# VISUAL IMPACT ASSESSMENT

# PROPOSED TUMELA MINE CENTRAL SHAFT PROJECT

**June 2013**

Prepared for:

WSP Environmental (Pty) Ltd
South View Block
Bryanston Place
199 Bryanston Drive
Bryanston
2191

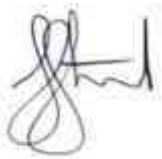
Visual Resource Management Africa cc
PO Box 7233, George, 6531
Tel: +27 44876 0020/ Fax: +27 86 653 3738
Cell: +27 83 560 9911
E-Mail: steve@vrma.co.za
Web: www.vrma.co.za

This document was completed by Silver Solutions 887 cc trading as VRM Africa, a Visual Impact Study and Mapping organisation located in George, South Africa. VRM Africa cc was appointed as an independent professional visual impact practitioner to facilitate this VIA.

This document was undertaken by the following team:

| | | |
|---|---|---|
| Stephen Stead | Director/ Visual Impact | APHP accredited VIA Practitioner |
| Heather Stead | Research/ Assistant | Bachelor of Arts |
| Lisa Shultz | Editing and Contrast Rating | Bachelor of Arts, Fine Art |

Stephen Stead has 12 years of experience in the field of Geographic Information System (GIS) mapping and 3 Dimensional (3D) modelling through his work as a GIS consultant and visual impact practitioner.



Stephen Stead
*APHP accredited VIA Specialist*

## TABLE OF CONTENTS

## TABLE OF FIGURES

## LIST OF TABLES



## LIST OF ACRONYMS

| | |
|---|---|
| *APHP* | Association of Professional Heritage Practitioners |
| *BLM* | Bureau of Land Management (United States) |
| *BPEO* | Best Practicable Environmental Option |
| *CALP* | Collaborative for Advanced Landscape Planning |
| *DEA&DP* | Department of Environmental Affairs and Development Planning (South Africa) |
| *DEM* | Digital Elevation Model |
| *DoC* | Degree of Contrast |
| *EIA* | Environmental Impact Assessment |
| *EMP* | Environmental Management Plan |
| *GIS* | Geographic Information System |
| *I&APs* | Interested and Affected Parties |
| *IDP* | Infrastructure Development Plan |
| *IEMA* | Institute of Environmental Management and Assessment (United Kingdom) |
| *IEMP* | Integrated Environmental Management Plan |
| *KOP* | Key Observation Point |
| *MAMSL* | Metres above mean sea level |
| *NELPAG* | New England Light Pollution Advisory Group |
| *PSDF* | Provincial Spatial Development Framework |
| *ROD* | Record of Decision |
| *SDF* | Spatial Development Framework |
| *SEA* | Strategic Environmental Assessment |
| *VAC* | Visual Absorption Capacity |
| *VIA* | Visual Impact Assessment |
| *VRM* | Visual Resource Management |
| *ZVI* | Zone of Visual Influence |

## GLOSSARY

*Best Practicable Environmental Option (BPEO)*
This is the 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, as well as the short, term.

*Cumulative Impact*
The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time.

*Impact (visual)*
A description of the effect of an aspect of a development on a specified component of the visual, aesthetic or scenic environment, within a defined time and space.

*Issue (visual)*
Issues are concerns related to the proposed development, generally phrased as questions, taking the form of “what will the impact of some activity be on some element of the visual, aesthetic or scenic environment?”

*Key Observation Points (KOPs)*
KOPs refer to receptors (people affected by the visual influence of a project) located in the most critical locations surrounding the landscape modification, who make consistent use of the views associated with the site where the landscape modifications are proposed. KOPs can either be a single point of view that an observer/evaluator uses to rate an area or panorama, or a linear view along a roadway, trail or river corridor.

*Management Actions*
Actions that enhance the benefits of a proposed development, or avoid, mitigate, restore or compensate for, negative impacts.

*Receptors*
Individuals, groups or communities who would be subject to the visual influence of a particular project.

*Sense of Place*
The unique quality or character of a place, whether natural, rural or urban.

*Scenic Corridor*
A linear geographic area that contains scenic resources, usually, but not necessarily, defined by a route.

*Scoping*
The process of determining the key issues, and the space and time boundaries, to be addressed in an environmental assessment.

*Viewshed*
The outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed. This reflects the area in which, or the extent to which, the landscape modification is likely to be seen.

*Zone of Visual Influence (ZVI)*
The ZVI is defined as 'the area within which a proposed development may have an influence or effect on visual amenity.'

# 1 INTRODUCTION

VRM Africa was appointed by WSP Environmental Pty (Ltd) (WSP) to undertake a Visual Impact Assessment (VIA) for the proposed Tumela Central Shaft Project (the "proposed project") on behalf Rustenburg Platinum Mines (RPM), a division of Anglo American Platinum (AAP). The mine is located approximately 40 km south of Thabazimbi and 15 km north of Northam in the Limpopo Province of South Africa, as indicated on in *Figure 1: Regional locality map overlaid onto topographic map*. The Tumela mine forms part of the Amandelbult Section (Amandelbult) under the management of RPM which is an established Section and is wholly owned by AAP. Amandelbult comprises two mines, Tumela Mine (Tumela) and Dishaba Mine (Dishaba), and is located within the Thabazimbi Local Municipality and the Waterberg District Municipality. The Tumela mine operates under a mining right covering a total area of 111 square kilometres and produces platinum, palladium, rhodium and gold (4E). *(www.angloplatinum.com).* Both the Tumela and Dishaba Mines fall under the same mining license. *(WSP 2013)*

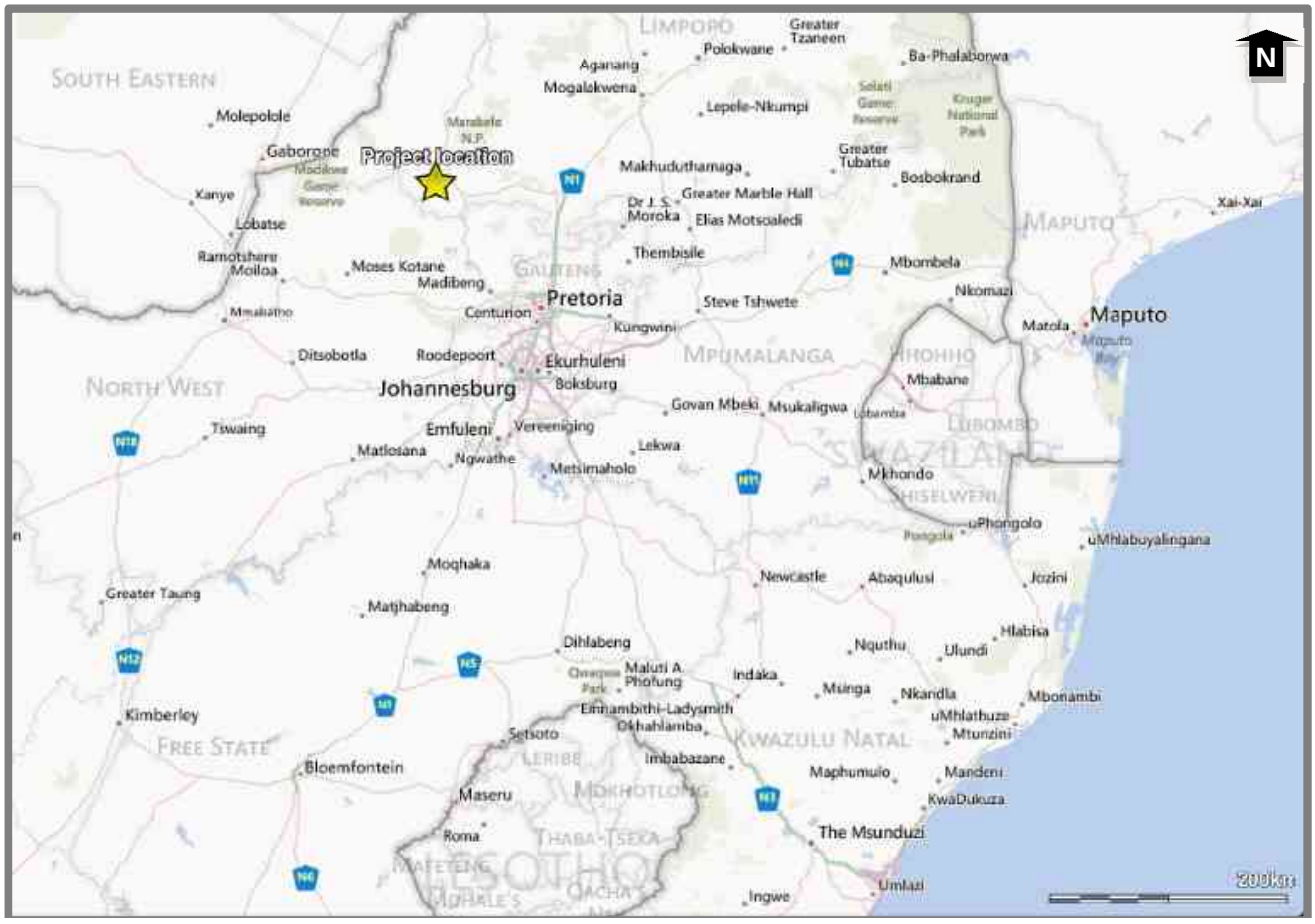



Figure 1: Regional locality map overlaid onto topographic map

# 2 APPROACH TO STUDY

## 2.1 Terms of Reference

The scope of the study is to cover the entire proposed project area. This includes a site visit of the full site extent, as well as areas where potential impacts may occur beyond the site boundaries.

- All available secondary data relevant to the affected proposed project area to be collated and analysed.
- Information was sourced from the following previous studies of the area:
    - WSP Background Information Document (BID) 2013. WSP. Notice of the Environmental Authorisation Processes for the proposed project.
    - WSP. 2013. WSP Environment and Energy. Draft Scoping Report: Tumela Central Shaft Project – Tumela Mine – Amandelbult Section, Rustenburg Platinum Mines. 2013/02/23

Cumulative effects are to be considered in all impact reports.

- Specific attention is to be given to the following:
    - Quantify and assess existing scenic resources/visual characteristics on, and around, the proposed site.
    - Evaluate and classify the landscape in terms of sensitivity to a changing land use.
    - Determine viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
    - Determine visual issues, including those identified in the public participation process.
    - Review the legal framework that may have implications for visual/scenic resources.
    - Assess the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the proposed project.
    - Identify possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Plan (EMP).

