Visual Impact Study for the Kudumane Expansion Project, near Hotazel in the Northern Cape Province

Report Prepared for

Kudumane Managanese Resources (Pty) Ltd.

Report Number 574378/VIA

Report Prepared by

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Visual Impact Study for the Kudumane Expansion Project, near Hotazel in the Northern Cape Province Visual Specialist Report

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Table of Contents

List of Tables

List of Figures

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List of Abbreviations

DEA&DP		Western Cape Department of Environmental Affairs and Development Planning
DEAT	-	Department of Environmental Affairs and Tourism
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
GIS	-	Geographic Information Systems
ha	-	hectares
km	-	kilometres
m	-	metres
KMR		Kudumane Manganese Resources
mamsl	-	metres above mean sea level
N	-	National Road
RS	-	Remote Sensing
SRK	-	SRK Consulting (South Africa) (Pty) Ltd.
VAC	-	Visual Absorption Capacity
VIA	-	Visual Impact Assessment
WC Guidelines	-	"*Guidelines for Involving Visual and Aesthetic Specialist in EIA Processes*" authored by the Provincial Government of the Western Cape

1 Introduction and Scope of Report

1.1 Introduction

Kudumane Manganese Resources (Pty) Ltd. (KMR) operates the KMR Manganese Mine near Hotazel Town in the Northern Cape Province of South Africa. KMR is authorised by the Department of Mineral Resources and Energy (DMRE) to mine and process manganese ore in terms of two Mining Rights (MRs) (MR 268 and MR 10053), two approved Environmental Management Programmes (EMPrs) (2010 and 2014 respectively), a 2016 Water-Use Licence (WUL) and a WUL amendment authorised in 2018.

KMR intends to consolidate their two MRs into a single MR, along with the consolidation of the associated EMPrs into one comprehensive EMPr. This will be done in accordance with Section 102 of the Mineral Petroleum Resources Development Act (MPRDA) No 28 of 2002. The Section 102 application to consolidate the MRs will be undertaken by KMR in conjunction with an integrated Environmental Application (EA) process, which will also include the consolidation and amendment of the EMPrs. The purpose of the consolidated EMPr will be to provide KMR with a more effective environmental management tool to manage their current and proposed operations.

KMR also intends to expand its existing operations by constructing additional mining-related infrastructure and amending certain mining-related activities and infrastructure to improve tit's production capacity. The actual application to consolidate and amend the EMPrs to allow for the expansion project will be undertaken in the near future.

Before KMR can commence with the proposed expansion activities, it needs to obtain the necessary authorisations from DMRE. This includes, amongst others, approval of a Scoping and Environmental Impact Assessment (EIA) for any project-related Listed Activities stipulated in the National Environmental Management Act (NEMA) No 107 of 1998 (as amended in 2014) and the National Environmental Management: Waste Act (NEM:WA) (No. 59 of 2008).

As part of this scoping and EIA phase, various specialist studies are required in fulfilment of the EIA Regulations (2014), promulgated in terms of Chapter 5 of NEMA No 107 of 1998. The Scoping, EIA and consolidated and amended EMPr will be submitted by SRK to the Northern Cape Province's DMRE for approval.

A Visual Impact Assessment (VIA) was identified as one of the specialist studies required to inform the EIA. This VIA report therefore provides an appraisal of the visual conditions for the study area and assesses potential impacts that the proposed mine may have on visual receptors within its visual envelope. The outcomes of this VIA study have been used to identify mitigation measures required to manage visual impacts.

Due to the absence of guidelines regarding VIA's in the Northern Cape Province, this assessment considers both the magnitude of the visual impact, rated and guided by the Western Cape Visual Impact Assessment Guidelines (WC Guidelines) (Oberholzer, 2005), and the significance of the visual impact, rated according to prescribed methodology.

1.2 Objectives of the Study

The objective of this VIA is to provide an opinion on whether changes to the mine since the previous EIA, as well as planned changes, have (or will have) an additional visual impact on surrounding visual receptors. In addition, the VIA will determine the significance of the impacts and evaluate whether existing mitigation measures are effective and identify additional measures if required.

1.3 Scope of work

The following formed the Scope of Work (SoW) for the VIA:

- A literature review of previous VIA's undertaken with the assumption that the baseline visual environment is as detailed in the VIA prepared by SLR in 2014 (8 years ago).
- A gap analysis to identify additional key infrastructure and structures that have been added since the previous VIA.
- Conduct a desktop investigation into the potential view catchment of the operation and identify whether viewer exposure has increased and the locations of potential additional viewers.
- Review the adequacy of mitigation measures to reduce or eliminate any potential visual impacts identified, as per the previous VIA report and proposed by the respective specialists.
- Undertake a high-level impact assessment and compare the assessment to that of the previous VIA Report prepared by SLR.
- Compile a VIA opinion incorporating the above.

2 Project History and Description

2.1 Project History

The KMR mining operations commenced in June 2013 under the Mining Right NC/30/5/1/2/2/0268 MR covering the farms York A 279 and Telele 312.

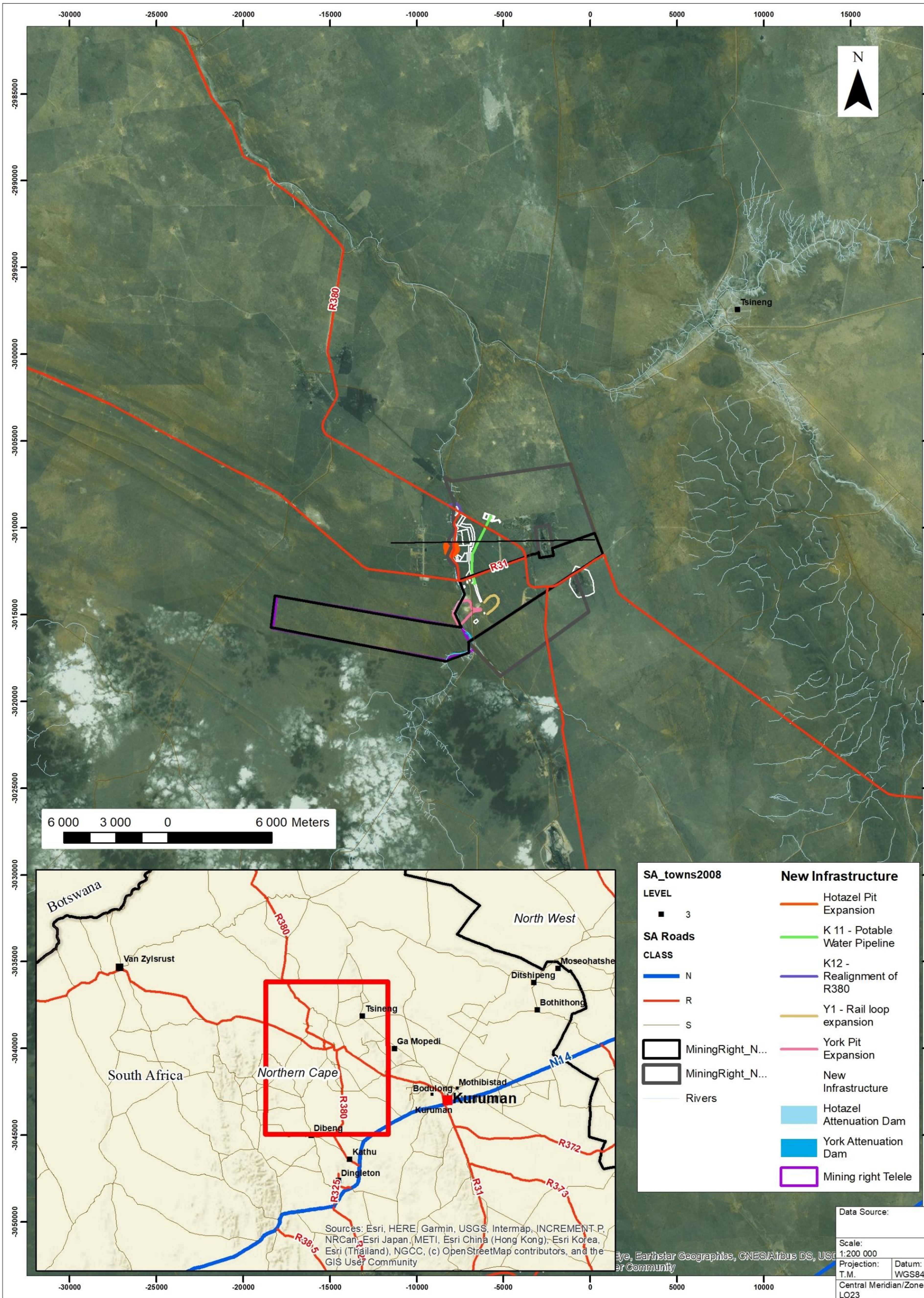
The initial operation included the following mining related infrastructure:

- An opencast and future underground mining operation;
- Associated residue handling and disposal facilities;
- A crushing and screening plant;
- Rail and road infrastructure;
- Water and electrical reticulation infrastructure; and
- Various other supporting infrastructure and services, such as offices, waste storage areas and sewage treatment facilities.

