of the south development site, Alberton, Gauteng.
- Report on the rescue and relocation of Hypoxis hemerocallidea at Forest Hill City – Phase 1, Monavoni x58, Gauteng.

Terrestrial Monitoring

- Terrestrial monitoring programme for Glencore Xstrata Eland Platinum Mine, North West Province.
- Terrestrial monitoring programme for Xstrata Boshoek, North West Province.