## 2.2 Summary of VIA Methodology

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method. This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using a standard assessment criteria and involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification brought about by a proposed project, against the same elements found in the existing natural landscape *(BLM. USDI. 2004). See Figure 2: VRM process diagram.*

The first step in the VIA process is determining the existing landscape context. A regional landscape survey is undertaken, which identifies defining landscape features that surround the site of a proposed development, and sets the scene for the VIA process to follow. These features, also referred to as visual issues, are assessed for their scenic quality/worth. A VIA also assesses to what degree people, who make use of these locations (e.g. a nearby holiday resort), would be sensitive to change(s) in their views, brought about by a proposed project (e.g. a mine). *(Assessment undertaken up to this point falls within the ambit of the Field Study.)*

These people are referred to as receptors and are identified early on in the VIA process. Only those sensitive receptors who qualify as Key Observation Points (KOPs) by applying certain criteria, are used to measure the amount of contrast generated by changes caused by proposed project activities, against the existing landscape (i.e. visual impact).

Visibility is sub-divided into 3 distance zones based on relative visibility from travel routes or observation points. Proximity to surrounding receptors is evaluated in terms of these distance buffers: foreground zone is less than 6km, background zone is from 6 to 24 km, and seldom seen (beyond 24

km) has no receptors. Viewshed maps are generated that indicate the overall area where the proposed project activities would be visible, and in which distance buffer zone the receptors fall.

The landscape character of the proposed project site is then surveyed to identify areas of similar land use and landscape character. These areas are evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the proposed site) in order to define the visual objective for the proposed project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the proposed project would be "absorbed" or "disappear", into the landscape). The areas identified on the proposed site are categorised into these Classes by using a matrix developed by BLM Visual Resource Management, which is then represented in a visual sensitivity map. *(Assessment undertaken up to this point falls within the ambit of the Baseline Study).*

The proposed project activities are then finally assessed from the KOPs around the site to see whether the visual objectives (VRM Classes) defined for the site, are met in terms of measuring the potential change to the site's form, line, colour and texture visual elements, as a result of the proposed project (i.e. are the expected changes within acceptable parameters to ensure that the visual character of the landscape is kept intact and, if not, what can be done by the AAP to ensure that it is). Photo montages are generated to represent the expected change in the views, as seen from each KOP and, if class objectives are not met, to also show how proposed mitigation measures could improve the same views.

Using the impact assessment method provided by the environmental consultant, each proposed project activity is assessed in terms of its potential visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors on whether the proposed activities meet the recommended visual objectives defined, to protect the landscape character of the area. Recommendations have been included and mitigation measures provided.

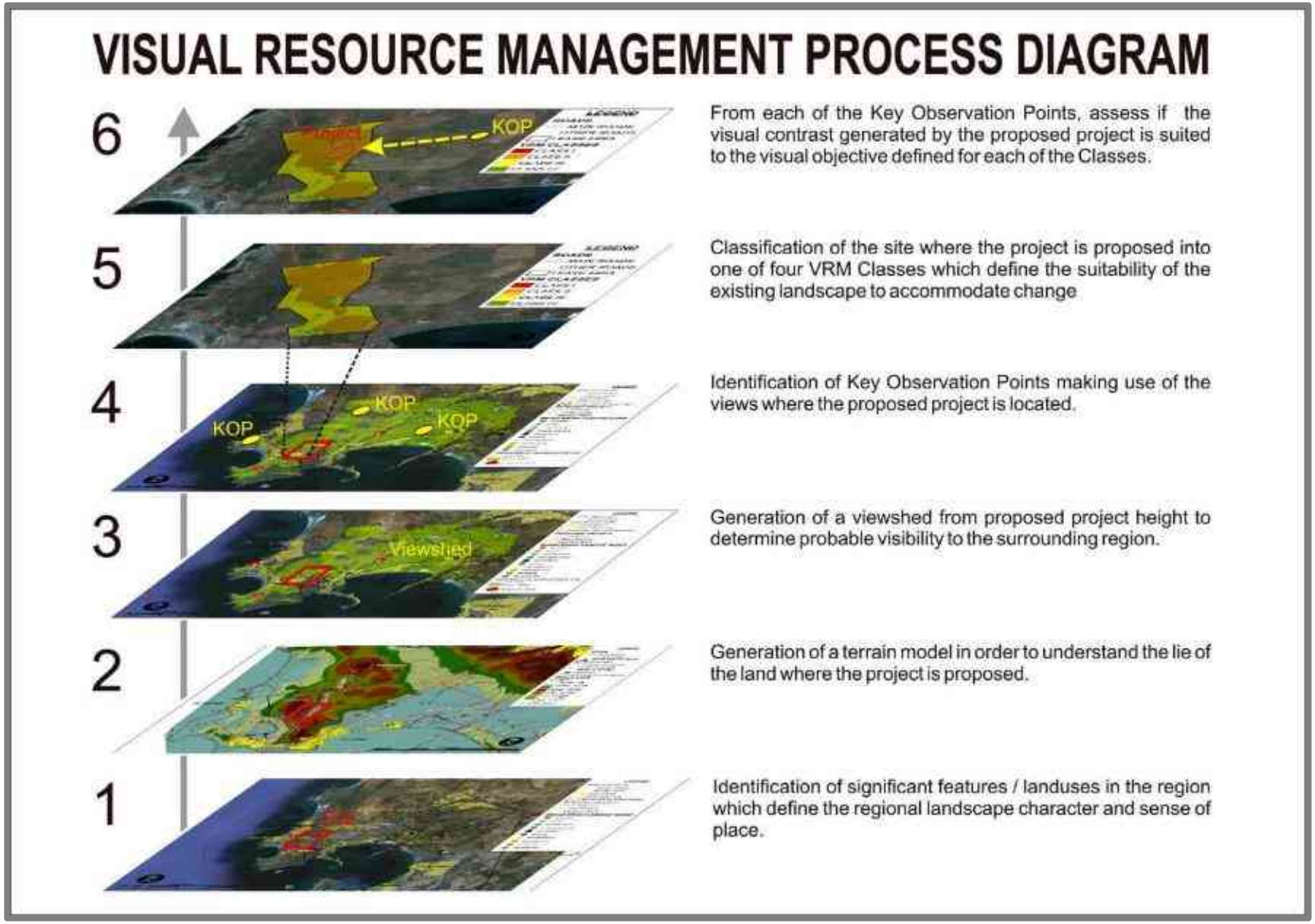



Figure 2: VRM process diagram

## 2.3 Limitations and Assumptions

- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of Google Earth Pro for mapping is licensed for use in this document.
- Some of the mapping in this document was created using Bing Maps (previously *Live Search Maps*, *Windows Live Maps*, *Windows Live Local*, and *MSN Virtual Earth*) and powered by the Bing Maps for Enterprise framework.
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
    - The Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data (ASTGTM_S2 3E014 and ASTGTM_S24E014 data set). ASTER GDEM is a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (NASA) in USA. *(ASTER GDEM. METI / NASA. 2011)*
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure *(Lange 1994)*. The project deliverables, including electronic copies of reports, maps, data, shape files and photographs, are based on the author's professional knowledge, as well as available information. This study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

'Principles that influence (development) within a receiving environment include the following:

- The need to maintain the overall integrity (or intactness) of the particular landscape or townscape;
- The need to preserve the special character or 'sense of place' of a particular area; and
- The need to minimise visual intrusion or obstruction of views within a particular area.' *(Oberholzer, B., 2005)*.

# 3 LEGISLATIVE CONTEXT

## 3.1 Applicable Laws and Policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the proposed property area to ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The proposed landscape modifications must be viewed in the context of the planning policies from the following organisations:

**Waterberg Municipality Integrated Development Plan (IDP) 2012/2013**

- Northam is sustained around the local mining activities in the area. The future role of this area will increase in importance as mining activities shift from iron ore to platinum.
- There is concern for the rapid degrading of many roads due to the increasing economic activities in the District (such as an increase in heavy vehicles carrying mining materials), and a lack of maintenance and rehabilitation.
- Corridors are spatial areas that offer advantages to mining, manufacturing and other businesses. The most important development corridor is the East-West and Rustenburg Spatial Development Initiative (SDI) which are closer to Waterberg.
- The landscape of the Waterberg District is a unique feature that distinguishes it from any other place in South Africa. There are four main landscape features in the Waterberg District, namely the Waterberg Plateau, the Transvaal Plateau Basin, the Pietersburg Plain and the Limpopo Depression.
- The Waterberg's internationally renowned tourism sites include the Waterberg Biosphere Reserve, which received its international status in March 2001 and now forms part of the World Network of Biosphere Reserves, registered with United Nations Educational, Scientific and Cultural Organisation (UNESCO). The Waterberg Biosphere Reserve is the first "savannah" biosphere reserve registered in Southern Africa. The ecological sensitivity of the Waterberg area was determined using a number of factors including vegetation types, the presence of rivers, streams, drainage lines and wetlands, presence of steep slopes or mountains and the potential presence of various plant and animal species of conservation concern.
- The mining industry in the municipal area contributes to the economic development of the District and the Province. The Waterberg area is the largest production area of platinum in the Province. The development of coal and petroleum mining in Lephalale has increased the demand for electricity generation.
- Large areas of land in private ownership are utilised mainly for Conservation/Tourism/game farming and commercial hunting. The situation exerts considerable influence, existing and potential, on future land use and management.
- Internal weaknesses: Lack of liaison with mining, tourism and agriculture sectors.

**Thabazimbi Municipality IDP 2012/2013**

- Thabazimbi is one of South Africa's most sought tourism attraction.
- Agriculture has also proven, in addition to mining, to be a strong economic sector in the municipality.
- Thabazimbi lies within the Southern African bushveld eco-region of Limpopo, renowned for cattle ranching and game farming. Platinum and iron ore mining are major contributors to the economy of the region.
- The area's local economy depends largely on the mining, agriculture and tourism sectors.

- The majority of the mines are located between Thabazimbi and Northam. The provincial road therefore acts almost as a spine for this Municipal area.
- Mining activities are in conflict with the needs of tourism. A mining belt should be identified.
- Nature reserves make a positive contribution towards conservation and eco-tourism. Development in, and in close proximity to, private conservation areas and nature reserves should be done very carefully to prevent a negative impact upon them.
- Tourism facilities in the area are adequate.