In 2015, the mine expanded its operation through the application of another mining right (Mining Right Ref: NC/ 30/5/1/2/2/10053 MR) over the farms Devon 277, Hotazel 280 and Kipling 271. Under this mining right, the following main mining related activities and infrastructure were approved:

- Mining and removal of manganese ore from a historical pit and tailings storage facility (TSF) on the farm Devon 227;
- Mining and removal of manganese ore from an historical pit on the farm Hotazel 280, along with the establishment of haul road, utilisation of existing roads including the establishment and utilisation of a conveyor system between the farms Hotazel 280 and York A 279; and
- Potential future mining on the farm Kipling 271.

The location of the project area is provided in **Error! Reference source not found.**.



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KUDUMANE MANGANESE RESOURCES EXPANSION PROJECT
LOCALITY

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2.2 Proposed Expansion

It is the intension of KMR to expand its existing operations and construct additional infrastructure in order to improve production capacity. The infrastructure and activities associated with the proposed KMR Expansion Project includes the following key infrastructure:

- A new opencast pit mine on Kipling.
- Expansion of the Hotazel and York opencast mines.
- Two attenuation dams on the Ga-Mogara River, to allow for the expansion of the York and Hotazel Pits.

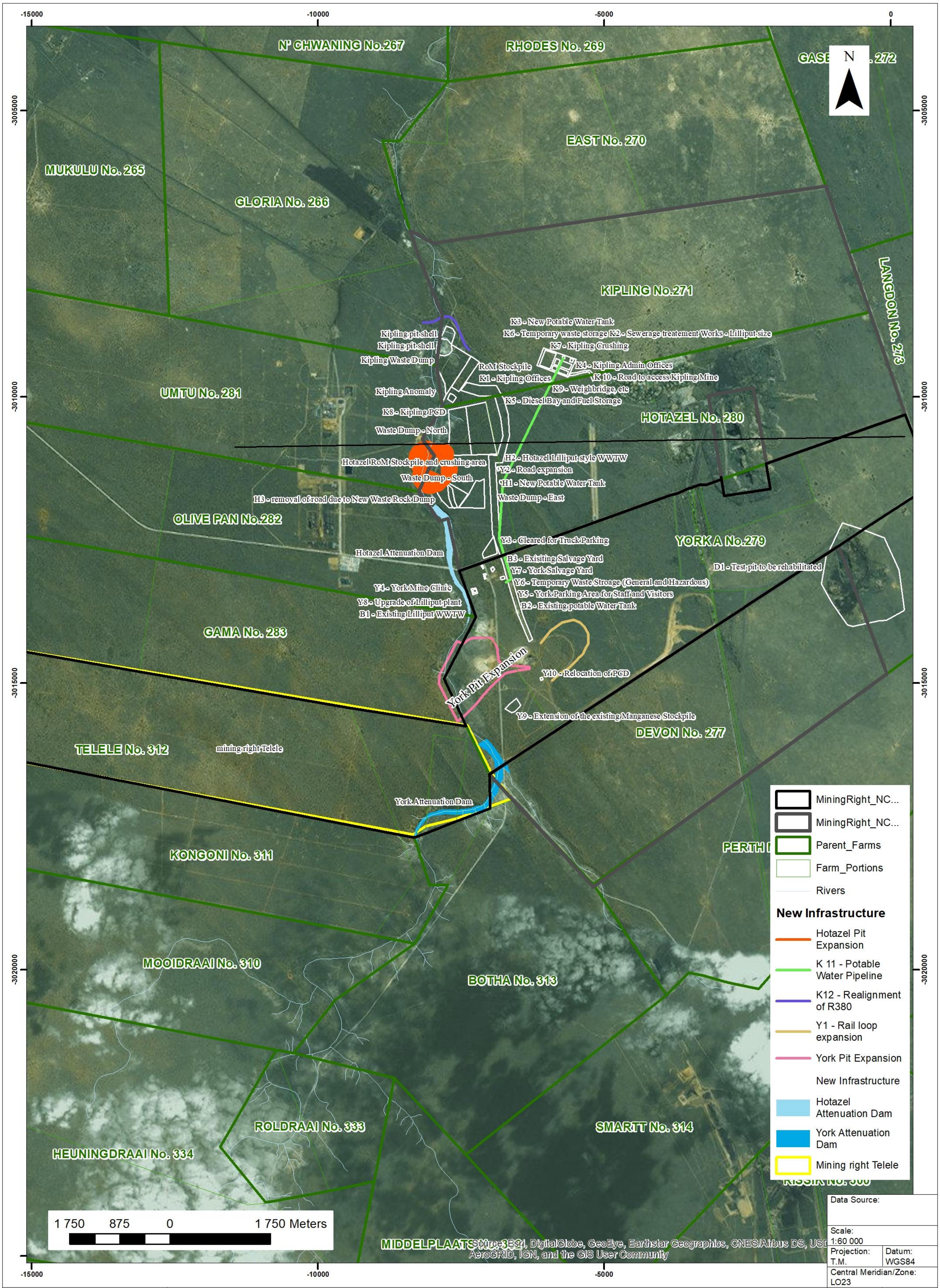
The above key infrastructure will have associated secondary infrastructure and activities, which includes:

- Establishment of water storage tank and pipelines
- Development and expansion of waste rock dumps
- Establishment and expansion of ore stockpiles
- New roads and expansion of existing roads
- Development and expansion of sewerage treatment plants
- Supporting infrastructure such as admin offices ancillary infrastructure
- Waste and fuel storage areas
- Pollution control dams
- Diversion of a tarred, provincial road including the development of a bridge over the Ga-Mogara River
- Contractor's camp
- Extension of existing powerlines.

The infrastructure and activities associated with the proposed KMR Expansion Project will take place on the following farms and associated farm portions:

- York A 279: Portion 2/279 & Portion 11/279
- Telele 312: Portion RE/312 & Portion 1/312
- Devon 277: Portion RE/277
- Hotazel 280: Portion RE/280 & Portion 4/280
- Kipling 271: Portion RE/271.

Figure 2-2 overleaf provides a map showing the location of the proposed infrastructure within KMR's mining right areas.



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KUDUMANE MANGANESE RESOURCES EXPANSION PROJECT
LAYOUT

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Revision: A Date: 27 09 2021

3 Approach and methodology

3.1.1 Approach

Given the subjective nature of visual issues, assessing the visual impacts in absolute and objective terms is not achievable. Thus, qualitative as well as quantitative techniques are required. Emphasis is therefore placed on ensuring that the methodology and rating criteria are clearly stated and transparent. For the impact assessment, all ratings are motivated and, where possible, assessed against explicitly stated and objective criteria.

There are very few guidelines that provide direction for visual assessment; the most relevant are the Landscape Institute's "Guideline for Landscape and Visual Impact Assessments" and the Western Cape Department of Environmental Affairs and Development Planning's (DEA&DP) "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes" (2005), both of which have been considered in this VIA. The VIA is also guided by Appendix 6 of the Environmental Impact Assessment (EIA) Regulations, 2014, which prescribe the required content of a specialist study.

Due to the proposed extension activities taking place within an existing mining area with few direct visual receptors, it was determined that a **Level 2 Assessment,** as described in the DEA&DP's Guidelines, would be the most appropriate level of assessment. The level of assessment is guided by the nature of the development and the intensity of the visual impact expected and is informed by the environmental state within which the development is proposed. The different levels of VIA's are summarised in Table 3-1.

Table 1-1: Determination of level of visual assessment

Approach and Method	Type of issue (see Box 3)				
	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 assessment recommended	**Level 1** visual assessment	**Level 2** visual assessment	**Level 3** visual assessment	**Level 4** visual assessment	

3.2 Methodology applied

The following methodology was applied to meet the terms of reference in the most objective way:

- Identification of data requirements and collation of data. This included acquiring spatial data on topography (contours), existing visual character and quality, conceptual details of the mining infrastructure, as well as other background information to:
  - Become familiar with the site and its surroundings;
  - Verify the desktop spatial analysis undertaken;
  - Identify possible visual receptors; and
  - Identify and assess visibility.
- Identification of key infrastructure that could potentially impact visual receptors.
- A geo-spatial analysis of all the processed data was conducted to determine the **magnitude** of the visual impacts of the following attributes:
  - Visual exposure and viewing distance;
  - Visibility;
  - Visual absorption capacity;
  - Landscape / townscape integrity; and
  - Sensitivity of viewing receptors.

- The significance of the impact has been calculated using a combination of the Hassell Matrix[1] and the prescribed impact rating methodology for the project. The aim of this report is to provide mitigation options and management guidelines in relation to potential visual impacts associated with the proposed expansion; and
- Identification of potential mitigation measures to reduce the overall visual impact to acceptable levels.

3.3 Key infrastructure identified for assessment

Visual impacts are likely to associated with above-ground infrastructure with relatively large footprints. Smaller infrastructure such as roads, pipelines and underground mine workings is less likely to have major visual impacts due to the area being flat and dominated by mining activities. In addition natural screening is provided by the bushveld and Kalahari type vegetation in the area.

The following key infrastructure have been identified as being potentially significant requiring further assessment in this VIA Report

- Development and expansion of waste rock dumps;
- Establishment and expansion of ore stockpiles;
- Aboveground infrastructure related to future underground mining on the farm Telele;
- Two attenuation dams on the Ga-Mogara River.

3.4 Assumptions and Limitations

The following assumptions and limitations are relevant to the study:

- No infrastructure heights were provided and no viewshed modelling could be undertaken. The extent of the impact is therefore subjective based on existing landscape and topography.
- No site visit was undertaken.
- A VIA, by nature, is not a purely objective or a quantitative process, but is dependent on the subjectivity of the judgments made. Where required, appropriate criteria and motivations have been clearly stated.

4 Evaluation of the visual landscape

4.1 Overview of design and structural aspects influencing visual impact

In order to understand the impact a structure may have on a receptor (viewer) it is important to understand the visual representation of the structure. The following key parameters are usually taken into account when assessing the probable visual impact on a receptor:

- **Height:** The higher the structure or facility is, the more extensive the visual envelope (viewshed) will be. The height of a structure may be mitigated / shielded by the topography of the surrounding area, man-made features or by natural features. The opposite is also true as the lack of the abovementioned “mitigation” or “shielding” may increase the visibility of a structure. Visually the perception of the height of a building or structure is partially a function of the spatial interaction between topography, height of existing man-made features and the height of natural features, such as trees and shrubs in the vicinity of the infrastructure.
- **Surface area:** The combination of the total surface area and the degree of visibility of the mine infrastructure has an impact on receptors. A smaller surface / face-area / cross-sectional area may reduce visibility from areas further away from the infrastructure and, hence could reduce the potential

1 The HASSELL matrix has been developed from “The Visual Management System (VMS)” produced by Litton(1968) primarily used for the U.S. Forest Service (1973) and the US Bureau of Land Management (1980).

visual impact the infrastructure may have. A larger surface / face / cross-sectional area will obstruct views which would previously have been visible and may lead to a more significant impact.

- **Arrangement of construction:** A staggered configuration, such as a powerline (as an example), ensures that the infrastructure might "blend" into the surrounding environment. Solid structures (retaining walls, TSF's, WRD's and buildings) are more obstructive and visible over a larger area.
- **Arrangement of colours:** The colour of infrastructure has an important function as it could either add emphasis on the structure, or it could assist in hiding / camouflaging it. It is therefore important that structures or buildings are painted with neutral colours which should be consistent with the colours of similar structures in the wider area.
- **Boundary with the environment:** The mine boundary may significantly change the appearance of the natural area in which it is located. It is therefore important to retain as many natural features as possible, such as the landscape and vegetation surrounding the site, where it does not pose a health or safety risk from an operational perspective.

4.2 Evaluation criteria

Due to the subjective nature of VIA's, a number of criteria have been used to describe the visual aspects of the environment. The criteria evaluate the current visual landscape and the potential changes to the landscape that the current infrastructure may have.

The following criteria can be used to describe the visual landscape of an area:

- **Visual Character:** Visual character is descriptive and non-evaluative, which implies that it is based on defined attributes that are neutral. A change in visual character cannot be described as having positive or negative attributes until it is compared with the viewer response to that change. The probable change caused by the existence of the mine is assessed against the existing degree of change caused through development;
- **Sense of Place:** Our sense of a place depends not only on spatial form and quality but also on culture, temperament, status, experience and the current purpose of the observer (Lynch, 1992). Central to the idea of 'sense of place' or *Genus Loci* is identity. An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places within the area; and
- **Visual Quality:** Visual quality is evaluated by identifying the vividness, intactness and unity present in the viewshed. This approach to evaluating visual quality can also assist in identifying specific methods for mitigating specific adverse impacts that may occur as a result of a project.

These criteria are combined with an assessment of the magnitude of the impact to determine its severity, it must however be noted that the sense of place is used to inform the potential sensitivity of a viewer and does not have its own rating.

Criteria used in the determination of the visual magnitude include:

- **Viewshed / "Area of Influence":** The viewshed indicates areas from which the infrastructure components will potentially be visible. This is established through spatial modelling;
- **Viewing Distance and Visibility:** The distance of a viewer from the mine is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an object diminishing / attenuating as the distance between the viewer and the object increases. This is a measurement of how visual impacts are modified by distance. The effect of scale, topography, vegetation, weather, and distance, in turn alters the degree of a visual effect;
- **Visual Absorption Capacity (VAC):** The Visual Absorption Capacity (VAC) is the potential for the area to conceal an object;
- **Landscape Compatibility:** Landscape or townscape compatibility refers to the compatibility of the infrastructure with the existing landscape and townscape; and

- **Viewer Sensitivity:** The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon, this is informed by the sense of place of an area. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists.

In the following section of the report, the magnitude of the visual impact in terms of the criteria listed above are discussed.

4.3 Visual Character

The KMR mine and associated expansion areas are situated on the eastern edge of what is referred to as the Kalahari Manganese Field on government and private land. KMR is situated approximately 3 km south-west of the town of Hotazel within the John Taolo Gaetsewe District Municipality (JTGDM) in the Northern Cape.

The project site is located approximately 5 km west of the R31 that links Hotazel to the regional town of Kuruman. Kuruman lies around 60 km south-east of Hotazel via the N14 that leads to Upington. The N14 is managed by the South African National Roads Agency (SANRAL), whilst the R31 and R380 are important provincial roads, linking Hotazel, Black Rock, Kuruman and Danielskuil. Apart from Hotazel, which is considered to be the main town in the area, there are several doorstep communities approximately 10 to20 km from the project site.

This wider area is rural and sparsely populated human settlements, and predominant commercial farms and mining activities. Closer to the project site, the land is dominated by mining activities. KMR is one of twelve (12) operating mines in the area. Some of these include United Manganese of Kalahari (UMK), South 32, Assmang Black Rock, Tshipi-e-Ntle, Kalagadi, Sebilo and Aquila Mine (KMR, 2018).

Most farms adjacent to the project site are rented by farmers for the purpose of cattle grazing. Several of the surrounding farms have been bought by mining companies in the last century and much of the existing farmland is reportedly in a general poor environmental condition.

The project site itself is relatively flat sloping gently from south east to north west. According to Scientific Terrestrial Services (STS, 2021) three broad habitat units exist in the area, including the Ga-Mogara Habitat Unit which is limited to the Ga-Mogara River channel and banks, the Savannah Habitat Unit comprising Degraded Thornveld, Karoid Shrubland and Mixed Thornveld.

The study area can be divided into distinct 'land types' each with a dominant landscape character. These land types are:

- Mining;
- Agriculture with mostly livestock farming on leased farms;
- Small settlements; and
- Natural to semi-natural areas.

The land use character of the area can be scored as per the criteria in Table 4-1

Table 4-1: Land Use Character Rating System

Description	Value	Typical Character / Use
Unmodified landscape/natural	5	No / minimal impact associated with the actions of man. National parks, coastlines, pristine forest areas.
Natural transition landscape	4	A changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones.
Modified rural landscape	3	Typical character is rural landscape, defined by field patterns, forestry plantations and agricultural areas and associated small-scale roads and buildings.
Transition landscape	2	Transitional landscape associated with the interface between rural, agricultural area and more developed suburban or urban zones.
Highly modified landscape, urban/industrial.	1	Substantially developed landscape. High levels of visual impact associated with buildings, factories, roads and other related infrastructure.

The visual character of the study area can be described as being an area modified by existing mining activities, interspersed with savannah type vegetation and agricultural activities. In terms of the rating system presented in Table 4-1, the visual character of the study area can be described as constituting a **Modified Rural Landscape (3),** attributed to the mine and the surrounding mines.