### 3.2 Relevant Standards to Comply With

The International Finance Corporation (IFC) prescribes eight performance standards (PS) on environmental and social sustainability. The first is to identify and evaluate the environmental and social risks and impacts of a project, as well as to avoid, minimise or compensate for any such impacts. Under PS 6, ecosystem services are organized into four categories, with visual/aesthetic benefits falling into the category of cultural services, which are the non-material benefits people obtain from ecosystems *(IFC. 2012).* This emotional enrichment that people experience and obtain from cultural ecosystems services is described by The Millennium Ecosystem Assessment, 2005, Ecosystems and Human Well-being: Synthesis report as follows: “Cultural ecosystems services: the non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences.” *(Millennium Ecosystem Assessment. 2005).*

The above includes the following, amongst others:

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising;
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations;
- Sense of place: Many people value the “sense of place” that is associated with recognised features of their environment, including aspects of the ecosystem;
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes (“cultural landscapes”) or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

The visual experience is not limited to the visual senses, but is a multisensory emotional involvement experienced by people when they perceive a specific scene, landmark, landscape, etc. The assessment subject of VIA is in itself a result of human perception.

# 4 PROJECT DESCRIPTION

The objective of this section is to describe the character of the proposed project activities and define the extent to which it will be visible to the surrounding areas. The proposed project Layout Plans can be seen in a selected extract in *Figure 3: Proposed layout map depicting WRD Alternative 1 Scenario* and original map can be seen in *Figure 35: Project Layout Plan (*A3*).*

## 4.1 Proposed Activities

The envisaged infrastructure for the Tumela Central Shaft includes:

- Waste Rock Dumps (WRD);
- Stockpile;
- WRD conveyor;
- A single 8.1 m downcast shaft equipped with a steel headgear (± 60 m height);
- A single 5m up-cast ventilation shaft;
- Ore silo with ore conveyor (20 m height);
- Access roads and railway links;
- Office Blocks;
- Change House;
- Salvage and timber yard;
- Explosives shed;
- Winder and lamp house;
- Parking area;
- Fridge plant with cooling water dams;
- Security Fencing (1.8 m high)
- Bulk air coolers; and
- Water storage dams.

*(Anglo American. Scope of Work EMPR Amendment Tumela Central Shaft Final. 2012)*

## 4.2 Proposed WRD Layout Alternatives

The WSP Draft Scoping Report outlined the three alternative WRD sites proposed for the project and the associated factors which led to selection of the preferred option. Only the following two options will be assessed:

- WRD Alternative 1 (Alt 1): located west of the R510 from the existing mine and
- WRD Alternative 2 (Alt 2): located east of the R510 adjacent to the existing mine.

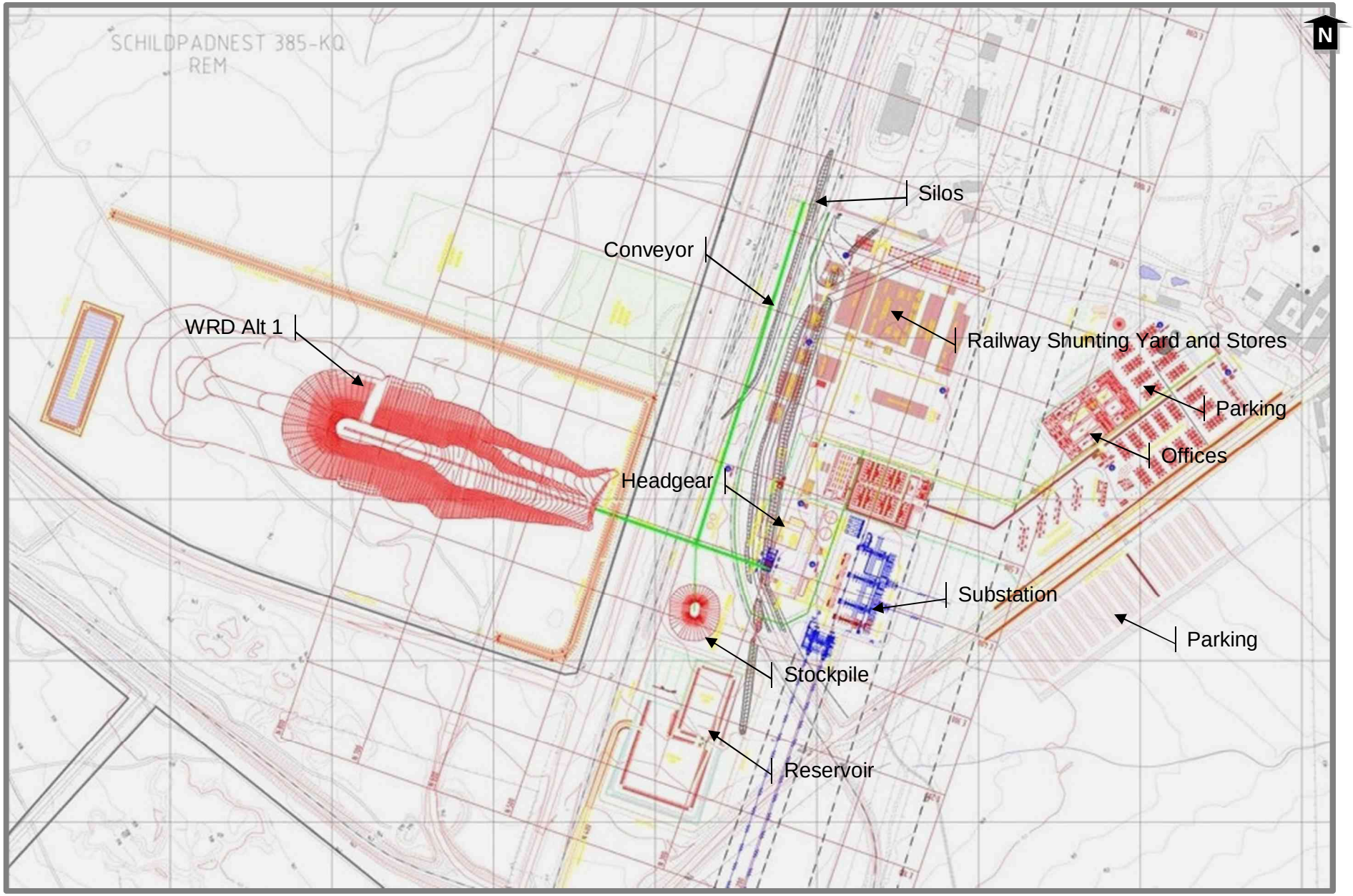



Figure 3: Proposed layout map depicting WRD Alternative 1 Scenario

# 5 LANDSCAPE CONTEXT

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, land form, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' *(Spon Press, 2002).* The first step in the VIA process is determining the existing landscape context of the region and of the site(s) where the project is proposed.

The proposed project site is located between Thabazimbi and Northam in the Thabazimbi Municipality, which is located in the south-western part of Limpopo Province and has Botswana as its international neighbour. The Municipal area falls within the Waterberg District Municipal area. The town is situated at the foot of the Ysterberg and is surrounded by the Witfonteinrand and Boshofberg mountains, with the majestic Kransberg in the background. See *Figure 4: Local Landscape Context Feature Location Map.*

Thabazimbi Municipality is known for its highly lucrative iron ore reef and surrounding industry. It was mined since the 1930's when iron and steel production started. The town was proclaimed in 1953. Today, Iscor Steelworks in Tshwane still draw much of their raw material from Thabazimbi Kumba Resources (Iron Ore mine). Apart from iron ore, the Thabazimbi Municipality is surrounded by platinum producing areas such as Northam platinum mine, and AAP, i.e. Amandelbult and Swartklip mines. Other minerals produced in the area include Andalusite, which is mined by Rhino Mine, and limestone for the production of cement by Pretoria Portland Cement (PPC). Thabazimbi Municipality is also known for its tourism appeal of the Marakele National Park, a subsidiary of National Parks Board, situated in the heart of the Waterberg Mountains. Game lodges scattered around the area help to promote the issue of environmental sustainability *(http://www.thabazimbi.gov.za).*

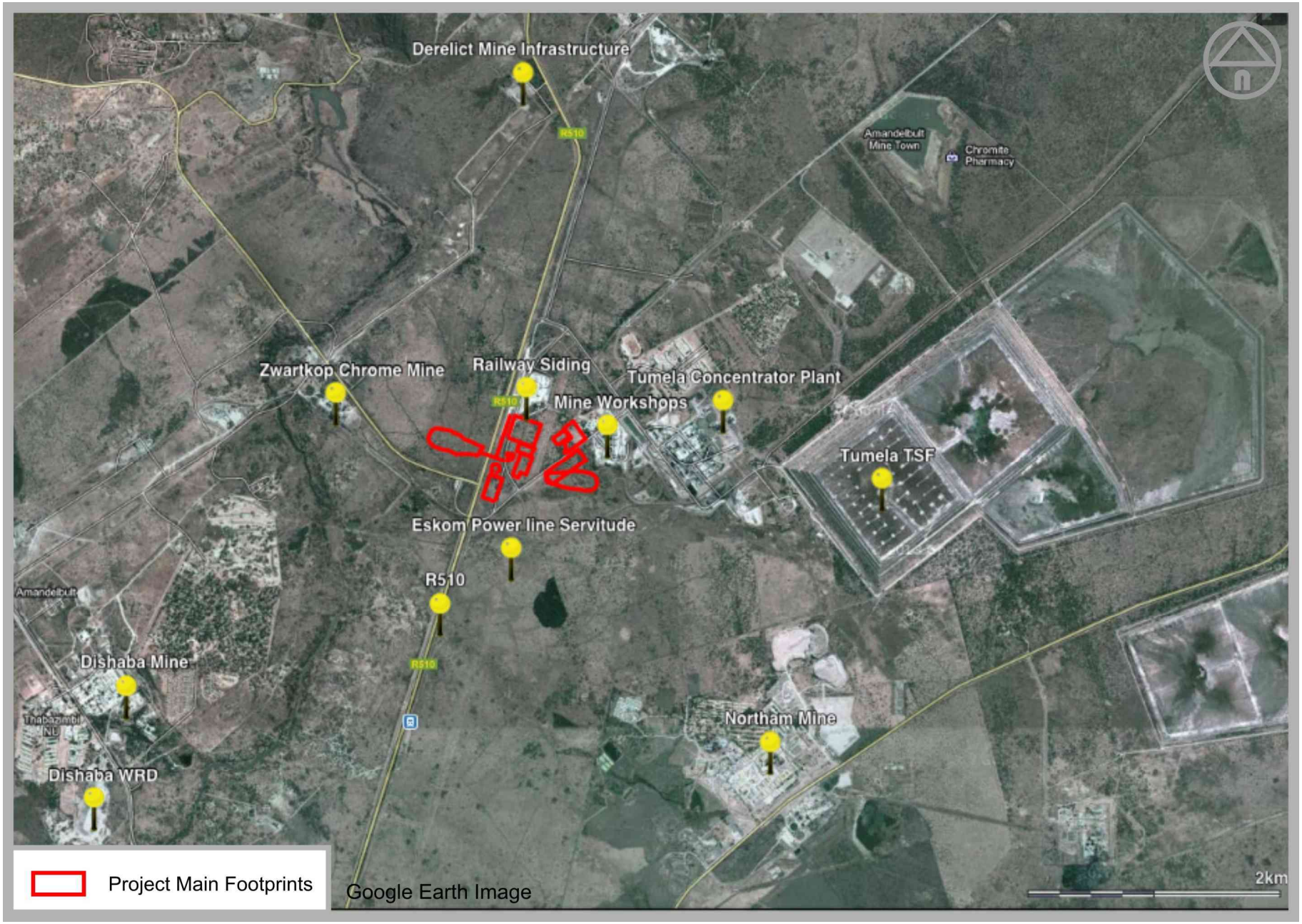



Figure 4: Local Landscape Context Feature Location Map

*Local Landscape Context*

The proposed project site is situated in a flat open plain, surrounded by distinctive low hills to the south and the Waterberg mountain range to the north. The main land use in the area is that of mining, but with agricultural, as well as tourism activities being created by the combination of the natural bushveld *vegetation and low surrounding terrain (See photo points in Figure 4: Local Landscape Context Feature Location Map).*