4.4 Sense of Place

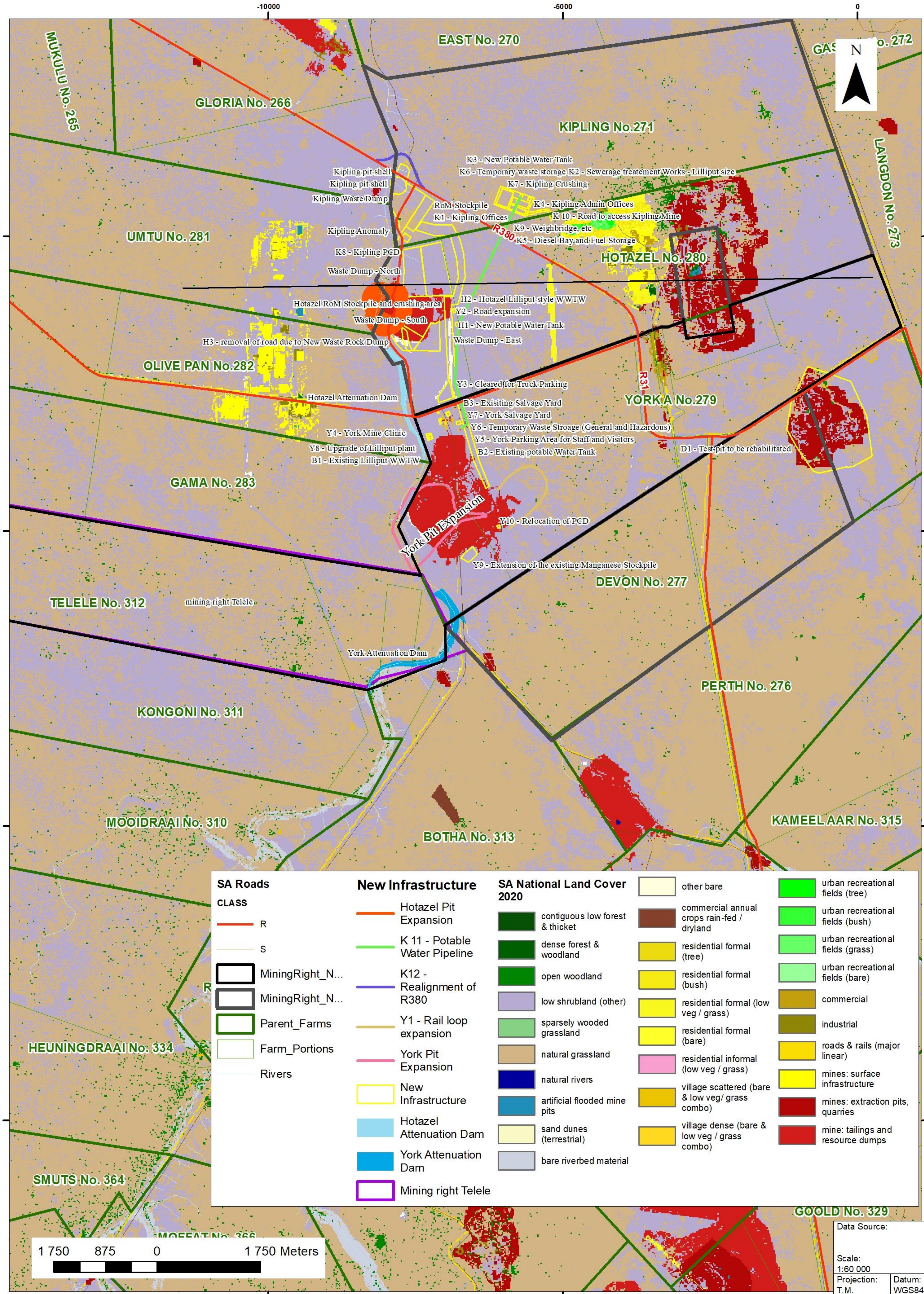
Our sense of a place depends not only on spatial form and quality but also on culture, temperament, status, experience and the current purpose of the observer (Lynch, 1992). Central to the idea of 'sense of place' or *Genus Loci* is identity.

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131).

Based on the land use map for the area (Figure 4-1), the predominant land use around the mine includes a flat open landscape comprising low shrubland and grassland with the only noteworthy town being Hotazel situated 3km away from the mine.

Most of the residents of Hotazel are likely used to the mining landscape due to the proximity of the town to the KMR and other mines in the areas. Many residents are likely to be reliant on the mine for primary or secondary income. The sense of place for the residents and the farmers in the area will be associated with mining and interspersed vast open spaces. The proposed expansions are unlikely to significantly change the sense of place of the residents of Hotazel.

Travellers using the R31 road and surrounding road networks will have a transient sense of place associated with mining while travelling through the landscape. As many other mines are visible along the R31 road, the expansions to the KMR mine are unlikely to alter the sense of place for motorists travelling through the area.



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LAND COVER

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4.5 Visual Quality

Visual quality is evaluated by identifying the vividness, intactness and unity present in the viewshed. This approach to evaluating visual quality can also help identify specific methods for mitigating specific adverse impacts that may occur as a result of the mine.

Aesthetic value is an emotional response derived from our experience and perceptions. As such, it is subjective and difficult to quantify in absolute terms. Studies in perceptual psychology have shown that humans prefer landscapes with higher complexity (Crawford, 1994). Landscape quality can be said to increase when:

- Topographic ruggedness and relative relief increases;
- Water forms are present;
- Diverse patterns of grassland and trees occur;
- Natural landscape increases and man-made landscape decreases; and
- Where land use compatibility (coherence) increases.

Thus, visual quality decreases when elements deter from the natural environment and, hence, influence the wider area of influence in a negative way. Elements that decrease the visual quality of an area includes “visual clutter” and man-made features.

Visual Quality is largely subjective, therefore adapted from the United States Department of Transport: Visual Impact Assessment for Highway Projects (1981) and the Landscape Institute with the Institute of Environmental Management and Assessment (2002), visual quality can be calculated as per the equation overleaf, where:

Vividness *is defined as the extent to which a landscape is memorable – this is associated with the distinctiveness, diversity, and contrast of visual elements.*

Intactness *is defined as the integrity of visual order within the landscape, as well as the extent to which the landscape is free from visual intrusions.*

Unity *is defined as the extent to which visual intrusions are sensitive to the existing landscape.*

$$Visual\ Quality = \frac{Vividness + Intactness + Unity}{3}$$ .... Equation 3-1

Visual Quality was calculated according to Equation 2-1, based on the following rating criteria specified in Table 4-2.

Table 4-2: Visual Quality rating criteria

Rating	High (5)	Medium (3)	Low (1)
Vividness	The visual impression received is highly memorable, as contrasting landscape elements combine to form distinctive visual patterns.	The visual impression received is moderately memorable, with some distinctive patterns moderately defined landscape or landforms are present.	The visual impression received is of low memorability. Little visual pattern is formed because landscape elements do not combine to from a striking or distinctive pattern.
Intactness	There is high visual integrity between the natural and man-made landscape to the extent that the landscape is free from visual encroachment.	There is an average visual integrity between the natural and man-made landscape. Some visual encroachment on to the landscape is present.	There is low visual integrity between the natural and man-made landscape features. Visual encroachment onto the landscapes very apparent.

Rating	High (5)	Medium (3)	Low (1)
Unity	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade and natural elements blend together.	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade elements blend with natural elements; however the visual order is disrupted.	Visual resources do not join together to form a coherent harmonious visual pattern. Manmade elements do not have a visual relationship to natural landforms or land cover patterns and visual order is lacking.

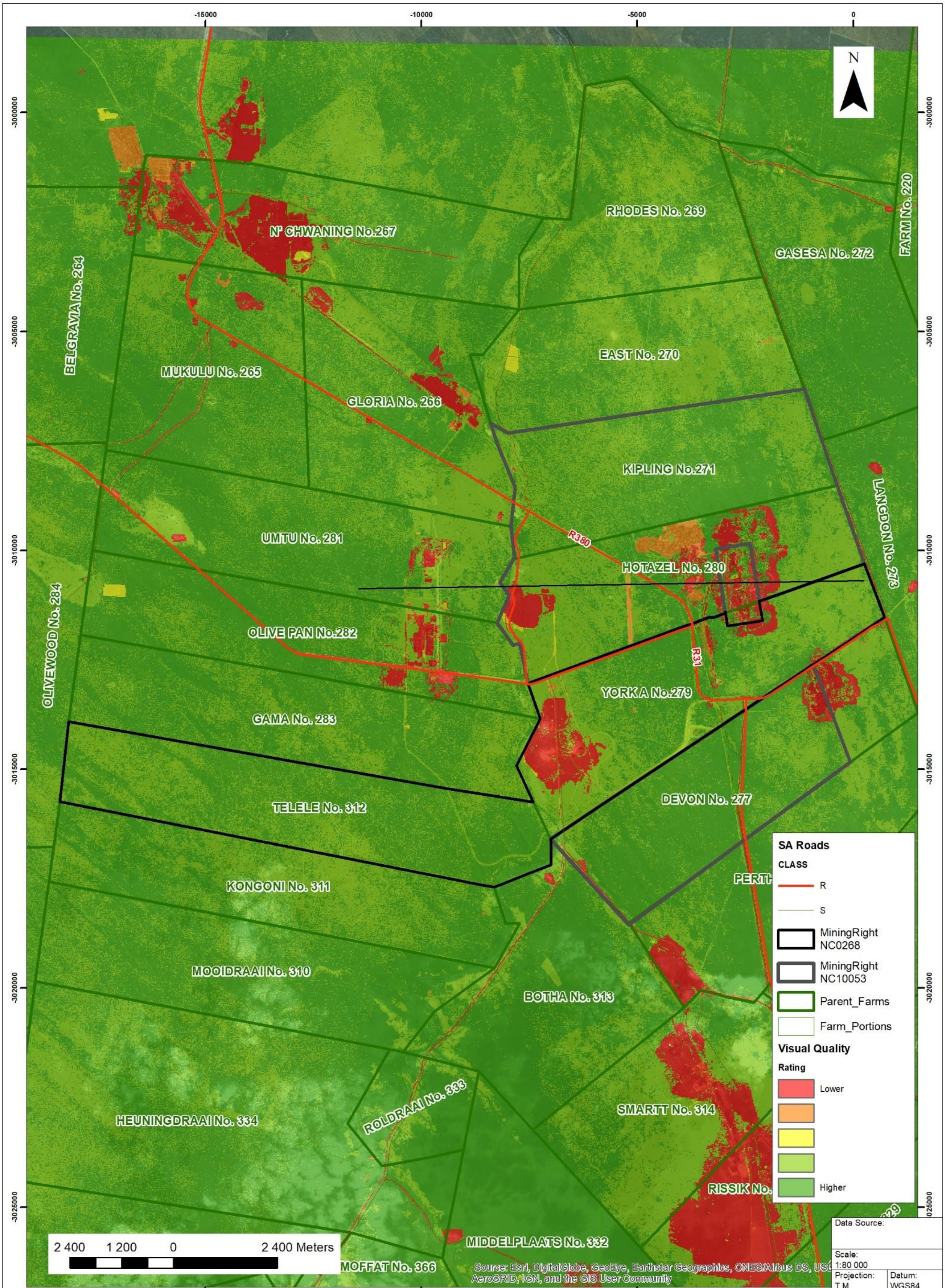
The visual quality of the study area is calculated and summarised in Table 4-3.

Table 4-3: Visual Quality rating for the KMR Mine surrounds

Criteria	Rating	Description
Vividness	3	The study area can be described as having a moderately memorable impression, based on the flat topography, sparse area and vegetation type in the area. Thus, the vividness of the area is classified as being **Medium**.
Intactness	3	The intactness of the area is classified as **Medium** due to some natural areas interspersed between the mines and agricultural plots/farms with degraded vegetation.
Unity	3	The study area can be classified as having a **Medium** unit. Although the manmade elements do not have a visual relationship to natural landforms or land cover patterns and visual order is lacking, the sparseness of the area creates unity beyond the mining footprints
Calculation	$Visual\ Quality = \frac{3\ +\ 3\ +\ 4}{3} = 3.33\ (\boldsymbol{MEDIUM\ to\ HIGH})$	

Based on the calculations made in Table 4-3, the visual quality of the area surrounding the mine is deemed to be **medium to high**.

Figure 4-2 overleaf shows a map in which land use has been reclassified in terms of visual quality attributes, for example highly built-up areas will have a lower visual quality than natural areas. The distinction between mining areas, the town and the natural environment surrounding the mines are evident and the reclassified map confirms that the visual quality outside the mining areas is medium to high.



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VISUAL QUALITY

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Revision: A Date: 27 09 2021

5 Analysis of the Magnitude of the Visual Impact

5.1 Introduction

The following section outlines the assessment that was undertaken to determine the **magnitude** of the visual impact associated with the proposed extension. Cumulative visual impacts, associated with the existing mining infrastructure, were assessed.

Various factors were considered in the assessment, including:

- Visual exposure of the mine infrastructure;
- Visibility and viewing distance;
- Visual absorption capacity (VAC) provided by the surrounding environment;
- Integrity with existing landscape / townscape; and
- The viewer's sensitivity to change.

These criteria are explained further in the following sections and are used to calculate the magnitude of visual impact, presented in Table 5-1 and Table 5-2.

5.2 Visual Exposure

5.2.1 Elements considered in determining visual exposure

Visual exposure is determined by an objects "zone of visual influence" or how visible an object may be in the landscape. The visual exposure of an object can be broken down into two elements:

- Firstly, how exposed is the object to the surrounding area? This can be determined by the topography in which the object is located; and
- Secondly, how exposed are viewers to the object? This can be determined through topography and land use in which the viewer is situated.

The following section outlines how both of these elements were used in determining the overall visual exposure of the key structures/infrastructure associated with the proposed extension.

The topography of an area can limit or expose the visibility of an object. Table 5-1 below outlines a set of Visibility Criteria that were used to rank how visible the expansion may be from Hotazel and the R31.

Table 5-1: Visibility criteria (Exposure)

Visibility Ranking			
Not Visible	Marginally Visible	Visible	Highly Visible
Visibility Criteria (Exposure Rating)			
1	2	4	5

Usually a viewshed is created using infrastructure footprints and heights to model areas from where infrastructure may be visible. As stockpile and infrastructure heights were not available for the assessment the modelling could not be undertaken and reliance is placed on topography and the criteria as per Table 5-1.

The topography of the area is relatively flat and the mine area slope gently from south east to north west (Figure 5-2). Visibility of aboveground infrastructure such as waste rock dumps, conveyors, TSF's, ventilation shafts etc usually increases in a flat landscape due to the absence of natural landforms to screen infrastructure.

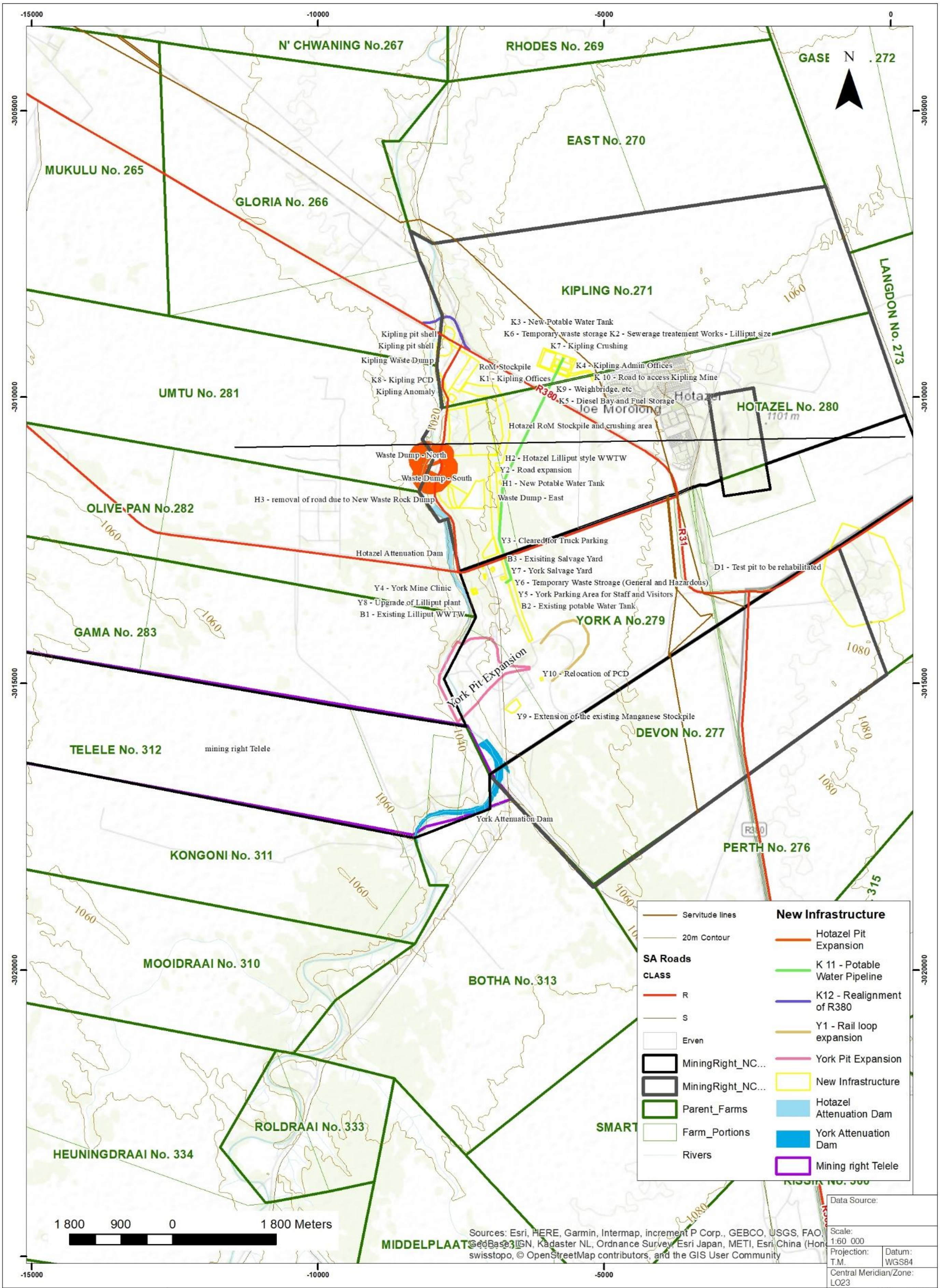
The proposed waste rock dumps and ore stockpiles associated with the new and expanded open cast mines will gradually increase over time and the visibility of these structures will become evident in the landscape due to the landscape being flat and currently devoid of hills that resembles the shape of waste rock dumps. Existing waste rock dumps associated with the York and Hotazel pits are clearly visible in the landscape (Figure 5-1) due to their large footprints, and being devoid of vegetation makes them stand out from the greenery in the environment surrounding it. It is likely that the proposed waste rock dumps will be visible to visual receptors in Hotazel town as well as motorists travelling on the R31. The visibility rating for the waste rock dumps and ore stockpiles is **highly visible (5).**