*Existing Mining Context*

The existing mining activities of the RPM, Amandelbult Section, comprises two mines, Tumela and Dishaba *See Figure 4: Local Landscape Context Feature Location Map.* It also includes a concentrator plant at which the ore extracted from the Dishaba and Tumela Mines is processed. The existing and proposed central shaft can be seen in *Figure 5: Layout Map of existing and proposed shaft sites*. AAP is the second-largest platinum mine in the world and life-of-mine is estimated to be in excess of 75 years *(www.miningweekly.com).*

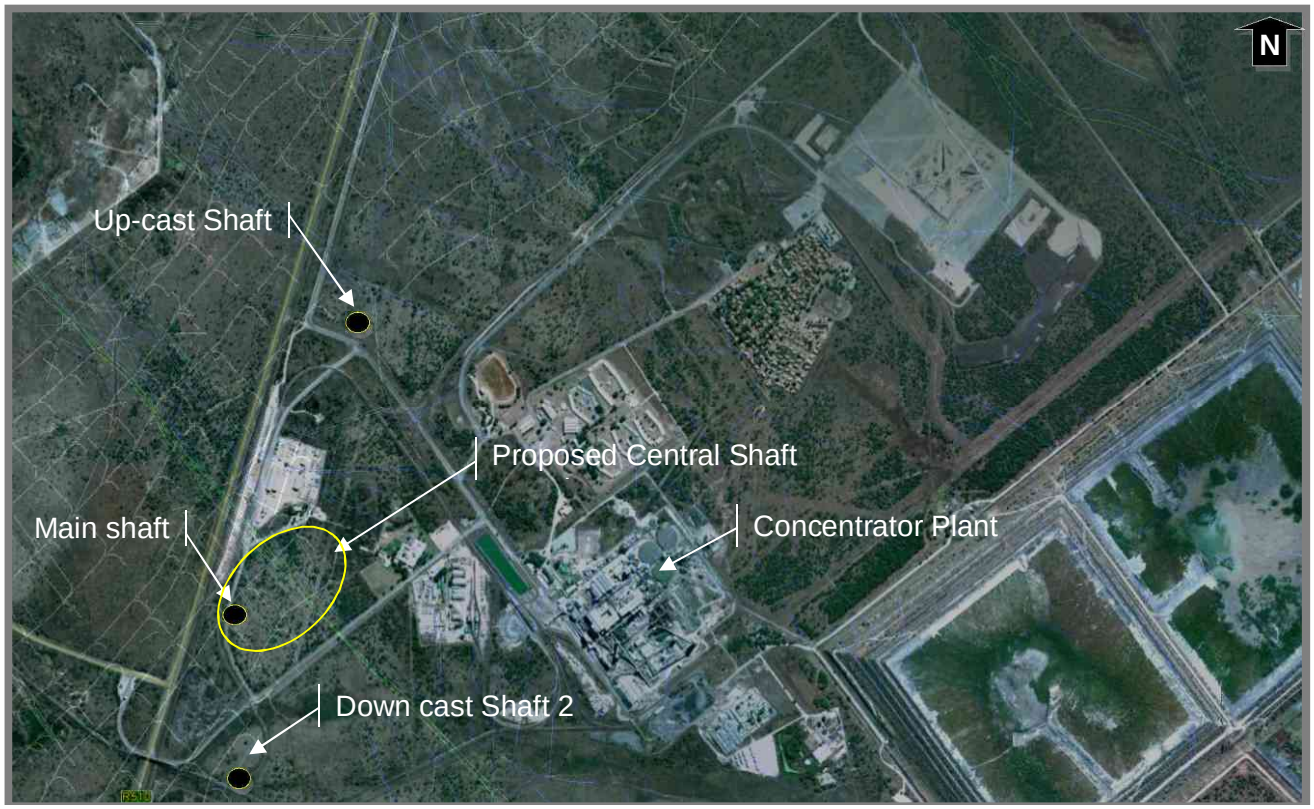



Figure 5: Layout Map of existing and proposed shaft sites

Figure 6: Existing Dishaba Amandelbult Mine shaft, Winching House and Silo infrastructure

Figure 7: View of Concentrator plant which is located adjacent the proposed mine site

Figure 8: South east view of the existing Tailings Storage Facility as viewed from the R510

Figure 9: Existing Tumela Mine Workshops with effective incorporation of trees to create natural shade area

*Surrounding Mining activity*

Northam Platinum is situated 3 km to the south east of the Amandelbult mines *(See Figure 4: Local Landscape Context Feature Location Map* Figure 4: *).* This surrounding mining infrastructure creates a strong mining sense of place within the foreground area of the proposed WRD sites. The viewshed of the existing Amandelbult WRD (40m in height) is extensive. There is derelect mining infrastructure 3 km north of the proposed site. The Zwartkop Chrome Mine is situated 1.2 km to the west of the proposed site.

Figure 10: Derelect Mining Infrastruture

Figure 11: Distant view of the Northam mine as seen from the R510

*Topography*

The overall mining area's elevation decreases in an easterly direction and is characterised with a gentle undulating topography ranging from 980 metres above mean sea level (mamsl) in the south-western boundary of the proposed project site, to 920 mamsl to the north-east. The proposed shaft is also situated on a relatively flat area with elevation decreasing in a westerly direction with a gentle slope ranging from 962 mamsl to 953 mamsl as depicted on the cross section in *Figure 12: Project site elevation map.*


Figure 12: Project site elevation map

The only other interesting landform in the surrounding areas is the conical shaped hills located 5 kilometres to the south of the proposed mine. These features add to the scenic quality of the R510.

Figure 13: The interesting conical shaped hills to the east of the site add value to the R510 scenic quality

*Vegetation*

A Vegetation Study undertaken by a WSP sub-consultant in 2007 indicated that the proposed project is situated within the Savannah Biome, which is characteristically comprised of a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near to the ground, the vegetation may be referred to as Shrubveld, where it is dense it is labelled Woodland, and the intermediate stages are locally known as Bushveld. An important component of the proposed project site location is the location of the Madeleine Robinson Game Reserve, which is owned by Amandelbult. *See Figure 14.* The Reserve is managed as a wildlife sanctuary and is situated to the south-west of the proposed Shaft. The Reserve covers an area of approximately 1 490 hectares (Ha). The Bierspruit River flows through the Reserve and is the main source of water for the wildlife *(WSP 2013).*

Figure 14: View towards Tumela Mine as seen from Madeleine Robinson Nature Reserve *(Source: www.panoramio/75837741)*

*Rivers*

Two water courses are situated near the proposed project area, namely the Bierspruit and Crocodile Rivers. The Bierspruit, a non-perennial stream, is located to the west of the mining area and flows in a northerly direction where it discharges into the Crocodile River. At its closest point the Crocodile River is 18 km to the north of the proposed project area. The Crocodile River is a perennial river situated to the east of the proposed Tumela Shaft where it flows in a north-westerly direction. This river is a source of water for the surrounding farm owners for irrigation purposes *(WSP 2013).*

*Other Land uses*

In terms of the proposed site for the proposed project, the immediate land use within the mine lease area is mining associated infrastructure and activities. The immediately surrounding area is comprised of general veld. Furthermore, there is also a game reserve adjacent to the proposed project area. The R510 constitutes the major public road and tourist route in the vicinity of the proposed project. The road runs in a north-south west direction of the proposed project connecting Northam to Thabazimbi. A number of farmlands are also located in the vicinity of the Tumela mine, primarily along the R510. The larger town of Thabazimbi is located approximately 25 km from the

proposed project site. The closest community to the proposed project site is Smash Block (also known as Schilpadnest) which is an informal settlement.

Figure 15: Eskom transmission line servitude which will also includes the Mdupi transmission lines

Figure 16: View of railway siding and mine yards as is visible from the R510

Figure 17: Local tourism in the area including private nature reserves and game farms

*Landscape Value*

There are some landscape features in the proposed project area which add to the scenic quality such as the surrounding vegetation, the three cone shaped koppies to the south of the proposed site and the trees lining the R510. However the mining context is clearly visible to the casual observers as seen from the R510 which include views of the Northam mine, the WRD, the existing mine shaft, the proposed silo, the existing Concentrator Plant as well as background views of the existing TSF. Due to the vegetation adjacent the R510, the views of the Tumela mine is partially screened where the viewer perceives the mining activities as being surrounded by vegetation. The partial views of mining activities should be maintained as much as possible to protect the current R510 receptor sense of place.

# 6 SITE LANDSCAPE CHARACTER

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points.

In terms of the VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change, and distance of the proposed landscape modification from key receptor points. The scenic quality is determined using seven key factors:

- **Land Form:** Topography becomes more of a factor as it becomes steeper, or more severely sculptured.
- **Vegetation:** Primary consideration given to the variety of patterns, forms, and textures created by plant life.
- **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
- **Colour:** The overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) are considered as they appear during seasons or periods of high use.
- **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.
- **Adjacent Land Use:** Degree to which scenery and distance enhance, or start to influence, the overall impression of the scenery within the rating unit.
- **Cultural Modifications:** Cultural modifications should be considered, and may detract from the scenery, or complement or improve the scenic quality of an area.

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined using the following factors:

- **Type of Users:** Visual sensitivity will vary with the type of users, e.g. recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen or used by large numbers of people are potentially more sensitive.
- **Public Interest:** The visual quality of an area may be of concern to local, or regional, groups. Indicators of this concern are usually expressed via public controversy created in response to proposed activities.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent lands. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be as visually sensitive.
- **Special Areas:** Management objectives for special areas such as Natural Areas, Wilderness Areas or Wilderness Study Areas, Wild and Scenic Rivers, Scenic Areas, Scenic Roads or Trails, and Critical Biodiversity Areas frequently require special consideration for the protection of their visual values.
- **Other Factors:** Consider any other information such as research or studies that include indicators of visual sensitivity.