It can be inferred that future underground mining and Telele will have aboveground infrastructure such as winders, ventilation shafts etc which will protrude from the flat surface area of the mine, These structures are likely to be visible to motorists on the R31 but unlikely to be visible from Hotazel, as other mining structures would have been developed between Telele and Hotazel. The structures are likely to be **visible (4).**

Figure 5-1: Left: existing Hotazel and York pits; right: Kalagadi Manganese Mine

Source: SRK Socio-Economic Impact Assessment, 2021

The two attenuation dams proposed to be constructed on the Ga-Mogara River is expected to have lower heights and is deemed to be **marginally visible (2**) in the landscape.



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KUDUMANE MANGANESE RESOURCES EXPANSION PROJECT
TOPOGRAPHY

Date: 27/09/2021	Compiled by: STOM
Project No. 574378	Fig No. 3-2

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5.3 Viewing distance and visibility

The distance of a viewer from the proposed structures and infrastructure is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an object diminishing / attenuating as the distance between the viewer and the object increases. This is a measurement of how visual impact is modified by distance. The effect of scale, topography, vegetation and weather, changes with distance, and in turn changes the degree of visual effect.

Hull and Bishop, 1988 identify the inverse relationship between viewing distance and visual impact, this relationship can be described as an exponential decrease in impact as the distance from the site or infrastructure increased. Figure 5-3 shows this relationship.

Viewsheds do not take into account the distance between the viewer and the infrastructure when determining the visibility of the infrastructure. Equation 3-1 (Ogburn, 2006) defines the equation used to determine the possible impact of a feature in the landscape, where:

μ = fuzzy membership

$d_{vp->ij}$= distance of object from the viewpoint

$b1$ = maximum distance from viewpoint of clear visibility

$b2$ = distance from viewpoint at which visibility drops to 50%

For this instance, and based upon the Hassell Matrix, the definition of where a feature may become 50% less visible was 1km.

$$1 \ for \ d_{vp \to ij} \leq b_1$$

$$and$$

$$\mu(x_{ij}) = \frac{1}{\left(1+2\left(\frac{d_{vp \to ij} - b_1}{b_2}\right)^2\right)} \ for \ d_{vp \to ij} > b_1$$

.... Equation 3-1

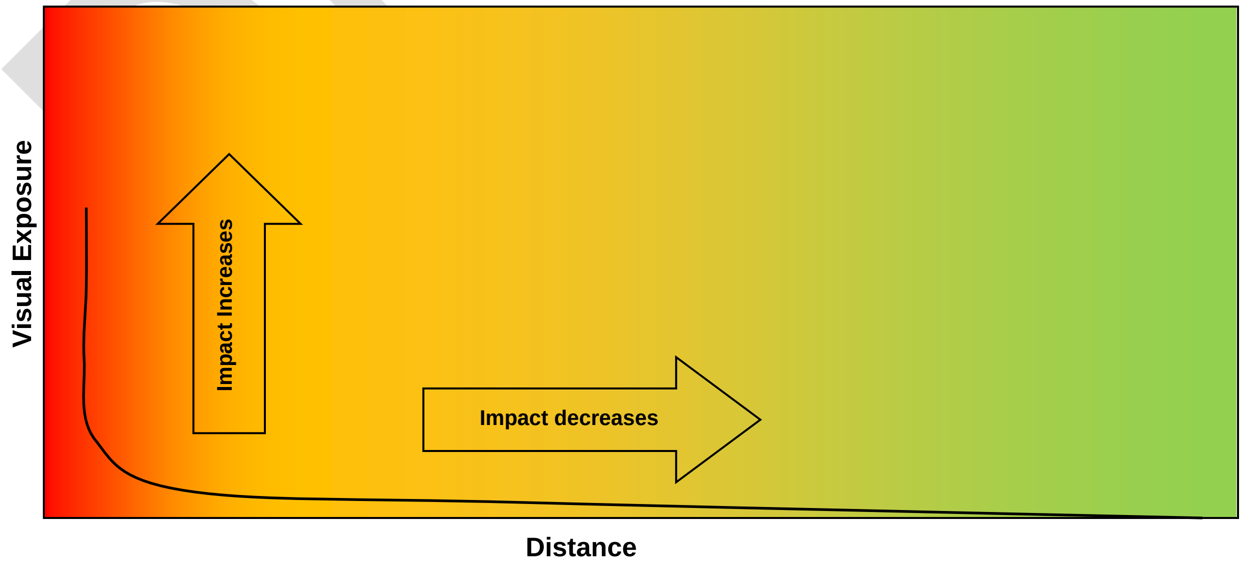

Figure 5-3 Depiction of how impact decreases with an increase in distance from a site (after Hull and Bishop, 1988)

The following rating system (Table 5-2) has been incorporated spatially with the viewshed to moderate distance between a viewer and an object. This rating system does not however, take into account the all existing features (such as vegetation and man-made structures).

Table 5-4: Distance Rating System

Location of development (From Viewpoint)	Category	Value	Description
0 to 0.5 km	Adjacent	5	Adjacent – The mine can clearly be seen. Usually on the property boundary or property grounds.
0.5 km to 1 km	Foreground	4	This is the zone in which details such as colour, texture and form can be appreciated. Objects in this zone are highly visible unless obscured by other landscape features, existing structures or vegetation.
1 km to 3 km	Middle ground	3	The zone which occupies the area "between" detail and indistinct colour and line discernment. Objects in this zone can be classified as visible to moderately visible unless obscured by other elements within the landscape.
3 km to 5 km	Distant middle ground	2	This zone is discerned by means of line and colour. Texture and form are generally not seen. Objects in this zone can be classified as marginally visible to not visible. Areas beyond 3 km are usually not investigated as the impact would be negligible on these areas.
5 km and greater	Background	1	Background – Not Visible (The mine can hardly / not be seen).

The proposed waste rock dumps and ore stockpiles falls within the **middle ground (3) category**, as these structures can be classified as being visible from Hotazel which is 3km away. It should be noted that due to the flat topography, existing vegetation and existing mining activities and related infrastructure, that views towards the mining infrastructure may be obscured from certain locations within the landscape. The waste rock dumps associated with Kipling and Hotazel pits will be in the **foreground (4)** for motorists travelling on the R380.

The proposed Telele underground operation will fall in the **Background (1)** category as it will be more than 5km away from Hotazel. The two attenuation dams will fall in the **Distant Middle ground (2)** category due to its distance from the R31.

5.4 Visual Absorption capacity

The Visual Absorption Capacity (VAC) is the potential for the area to conceal / mitigate the impact of the mining infrastructure through natural or man-made features in the landscape. Factors contributing to the VAC include:

- Topography and vegetation that is able to provide screening and increase the visual absorption capacity of a landscape;
- The degree of urbanisation compared to open space. A highly urbanised landscape is better able to absorb the visual impacts of similar developments;
- An interrelated landscape comprising a unified environment; and
- The scale and density of surrounding developments.

Visual absorption within the wider area of influence will further be provided by:

- Residential suburbs or villages which may reduce the visibility of the site to people residing in the centre or towards the back of the residential area;
- The existing road infrastructure between viewpoints further than 2 km away; and
- Powerlines, railway lines etc.

The VAC is rated from high (1) to low (5) based on the capacity of the environment to absorb the visual impact of the facility. The VAC will be high when the environment can impede the infrastructure and as such, the colour of a facility can also determine its VAC. The VAC will be low in areas where the topography is flat and natural features such as trees, outcrops and mountains are absent.

The area within which the mine is situated is generally flat. Existing vegetation, although being relatively low growing, is likely to act as a visual buffer towards views of the proposed mine infrastructure from various areas and may mitigate the visual exposure from certain areas.

The vegetation is likely to provide a good VAC for low infrastructure such as WWTP's, buildings, pipelines etc. In addition, vegetation and acacia trees along some sections of the R31 will provide some screening to motorists travelling through the area.

Due to the low growing and sparse nature of the vegetation it is unlikely that it would provide sufficient VAC to "hide" infrastructure such as the waste rock dumps, stockpiles and aboveground infrastructure associated with future underground mining. The VAC is likely to be higher for structures such as the water attenuation ponds, provided that vegetation around these ponds is left intact.

The proposed WRD's and stockpile areas are proposed to be situated in close proximity to other existing stockpiles and mining areas and will blend in with existing structures, although this will increase the magnitude of the visual impact on the area over time

Given the above, the VAC for the WRD's and stockpile areas are considered to be **low to medium (4)** for the WRDs, stockpiles and aboveground infrastructure associated with future underground mining. The VAC for attenuation ponds is considered to be **high (1).**

5.5 Landscape / townscape compatibility

Landscape or townscape compatibility refers to the compatibility of the proposed structures with the existing landscape or townscape. Landscape / townscape compatibility was rated based on the following criteria specified in Table 5-3.

Table 5-5: Landscape / townscape compatibility rating criteria

High (1)	Moderate (3)	Low (5)
The mine: • Is consistent with the existing land use of the area; • Is highly sensitive to the natural environment; • Is consistent with the urban texture and layout; • The buildings and structures are congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is similar to what exists.	The mine: • Is moderately consistent with the existing land use of the area; • Is moderately sensitive to the natural environment; • Is moderately consistent with the urban texture and layout; • The buildings and structures are moderately congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is moderately similar to what exists.	The mine: • Is not consistent with the existing land use of the area; • Is not sensitive to the natural environment; • Is very different to the urban texture and layout; • The buildings and structures are not congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is different to what exists.

Due to the mine being in operation for a few years, and the number of other mines in the area, the proposed expansion is deemed **moderately compatible (3)** with the landscape. It is not deemed to be highly compatible as the area around the mines are relatively natural as shown in Figure 4-2.

5.6 Sensitivity of viewers

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer’s perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists.

The viewer sensitivity is ranked from high (5) to low (1) based on the probable perceptions of the viewers and their willingness to change. The viewer sensitivity for the mine is regarded as being **medium to low (2)**. This rating is attributed to the mine being in existence for a number of years but also considering that many other mines are operating in the area. The closest town of Hotazel is 3 km away from the mine and many residents are likely to be employed by the mine or other mines in the area. It is understood that the mine has bought most farms around it and is leasing these farms for livestock grazing.

The public participation process will inform this aspect further and will require re-evaluation prior to the submission of the Final Report to the authorities.

5.7 Calculation of the Magnitude of the Visual Impacts

Table 5-4 combines the various factors influencing the visual impacts that the proposed extended NWRD footprint may have, thereby providing input towards calculating the magnitude of the visual impacts for mine.

Table 5-4: Summary of the magnitude of the Visual Impact of the proposed expansion areas

Criteria	Score (WRD and TSF)	Score (Telele – Future UG Mine)	Score (Attenuation Ponds)
Visual Character	3	3	2
Visual Quality of the Environment	3.33	3.33	3.33
Visual Exposure	5	4	2
Visibility and Distance	3	1	2
Visual Absorption Capacity	4	4	1
Landscape Compatibility	3	3	2
Viewer Sensitivity	2	2	2
Magnitude	**3.33**	**2.90**	**2.04**

The **magnitude** of the visual impact, which is a subjective measure, is calculated based on an average between all criteria listed in Table 5-4, and are described in Section 4 & 5. The magnitude is ranked from high (5) to low (1), and is included in Section 6 as the Severity rating to inform the overall assessment of the visual impact, by means of a quantitative ranking approach.

Based on a calculated score of 3.6, the magnitude of the visual impact is deemed to be **medium** for the WRDs, stockpiles and future underground operations at Telele and **Low** for the proposed attenuation ponds.

6 Visual Impact Assessment

The following section incorporates the findings of Section 5 and compiles them into a visual impact rating system. The impact assessment focuses on the construction, operational and closure phases of the extension.

The significance of the impacts was assessed according to the following criteria:

- Magnitude – severity or intensity.
- Duration (temporal influence) – Temporal influence.
- Scale (spatial influence) – Spatial influence.
- Probability - likelihood of an event occurring.

6.1 Impact Assessment Methodology

All specialists are required to assess each identified potential impact according to the following Impact Assessment Methodology as described below. This methodology has been formalised to comply with Regulation 31(2)(l) of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), which states the following:

An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision, and must include –

- An assessment of each identified potentially significant impact, including –
  - Cumulative impacts.
  - The nature of the impact.
  - The extent and duration of the impact.
  - The probability of the impact occurring.
  - The degree to which the impact can be reversed.
  - The degree to which the impact may cause irreplaceable loss of resources.
  - The degree to which the impact can be mitigated.

Based on the above, the EIA Methodology will require that each potential impact identified is clearly described (providing the nature of the impact) and be assessed in terms of the following factors:

- Extent (spatial scale) - will the impact affect the national, regional or local environment, or only that of the site?
- Duration (temporal scale) – how long will the impact last?
- Magnitude (severity) – will the impact be of high, moderate or low severity?
- Probability (likelihood of occurring) – how likely is it that the impact may occur?

To enable a scientific approach for the determination of the environmental significance (importance) of each identified potential impact, a numerical value has been linked to each factor:

Table 6-1: Ranking scales for the impact assessment

	Duration:	**Probability:**
Occurrence	5 – Permanent	5 – Definite/don’t know
	4 - Long-term (ceases with the operational life)	4 – Highly probable
	3 - Medium-term (5-15 years)	3 – Medium probability
	2 - Short-term (0-5 years)	2 – Low probability
	1 – Immediate	1 – Improbable
		0 – None
Severity	**Extent/scale:**	**Magnitude:**
	5 – International	10 - Very high/uncertain
	4 – National	8 – High
	3 – Regional	6 – Moderate
	2 – Local	4 – Low
	1 – Site only	2 – Minor
	0 – None	

Once the above factors had been ranked for each identified potential impact, the environmental significance of each impact can be calculated using the following formula:

Significance = (duration + extent + magnitude) x probability

The maximum value that can be calculated for the environmental significance of any impact is 100. The environmental significance of any identified potential impact is then rated as either: high, moderate or low on the following basis:

- More than 60 significance value indicates a high (H) environmental significance impact.
- Between 30 and 60 significance value indicates a moderate (M) environmental significance impact.
- Less than 30 significance value indicates a low (L) environmental significance impact.

In order to assess the degree to which the potential impact can be reversed and be mitigated, each identified potential impact will need to be assessed twice:

- Firstly, the potential impact will be assessed and rated prior to implementing any mitigation and management measures.
- Secondly, the potential impact will be assessed and rated after the proposed mitigation and management measures have been implemented.

The purpose of this dual rating of the impact before and after mitigation is to indicate that the significance rating of the initial impact is and should be higher in relation to the significance of the impact after mitigation measures have been implemented.

In order to assess the degree to which the potential impact can cause irreplaceable loss of resources, the following classes (%) will be used and will need to select based on your informed decision and discretion:

Table 6-6: Loss of resource

Rating	Loss of resource (%)
5	100% - Permanent loss
4	75% - 99% - significant loss
3	50% - 74% - moderate loss
2	25% - 49% - minor loss
1	0% - 24% - limited loss
The loss of resources aspect will not affect the overall significance rating of the impact.	

In terms of assessing the cumulative impacts, specialists are required to address this in a sentence/paragraph fashion as the spatial extent of the cumulative impacts will vary from project to project. Cumulative impact, in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing or potential impacts eventuating from similar or diverse activities or undertakings in the area.

6.2 Visual Impact Assessment

Potential Visual Impacts resulting from the proposed project are further discussed below. The Significance Rating of the visual impact is calculated based on the methodology presented in Section 4.