The table below is utilised to define the VRM Classes that represent the relative value of the visual resources of an area:

i. **Classes I and II** are the most valued;
ii. **Class III** represents a moderate value; and
iii. **Class IV** is of least value.

This is undertaken making use of the matrix below developed by USA Bureau of Land Management (BLM) Visual Resource Management method as seen below, which is then represented in a visual sensitivity map.

| | | VISUAL SENSITIVITY LEVELS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | High | | | Medium | | | Low | | |
| SCENIC QUALITY | A (High) | II | II | II | II | II | II | II | II | II |
| | B (Medium) | II | III | III/ IV * | III | IV | IV | IV | IV | IV |
| | C (Low) | III | IV | IV | IV | IV | IV | IV | IV | IV |
| DISTANCE ZONES | | Fore/middle ground | Background | Seldom seen | Fore/middle ground | Background | Seldom seen | Fore/middle ground | Background | Seldom seen |

*(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)*

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Ten locations, which are associated with the various proposed project activities, were surveyed during the field study to determine scenic quality, receptor sensitivity to landscape change and distance from nearest receptors. See Figure 18: Survey Point Locality Map. Making use of the ASTGTM survey data, a terrain model was generated for the area around the proposed project activity and using the viewshed the receptors for each activity were identified. KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations, or receptors, surrounding the property. The DoC generated by the proposed landscape modifications is measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible *(USA Bureau of Land Management, 2004)*.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation;
- Number of viewers;
- Length of time the project is in view;
- Relative project size;
- Season of use;
- Critical viewpoints, e.g. views from communities, road crossings; and
- Distance from property.

The following activities were assessed:

- WRD Alt 1;
- WRD Alt 2;
- Headgear, Compressor and Winder house structures;
- Stockpile;
- Silos;
- Water reservoir;
- Substation;
- Railway shunting and stores; and
- Office structures and parking areas.


Figure 18: Survey Point Locality Map

Table 1: Site Visibility, Zone of Visual Influence and Exposure Table

| Activity | Landuse | Viewshed | Motivation | Zone of Visual Influence | Motivation. | Exposure | Motivation. |
|---|---|---|---|---|---|---|---|
| WRD Alt1 | Open ground within private nature reserve. | High | Exceeds height of adjacent vegetation. | Low | Location removed from adjacent mines. Height of the proposed activity would exceed the height of surrounding vegetation. | High | Adjacent R510 |
| WRD Alt2 | Open ground | High | Height of WRD dominates above adjacent bush veld and flat surrounding terrain. | High | Adjacent mine concentrator plant is large in form and colour contrast. TSF in background is similar in colour and size to proposed WRD. | Medium | R510 located approx. 0.5 km to west. |
| Stockpile | Open ground | High | Exceeds height of adjacent vegetation. | Medium | Rail, powerline, road and mine process plant in mid ground. | High | Adjacent R510 |
| Silos | Open ground | High | Exceeds height of adjacent vegetation. | Medium | Rail, powerline, road and mine process plant in mid ground. | High | High exposure to R510 receptors. |
| Headgear | Open ground | High | Exceeds height of adjacent vegetation. | Medium | Rail, powerline, road and mine process plant in mid ground. | High | Adjacent R510 |
| Water reservoir | Rubble dump and footpath | Medium | Contained by adjacent trees and rise of bridge to the south. | Medium | Close to rail and Eskom transmission lines. | High | Adjacent R510 |
| Offices and parking | Modified ground and bush veld | Medium | Adjacent medium sized trees offer some screening. | High | Adjacent mine concentrator plant is large in form and colour contrast. TSF in background is similar in colour and size to proposed WRD. | Medium | R510 located approx. 0.5 km to west. |
| Railway shunting and stores | Open ground and transport corridor | High | Even though project low profile, elevated ground is open to west | Medium | Adjacent rail yards and infrastructure offers some contrast but low profile. | High | High exposure to R510 receptors. |
| Substation | Open ground | Medium | Base views screened by adjacent trees. | High | Adjacent trees and road, mine plant in background. | Medium | Screening from most receptors. |

Table 2: Site Scenic Quality Table

| Activity | Landform | Vegetation | Water | Colour | Adj. Scenery | Scarcity | Cultural Modification | Total | Scenic Quality | Motivation |
|---|---|---|---|---|---|---|---|---|---|---|
| WRD Alt1 | 1 | 3 | 1 | 2 | 2 | 3 | 0 | 12 | B | Scenic quality is rated *moderate*. Some value is added from the vegetation which includes some medium to large trees. As the site is currently a private nature reserve, the scarcity value is increased. Cultural modifications are currently limited to small access tracks. |
| WRD Alt2 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 8 | C | The scenic quality is rated *low* due to limited variation in terrain and vegetation and the close proximity to the mine concentrator plant and TSF. |
| Stockpile | 1 | 2 | 1 | 2 | 1 | 1 | -2 | 6 | C | Rating is *low* for scenic quality due to flat terrain, not views of water and limited colour variation. Close proximity to powerlines and Concentrator plant decrease value. |
| Silos | 1 | 2 | 1 | 2 | 1 | 1 | -2 | 6 | C | The scenic quality was rated *low* due to the transformed nature of the site and very close proximity to the existing railway shunting yard and mine stores. |
| Headgear | 1 | 2 | 1 | 2 | 1 | 1 | -2 | 6 | C | Rating is *low* for scenic quality due to flat terrain, no views of water and limited colour variation. Close proximity to powerlines and concentrator plant decrease the value. |
| Water reservoir | 1 | 2 | 1 | 2 | 1 | 1 | -4 | 4 | C | As per the headgear rating but with a higher negative value for cultural modification due to the site being utilised as a rubble dump. |
| Offices and parking | 1 | 2 | 1 | 2 | 1 | 1 | -2 | 6 | C | As per the WRD Alt 2 rating but with high negative rating for cultural modifications as the site is currently transformed and includes mine structures. |
| Railway shunting and stores | 2 | 2 | 1 | 2 | 1 | 1 | -2 | 7 | C | The scenic quality is rated *low* due to the transformed nature of the site and very close proximity to the existing railway shunting yard and mine stores. |
| Substation | 1 | 2 | 1 | 2 | 1 | 1 | -2 | 6 | C | As per the headgear rating. |

Table 3: Receptor Sensitivity Table

| Photo Point | Type Users | Amount of use | Public interest | Adj. land users | Special areas | Receptor sensitivity | Motivation |
|---|---|---|---|---|---|---|---|
| WRD Alt1 | Medium | High | Medium | Medium | High | Medium to High | Close proximity to the R510 which carries some tourist traffic and has high usage. Due to current private reserve status of site, special area is rated as *high* and adjacent land users is higher as the natural vegetation increases the scenic quality. |
| Headgear | Medium | High | Low | Medium | Low | Medium | Views of the Headgear will be related to existing views of the mine concentrator plant in the background which would moderate receptor sensitivity. |
| Stockpile | Medium | High | Low | Low | Low | Medium | As for Headgear. |
| Water reservoir | Medium | High | Low | Low | Low | Medium | As for Headgear. |
| Substation | Medium | Low | Low | Low | Low | Medium | As for Headgear. |
| Railway shunting and stores | Medium | High | Low | Medium | Low | Medium | As for Headgear. |
| Silos | Medium | High | Low | Medium | Low | Medium | As for Headgear. |
| WRD Alt2 | Medium | High | Low | Medium | Low | Medium | As for Headgear. |
| Offices and parking | Medium | High | Low | Medium | Low | Medium | As for Headgear. |

## 6.1 Zone of Visual Influence (ZVI)

All of the sites surveyed, with the exception of the northern section of the office buildings and associated parking, were situated on open ground with existing limited landuse. Areas allocated to proposed office buildings and parking sites have been transformed into a playing field and office buildings. The proposed WRD Alt1 site is located in the Madeleine Robinson Game Reserve, which is owned by the mine. *See Table 1: Site Visibility, Zone of Visual Influence and Exposure Table*.

The viewshed generated by the taller proposed landscape modifications will be *high.* This extensive viewshed is due to the height of the proposed structures exceeding the height of the bushveld type vegetation. Existing trees on the perimeter of the proposed sites would offer some mitigation to R510 receptors. The landscape modifications of a lower height: the water reservoir, the substation and office structures, will generate a *moderate* viewshed. A combination of localised trees adjacent to the R510 would produce a *moderate* visual intrusion.

Due to their location being in close proximity to the R510, the main proposed mining infrastructure and structures will have *high* exposure levels to the R510 receptors. The WRD Alt 2, the substation and office complex will have *moderate* levels of exposure.

The ZVI for the proposed project will range between *moderate to high,* with the exception of the WRD Alt 1 which will have a low ZVI. The main mining landscape modifications will have a *moderate* ZVI. This is because of their being situated further from the existing high contrast generating landscape of the concentrator plant and TSF. The proximity of the proposed silos and shunting yard to the existing shunting yard would reduce the degree of contrast but only to a *moderate* degree as the size and scale of the proposed landscape modifications would exceed the contrast generated by the existing railway station. The location of the proposed WRD Alt 2 to the west of the road away from the existing concentrator plant and the existing TSF, reduces the ZVI for this proposed landscape modification. The view to the west in the direction of the Alt 2 WRD does not currently include mining landscape in the fore or middleground.

## 6.2 Scenic Quality

For all sites surveyed the scenic quality was found to be *low* due to the close proximity of the proposed sites to existing large scale mining landscapes. In most cases the land is modified to some degree. Areas adjacent to the R510 are in close proximity to the railway line, with rubble dumped on site and clear views of the existing railway shunting yard. The proposed WRD Alt 1 is located to the west of the road and has *moderate* scenic quality levels due to the site having more intact natural vegetation and more prolific trees. Existing cultural modifications are limited as the site is currently utilised as a private nature reserve. This factor also influences the scarcity factor which is rated *higher* as the area does add value to the surrounding landscape character by virtue of the site not being associated with mining activity. *See Table 2: Site Scenic Quality Table*.

## 6.3 Receptor Sensitivity

The R510 is an important tourist route and local spatial planning has identified that tourism is an import factor in the local and regional economy. However, due to the existing mining context created by the Concentrator, the TSF, the headgear and existing WRD, the receptor sensitivity to landscape change iss rated as *moderate*. Receptor sensitivity to the proposed WRD Alt 2 site was rated as *moderate to high* as landscape will change. The current “private reserve” status of the site acts as a buffer zone to the background mining landscapes and benchmarks the natural vegetation sense of place. *See Table 3: Receptor Sensitivity Table*.