6.2.1 VIA1: Visual Impacts during construction and operation of the WRDs

The development /expansion and operation of the WRDs occur simultaneously and visual impacts expected with this phase are evaluated in a similar manner. The rating provided for the construction phase assumes that the dump will grow over time.

Key visual impacts associated with the development and operation of the WRDs include dust (nuisance impact evaluated in Air Quality Impact Assessment), vehicular movement and gradual increase in structure footprint which increases visibility over time.

Table 6-3 evaluates the significance of the visual impact before and after mitigation measures have been implemented. The impact will be high prior to the implementation of management measures and can be mitigated to moderate. The fact that the extended WRDs will be in a very flat area with low and scattered vegetation infers that even with mitigation, the views of the WRDs will not be completely be screened. The impact can however be reduced by planting/retaining vegetation between the roads and town of Hotazel and the WRDs. In addition, progressive rehabilitation is advocated if practical and safe.

The WRDs protrudes from the landscape and the colour of the bare soil creates a contrast with the green landscape surrounding it, making it more visible. As such, shaping and revegetating the side slopes of the WRD is likely to assist with blending it into the environment.

Although difficult to determine at this stage, the long term cumulative impact is likely to be mitigated to Moderate if the Closure Plan is implemented. The area is known for mining and many mines occur in the surrounding landscape and the impacts associated with each mine is likely to be localised, although should mines expand and mine surface areas between them, the cumulative visual impact associated with the broader landscape may increase. This is currently mitigated by the relatively low number of visual receptors in the landscape.

6.2.2 VIA2: Visual Impacts during construction and operation of future Telele Underground Mine

The location and orientation of the proposed Telele underground mine is not known at this stage. It is likely that the visual impact during construction will be low to medium and medium during construction (Table 6-4). As the infrastructure will be removed upon closure, the visual impact can be mitigated to low upon closure. Given the mining activities in the area, potential visual impact during closure is not envisaged.

6.2.3 VIA3: Visual Impacts during construction and operation of attenuation ponds

The attenuation ponds will be situated in an existing mining area and will be screened from visual external receptors by natural vegetation and mining infrastructure. Vegetation should be retained around the ponds to ensure that these blend into the environment. No post-closure impacts are envisaged should the closure plan mitigation measures be implemented and vegetation be retained around these structures (Figure 6-5).

Table 6-3: Impact Ranking of the WRD and Stockpile areas

Nature of the impact		Significance of potential impact BEFORE mitigation							Mitigation Measures	Significance of potential impact AFTER mitigation							Degree of mitigation (%)
		P	D	E	M	LoR		Significance		P	D	E	M	LoR		Significance	
ACTIVITY: Site clearing of vegetation																	
Construction Phase																	
	-	4	5	3	6	3	56	Moderate	• Undertake gradual clearing of land/vegetation • Ensure harvesting of plants from this area and preserve in the nursery for rehabilitation purposes, where practical. • Adhere to the management measures regarding dust provided by the air quality specialist.	4	5	3	6	3	56	Moderate	0.0
Operational Phase																	
	-	5	5	3	6	3	70	High	• Undertake gradual clearing of land/vegetation • Ensure harvesting of plants from this area and preserve in the nursery for rehabilitation purposes, where practical. • Adhere to the management measures regarding dust provided by the air quality specialist. • Undertake progressive rehabilitation of the WRDs, if practically possible. • Plant or retain vegetation such as trees and shrubs on periphery of the town to provide a screen/buffer of direct views towards these structures. Point lighting inwards and not to villages to avoid nocturnal impacts. • Natural vegetation, wherever possible, should be retained on and around the mine property as well as along the boundary of the mine.	5	4	2	4	3	50	Moderate	28.6
Closure/Rehabilitation Phase																	
	-	3	2	2	4	3	24	Low	• Reshaping of the WRD to blend into environment • Revegetate side slopes • Implement closure plan	3	2	2	2	1	18	Low	25.0
Cumulative Impacts																	
	-	5	5	3	8	4	80	High	• Dust suppression • Progressive rehabilitation of side slopes • Implement closure plan and keep plan up to date	5	5	2	4		55	Moderate	31.3

Table 6-4: Impact Ranking of the future Telele Underground mine infrastructure

Nature of the impact	Significance of potential impact BEFORE mitigation						Mitigation Measures	Significance of potential impact AFTER mitigation						Degree of mitigation (%)
	P	D	E	M	LoR	Significance		P	D	E	M	LoR	Significance	
ACTIVITY: Site clearing of vegetation														
Pre-Construction Phase														
-	2	1	1	4	1	**12**	**Low**	• Dust suppression	2	1	1	4	1	**12**	**Low**	0.0
Construction Phase														
-	2	2	1	4	1	**14**	**Low**	• Dust suppression • Keep nocturnal lighting towards the construction areas • Adhere to the management measures regarding dust provided by the air quality specialist. • Retain natural vegetation where possible	2	2	1	4	3	**14**	**Low**	0.0
Operational Phase														
-	4	4	2	6	2	**48**	**Moderate**	• Dust suppression • Keep nocturnal lighting towards the operational areas and avoid lighting pointing toward roads or the town • Adhere to the management measures regarding dust provided by the air quality specialist. • Retain natural vegetation where possible	4	4	2	6	3	**48**	**Moderate**	0.0
Closure/Rehabilitation Phase														
-	1	1	1	2	1	**4**	**Low**	• Dust suppression • Closure plan and keep plan up to date	1	1	1	2	1	**4**	**Low**	0.0
Cumulative Impacts														
-	4	4	2	6	2	**48**	**Moderate**	• Dust suppression • Keep nocturnal lighting towards the operational areas and avoid lighting pointing toward roads or the town • Adhere to the management measures regarding dust provided by the air quality specialist. • Retain natural vegetation where possible • Implement the Closure Plan for the Mine	4	4	2	4	1	**40**	**Moderate**	16.7

Table 6-5: Impact Ranking of the attenuation ponds

Nature of the impact		P	D	E	M	LoR	Significance of potential impact BEFORE mitigation: Significance		Mitigation Measures	P	D	E	M	LoR	Significance of potential impact AFTER mitigation: Significance		Degree of mitigation (%)
ACTIVITY: Site clearing of vegetation																	
Pre-Construction Phase																	
	-	2	1	1	4	1	**12**	**Low**	Retain natural vegetation where possible	2	1	1	4	1	**12**	**Low**	0.0
Construction Phase																	
	-	2	2	1	4	1	**14**	**Low**	• Dust suppression • Adhere to the management measures regarding dust provided by the air quality specialist. • Retain natural vegetation where possible	2	2	1	4	3	**14**	**Low**	0.0
Operational Phase																	
	-	3	4	1	4	2	**27**	**Low**	• Dust suppression • Adhere to the management measures regarding dust provided by the air quality specialist. • Retain natural vegetation where possible • Revegetate sides	2	4	1	2	3	**14**	**Low**	48.1
Closure/Rehabilitation Phase																	
	-	1	1	1	2	1	**4**	**Low**	• Implement closure plan	1	1	1	2	1	**4**	**Low**	0.0
Cumulative Impacts																	
	-	2	4	1	4	2	**18**	**Low**	• Retain vegetation • Implement closure plan	2	4	1	2	1	**14**	**Low**	22.2

7 Conclusions

Ancillary infrastructure and buildings are not deemed to be contributing to visual impact as much as the WRD's, and with the low number of visual receptors in the area focus was placed on structures that would be intrusive and remain in the landscape post-closure. As such, the WRDs, future major above ground infrastructure (related to future underground mining) and attenuation ponds were identified as requiring further evaluation.

It is concluded that visual impacts associated with the WRDs and stockpile areas will be high without management measures put in place, mainly due to the footprint and height of the structures, the flat topography and low growing vegetation. Progressive rehabilitation will be important to undertake, if possible and the recommendations of the closure plan must be implemented to blend these structures into the natural environment. The impact can be mitigated to be moderate, and mitigation is mainly focussed on reducing the WRD contrast in the surrounding environment.

The location and layout of the future underground mine at Telele is not known at this stage, a broad evaluation of this aspect was undertaken. The visual impact is deemed to be moderate during operation and will be low upon decommissioning as the infrastructure will be removed upon closure. Telele is currently situated almost 5km away from Hotazel and the R31 and it is likely that the visual impact will be low due to a limited number of visual receptors in the landscape.

The two attenuation ponds are unlikely to have a visual impact due to natural screening provided by the surrounding environment.

The mine expansion is in line with the wider development plans of the area, as the area is predominantly characterised by mining.

Ancillary infrastructure and buildings are not deemed to be contributing to visual impact as much as the WRD's, and with the low number of visual receptors in the area focus was placed on structures that would be intrusive and remain in the landscape post-closure.

The mine must consider/incorporate measures during current and future project planning to mitigate against cumulative visual impacts.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendices

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