## 6.4 Visual Resource Management and KOPs

Table 4: VRM Table

| Photo Point | Visual Inventory | Visual Resource | Motivation |
|---|---|---|---|
| WRD Alt1 | Class III | Class III | Moderate scenic quality levels with high exposure to moderately sensitive receptors. |
| WRD Alt2 | Class IV | Class IV | Moderate to low scenic quality with moderate exposure to low sensitivity receptors. |
| Headgear | Class IV | Class III | Low scenic quality with high exposure to medium sensitivity receptors. |
| Stockpile | Class IV | Class III | Low scenic quality with high exposure to medium sensitivity receptors. |
| Water reservoir | Class IV | Class III | Low scenic quality with high exposure to medium sensitivity receptors. |
| Substation | Class IV | Class IV | Low scenic quality with medium exposure to medium sensitivity receptors. |
| Railway shunting and stores | Class IV | Class III | Low scenic quality with high exposure to medium sensitivity receptors. |
| Silos | Class IV | Class III | Low scenic quality with high exposure to medium sensitivity receptors. |
| Offices and parking | Class IV | Class IV | Low scenic quality with medium exposure to medium sensitivity receptors. |

A visual objective was defined for each site surveyed based on the scenic quality, receptor sensitivity to landscape change and distance from receptors. Due to the existing modified nature of most of the sites and the lack of significant natural resources, no Class I or Class II areas were defined. A Class III visual objective was defined for the proposed headgear, stockpile, water reservoir, railway shunting yards, stores and the silos in order to protect the visual resources of the R510 view corridor. The Class III objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be *moderate*. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.*See Table 4: VRM Table*

A Class IV objective was defined for the proposed WRD Alt 2, the substation, the office and parking, as these areas are in close proximity to the existing concentrator plant and are further away from the R510. The visual objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be *high*, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

# 7 CONTRAST RATING AND PHOTO MONTAGES

The assessment of the DoC is a systematic process undertaken from KOPs surrounding the proposed project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications. KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the DoC that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations, or receptors, surrounding the property. The DoC generated by the proposed landscape modifications is measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible *(USA Bureau of Land Management, 2004)*.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation;
- Number of viewers;
- Length of time the proposed project is in view;
- Relative proposed project size;
- Season of use;
- Critical viewpoints, e.g. views from communities, road crossings; and
- Distance from property.

Making use of the above criteria, the following receptor locations were identified, as indicated in the map below:

- R510 Northbound; and
- R510 Southbound.

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform Interested and Affected persons (I&APs) and decision-making authorities of the nature and extent of the impact associated with the proposed project. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In this regard, VRM Africa subscribes to the proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) *(Sheppard, S.R.J., 2005)*. *See Annexure 3: Methodology for further details.* This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information;
- Accuracy;
- Legitimacy;
- Representativeness;
- Visual Clarity; and
- Interest.

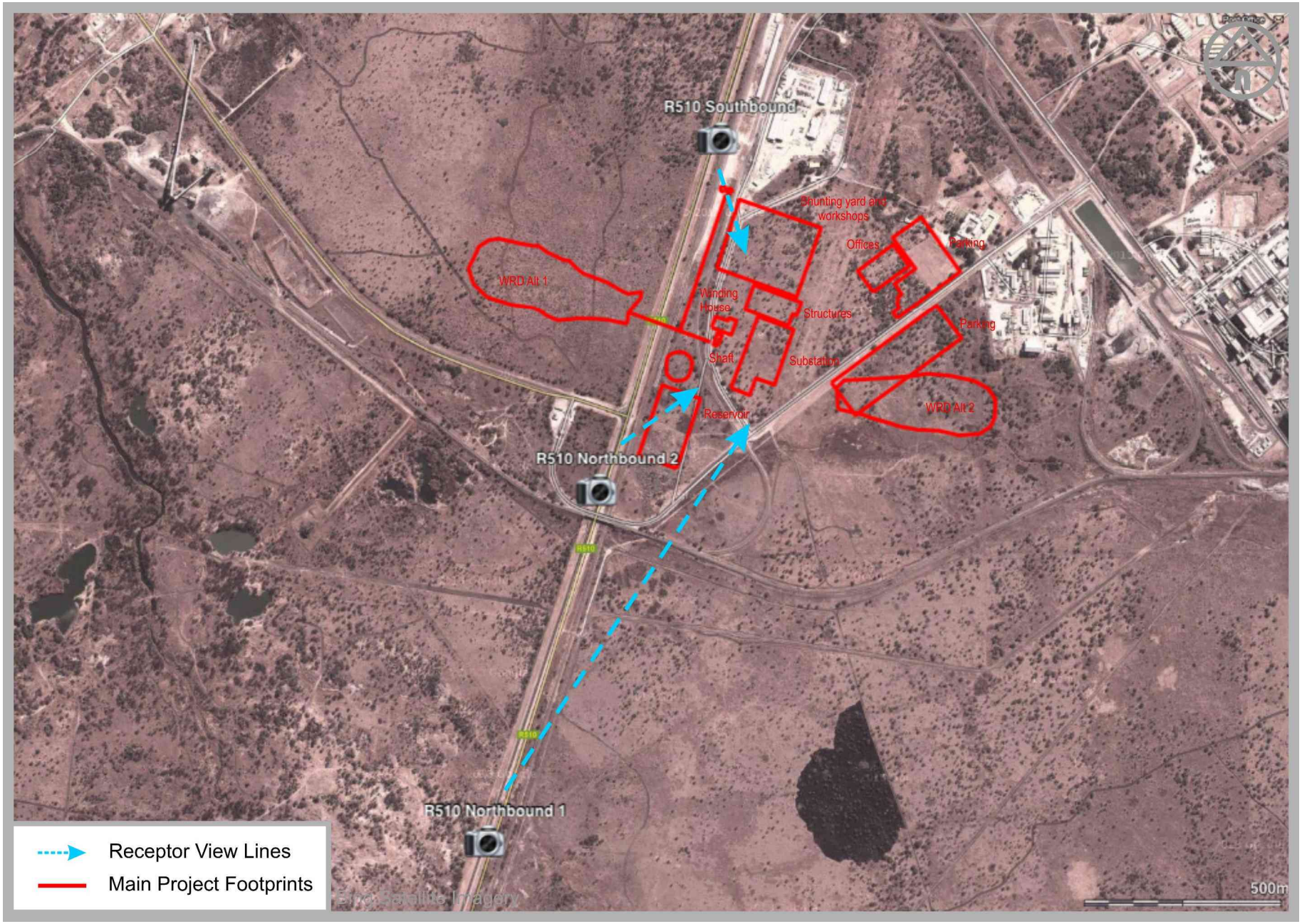
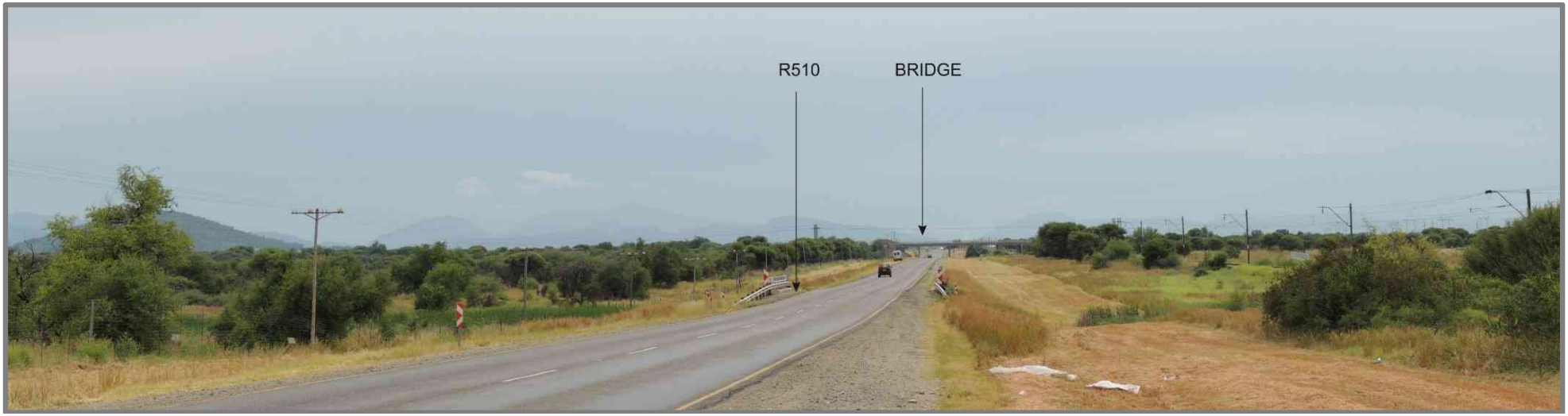



Figure 19: Receptor Key Observation Point Locality Map




Existing view from R510 northbound


Photomontage of proposed development ***(Mine infrastructure not indicated)*** **For illustrative purposes only**

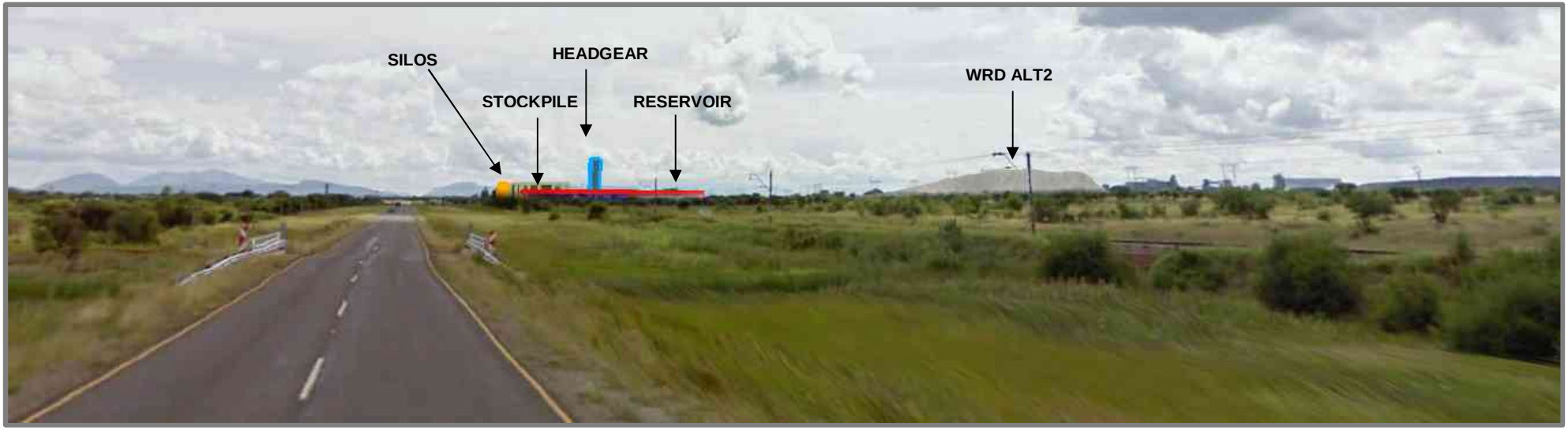
Figure 20: Photomontage Alt 1 WRD: View 1 from R510 Northbound (850 m)


Existing view from R510 northbound


Photomontage of proposed development ***(Mine infrastructure not indicated)*** **For illustrative purposes only**

Figure 21: Photomontage Alt 1 WRD: View from R510 Southbound (700 m)

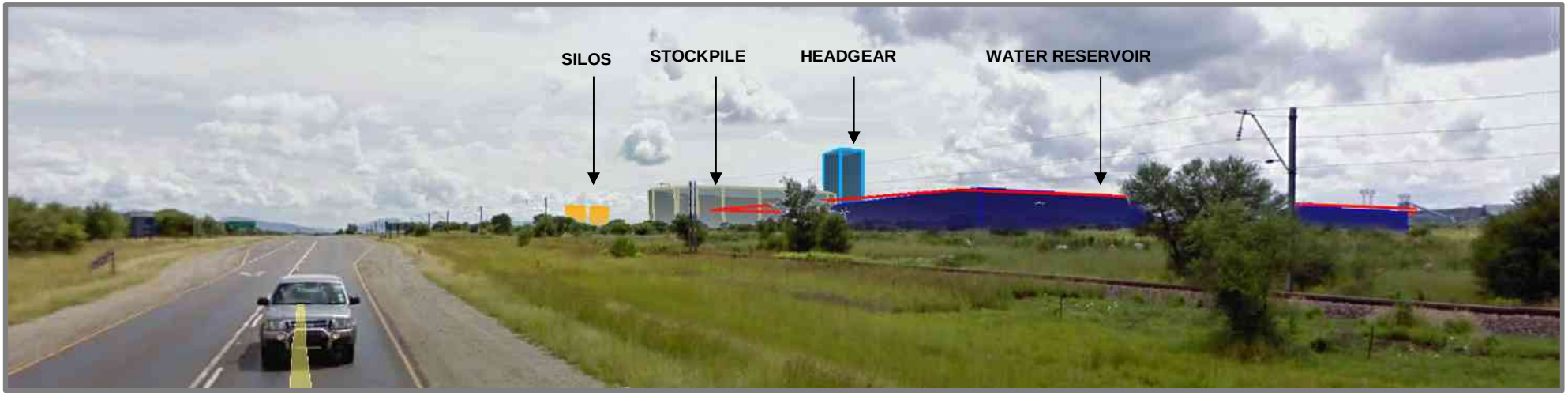
Existing view from R510 northbound 1




Photomontage of proposed development ***(Mine block models only)*** **For illustrative purposes only**

Figure 22: Photomontage Alt 2: View from: R510 northbound 1 (1.3 km)

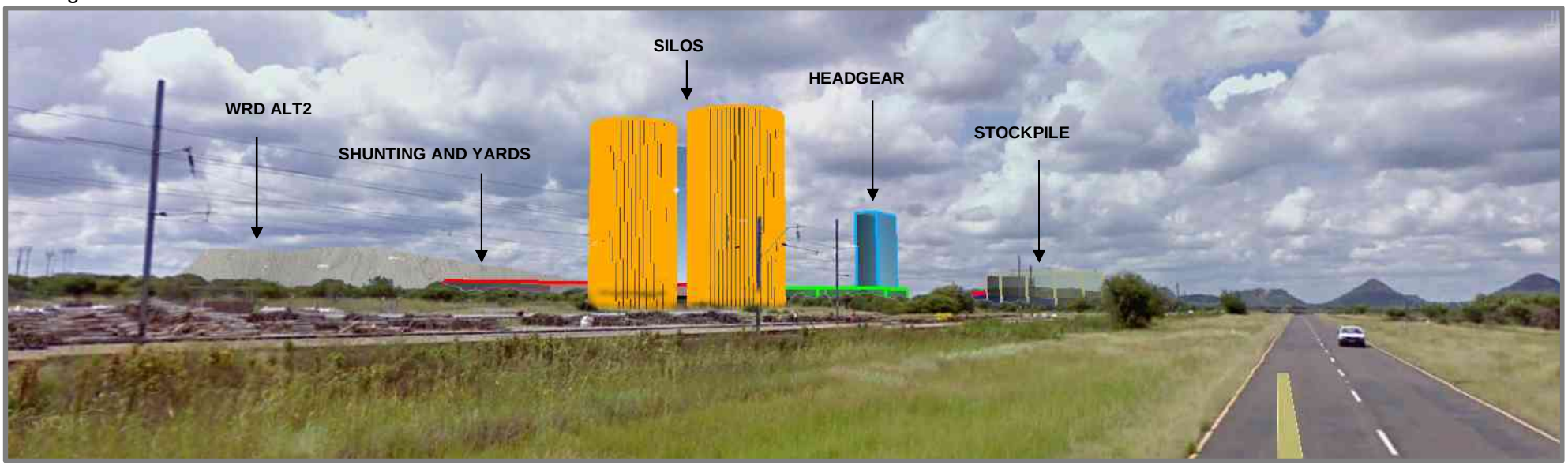
Existing view from R510 northbound




Photomontage of proposed development ***(Mine block models only)*** **For illustrative purposes only**

Figure 23: Photomontage Alt 2: View from: R510 northbound 2 (400 m)

Existing view from R510 southbound




Photomontage of proposed development ***(Mine block models only)*** **For illustrative purposes only**

Figure 24: Photomontage Alt 2: View from: R510 southbound (400m)

# 8 IMPACT ASSESSMENT

Impact, as defined by South Africa's Department of Environmental Affairs and Development Planning's (DEA&DP) Guideline for involving Visual and Aesthetic Specialists in Environmental Impact Assessment (EIA) processes (2005), is: 'A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space' *(Oberholzer. 2005)*.

## 8.1 Contrast Rating

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed. The suitability of landscape modification is assessed by measuring the DoC of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- **None** : The element contrast is not visible or perceived.
- **Weak** : The element contrast can be seen but does not attract attention.
- **Moderate** : The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** : The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

## 8.2 Anglo Platinum Impact Rating Matrix

The Environmental Impact Rating was undertaken according the Anglo Platinum's 5 x 5 Impact Rating Matrix utilised to determine the significance of the potential impact as a result of the proposed project. These rating criteria are further explained in *Annexure 3: Methodology.*

## 8.3 WRD Alt 1

The proposed WRD would be created over a long period of time, making use of an inclined conveyor belt which would be raised to a maximum height of 40m and then extended parallel to the ground. The resultant constructed shape would be an inclined wedge which would merge into a horizontal rectangle. Based on visual images of the existing WRD, the colour would be a mid-grey and the texture rough. The construction phase would merge with the operational phase without any distinct segregation in activity, and the raising of the platform would take many years. The diagonal line created by elevated dump would be moderated by the diagonal lines created by the TSF in the background. The grey colour, rough textures and block form of the proposed WRD would generate *strong* levels of contrast against the green colours and smooth textures of the mountains and cone-shaped forms of the background hills. Further to the north the views of the site are screened from the receptors travelling south on the R510 by the medium to large sized trees adjacent to the road. However, closer to the proposed project site, as indicated in the photomontage, a gap in the tree line appears which allows clear views of the site and of the proposed landscape modification. Early planting of trees in this gap area will allow the trees to grow to a suitable screening height by the time the activity occurs. The trees along the road would also add to the existing wilderness sense of place which occurs along many sections of this road. *See Figure 20 and Figure* 21 *and photographs and viewshed of proposed site in Annexure 1.*

A Class III visual objective was defined for the site to protect the R510 scenic resources. A contrast rating from the R510 north and southbound found that the proposed form, line, colour and texture would exceed the *moderate* levels of landscape change required to maintain the existing landscape character with or without mitigation. The risk would be *almost certain* with *moderate* consequence. Without mitigation the significance would be ***high*** but could be reduced to ***medium*** with mitigation.

*Construction*

- Stockpile of topsoil;
- Berm along R510 and rehabilitation;
- Plant trees along R510;
- Dust control measures; and
- Limit clearing to phase of construction to reduce dust.

*Operation:*

- Ongoing rehabilitation of lower sections of the WRD to veld grasses.

*Closure:*

- Rehabilitation and restoration;
- Remove all structures not required; and
- Reshape any heaps to allow for natural runoff.

### 8.4 WRD Alt 2

The WRD Alt 2 is situated east of the R510. Its exposure is *moderate* as there is some distance between receptors and the proposed project. Visibility is *high* as the proposed height exceeds the surrounding landscape or structures in relatively flat terrain. The ZVI is *moderate* due to the closer proximity to existing TSF which form a backdrop to all receptor views. Receptors would be the R510 northbound and southbound. *See Figure 22, Figure 23 and Figure 24 and photographs and viewshed of proposed site in Annexure 1.*

*Moderate* levels of contrast are generated by the line, colour, texture and form contrast. The strong diagonal line is moderated by the diagonal lines of linear perspective created by the parallel road. These meet at a focal point where the road meets the horizon line. Some moderation of the horizontal nature of the WRD form is created by the railway siding structures which are also horizontal in shape. The planting of screening trees on the side of the road could effectively mitigate the stronger contrast elements. This would effectively improve overall landscape character, as they would screen off the views of the railway siding, which also currently generates high levels of visual contrast as seen from this location. The advantage of this location is that the *high* levels of contrast generated by the proposed conveyor bridge would not take place and the WRD would be located in the area more strongly associated with mining infrastructure and man-made structures/landscapes.

The WRD Alt 2 is situated in an area with a Class IV VRM rating due to its close proximity to the existing mine concentrator plant and the TSF. The Visual Objectives would therefore be met. The risk would be *possible* and the consequence would be *minor.* Without mitigation the significance would be ***medium*** but would be reduced to ***low*** with mitigation.

*Preconstruction*

- Plant indigenous endemic trees along the R510 as indicated on the mitigation map in Figure 10. Assess the possibility of transplanting the existing acacia trees from the construction footprint areas;
- Re-align the WRD slightly to the north so as to evade the drainage line to the south; and
- Retain as many of the existing acacia trees located on the site peripheries to increase screening of the base views of the proposed landscape modification.

*Construction*

- Control dust in areas cleared of vegetation; and

- Stockpiling of topsoil during construction for use later in facilitating plant growth on the side of the WRD as well as implementing dust control measures.

*Operation*

- Expand existing dust control measures to include the proposed WRD*;* and
- Undertake plant regrowth trials on initial lift of the WRD to inform rehabilitation plan to plant veld grasses (or similar indigenous) onto the sides of the WRD operating from the ground.

*Closure*

- Rehabilitate and restore the footprint areas created by bridge and conveyor;
- Remove the conveyor on the WRD and associated infrastructure;
- Shape remains of the stockpile; and
- Continue with WRD and stockpile remains rehabilitation plan including accessing the upper sections of the WRD.

### 8.5 Stockpile

The stockpile is situated adjacent to the R510 alongside the water storage reservoir. Its exposure is *high* as it is directly adjacent to the R510. Visibility is *high* as its height exceeds the surrounding landscape or structures in relatively flat terrain. The ZVI is *moderate* due to its closer proximity to the existing TSF which forms a backdrop to all receptor views. Receptors would be the R510 northbound and southbound.

As with the WRDs, the stockpile would be created in a similar method, with an inclined conveyor, but would differ in that the height and the extent of the platform would be considerably smaller and would only be raised to approximately 20 m above ground level. As seen from the southbound key observation points, the stockpile would be effectively screened by the trees adjacent to the road. The diagonal lines created by the fully formed stockpile would be effectively moderated by the similar lines of the cone-shaped hills in the background. At close proximity, without mitigation the form would generate *strong* levels of contrast and would dominate the landscape character. Early planting of indigenous and endemic trees would allow for the massing of this landscape modification to be effectively mitigated.

The stockpile has a Class III VRM rating in order to protect the visual resources of the R510 view corridor. Due to *strong* contrast generated by the diagonal lines and the grey colour of the wedge shaped form, the visual objectives would not be met unless trees were planted adjacent the eastern side of the R510 as screening mitigation. The risk would be *almost certain* and the consequence would be *moderate.* Without mitigation the significance would be ***high*** but would be reduced to ***medium*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*
Mitigations as per WRD Alt 2.

### 8.6 Silos

The proposed silos are situated on open ground which has a *moderate* Visual Absorption Capacity. (VAC) They will generate a *high* viewshed. It is situates in the foreground view of the R510 receptors. The scenic quality of the area is *low* with no outstanding features.

The proposed silo site was defined as having a Class III rating in order to protect the visual resources of the R510.The R510 is a main view corridor and tourist route through the Limpopo province to Botswana. There are also many nature reserves and tourist attractions located in the area which would be accessed via this route.

The contrast created by the line, colour and texture would be *strong.* The large form/nature of the silos would generate strong colour and line contrast to the R510 receptors located in close proximity. They are strongly vertical forms in a predominantly horizontal landscape. The Class III Visual Objectives defined for the site would therefore not be met *with or without mitigation*. The risk would be *almost certain* and the consequence would be *moderate to high* as the context is already strongly

associated with mining landscape. Without mitigation the significance would be *high* and would remain *high* with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site;
- Retain as many of the existing acacia trees located on the site peripheries to increase screening of the base views of the proposed landscape modification;
- Dust control during site clearing;
- Retain rough cement finish; and
- No signage on the structure.

*Operation:*

- Ensure continued growth of screening trees adjacent the road; and
- Light exposure management.

*Closure:*

- Removal and re-use/recycling of all structures;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

### 8.7 Headgear

The shaft headgear will be constructed from steel and will rise approximately 52m from the ground surface. The headgear will be developed according to the A-frame box type construction design. It has *high* exposure as it is directly adjacent the R510. Visibility is *high* as the proposed height exceeds surrounding landscape vegetation or structures in a relatively flat terrain. The ZVI is *moderated* by the close proximity of the railway and R510 infrastructure, bridge and railway shunting yard. The headgear site was given a Class III visual objective in order to protect the visual resources of the R510 view corridor. *Strong* line and texture contrasts would be generated by the proposed landscape modification which would be visible to a large surrounding area. Visual objectives could only be partially met with mitigation, which includes the planting of screening trees adjacent the R510 on the east side. This would offer some screening to the base views of the structure. The risk would be *almost certain* and the consequence would be *moderate,* as the landscape context is already strongly associated with mining activities. Without mitigation the significance would be ***high*** but would be reduced to ***medium*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1..*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site;
- Retain as many of the existing acacia trees located on the site peripheries to increase screening of the base views of the proposed landscape modification;
- Dust control during site clearing;
- Retain rough finish and paint mid-grey; and
- No signage on the structure.

*Operation:*

- Ensure continued growth of screening trees adjacent the road; and
- Management of lighting during night time operation.

*Closure:*

- Removal and recycling of all structure;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

### 8.8 Compressor and Winder house structures

The compressor and winder house supply compressed air to power various sections of the Tumela mine. It has *high* exposure as it is adjacent the R510. Visibility is *moderate* as there is partial screening from existing trees adjacent to the road. The ZVI is *moderate* due to its close proximity to the station, the bridge and background views of the concentrator plant and TSF. Receptors would be the R510 northbound and southbound. The compressor and winder house structures would have a Class III VRM rating in order to protect the visual resources of the R510 view corridor. The Visual Objectives would therefore be met *with mitigation*. The risk would be *likely* and the consequence would be *moderate.* Without mitigation the significance would be ***high*** but would be reduced to ***medium*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site.
- Retain as many of the existing acacia trees located on the site peripheries to increase screening of the base views of the proposed landscape modification.
- Dust control during site clearing.
- Paint structures mid-grey colour
- No signage on structure.

*Operation:*

- Ensure continued growth of screening trees adjacent the road.
- Light management during night time operations

*Closure:*

- Removal and recycling of all structure.
- Shaping to allow natural runoff.
- Rehabilitation and restoration to veld grasses.

### 8.9 Water reservoir

The proposed water reservoir is situated on an existing rubble dump and footpath and has a *moderate* VAC and a *moderate* viewshed. A Class III visual objectives was defined for the site in order to protect the R510 visual resources. The Visual Objectives would therefore be met *with mitigation* which would entail the construction of a 4 metre berm between the site and the R510 which would be planted with screening vegetation. The risk would be *likely* and the consequence would be *moderate.* Without mitigation the significance would be ***high*** and would be reduced to ***low*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site;
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification; and
- Construction of a four metre berm between the site and the R510 and rehabilitation of berm to veld grasses and small bushes (endemic and indigenous). *(See Figure 25: )*

*Operation:*

- N/A

*Closure:*

- Removal and recycling of all structure;
- Shaping to allow natural runoff (excluding the mitigation berm) unless it should become unstable from removal of the concrete retaining wall, in which case the eastern side should be stabilised and rehabilitated); and
- Rehabilitation and restoration to veld grasses.

## 8.10 Workshops

The workshops are a large factory like structure which will have *moderate* exposure as there is some distance between receptors and proposed project. Visibility is *moderate* as there is partial screening from existing trees adjacent to the road. The ZVI is *low* due to the similar contrast created by existing railway yard structures and concentrator plant structures. Receptors would be the R510 northbound and southbound. The workshops would have a Class III VRM rating in order to protect the visual resources of the R510 view corridor. The Visual Objectives would therefore be met *with mitigation*. The risk would be *possible* and the consequence would be *moderate.* Without mitigation the significance would be *high* but would be reduced to *low* with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site;
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification;
- Dust management; and
- Incorporating trees into design.

*Operation:*

- N/A

*Closure:*

- Removal and re-use/recycling of all structures;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

## 8.11 Office structures and Parking

The proposed office and building infrastructure for the Tumela mine will have *moderate* exposure as there is some distance between receptors and proposed project. Visibility is *low* as they are of a low height to receptors which increases the effectiveness of vegetation screening. The ZVI is *low* due to the similar contrast created by existing railway yard structures and concentrator plant structures. Receptors would be the R510 northbound and southbound. The workshops would have a Class IV VRM rating as the proposed site is in close proximity to the existing mine workshops. The Visual Objectives would therefore be met *with mitigation* in order to maintain best environmental practice. The risk would be *unlikely* and the consequence would be *minor.* Without mitigation the significance would be ***low*** and would remain ***low*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site;
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification;
- Dust management; and
- Incorporating trees into design.

*Operation:*

- N/A

*Closure:*

- Removal and recycling of all structure;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

### 8.12 Railway shunting yard

The railway shunting and yards are used to move, separate or join railway trucks. They will have a *moderate* exposure as there is some distance between receptors and proposed project. Visibility is *low* as they are of a low height in relation to distance to receptors which increases the effectiveness of vegetation screening. The ZVI is *low* as the proposed yard is in close proximity to railway line infrastructure. Receptors would be the R510 northbound and southbound. The workshops would have a Class III VRM rating in order to protect the visual resources of the R510 view corridor. The Visual Objectives would therefore be met. The risk would be *unlikely* and the consequence would be *minor.* Without mitigation the significance would be ***low*** and would remain ***low*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Screening tree planting alongside the R510, assessing the possibility of transplanting the existing medium sized acacia trees from the site; and
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification.

*Operation:*

- N/A

*Closure:*

- Removal and re-use/recycling of all structure;
- Shaping to allow natural runoff;and
- Rehabilitation and restoration to veld grasses.

### 8.13 Conveyors

The proposed conveyor and conveyor bridge will be a metal structure clad in sheet metal. Its exposure is *high* as it is directly adjacent to the R510. Visibility is *high* with direct views as the conveyor crosses the R510. The ZVI is *moderate* due to its close proximity to the bridge. Receptors would be the R510 northbound and southbound. The conveyor has a Class III VRM rating in order to protect the visual resources of the R510 view corridor. The Visual Objectives would therefore be met with mitigation.

*Conveyor Alt 1:*

The risk would be *almost certain* and the consequence would be *moderate to high* as the conveyor would cross over the R510*.* Without mitigation the significance would be ***high*** but would be reduced to ***medium*** with mitigation. These would include being painted a mid-grey colour and having no signage.

*Conveyor Alt 2:*

The risk would be *rare* and the consequence would be *insignificant* as the conveyor would be visually absorbed into the mine working. Without mitigation the significance would be ***low*** and would remain ***low*** with mitigation.

*Construction*

- Painting surface materials a mid-grey colour and having no signage; and
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification.

*Operation:*

- N/A

*Closure:*

- Removal and re-use/recycling of all structure;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

## 8.14 Substation

The Electrical substation and Eskom transmission lines will have *moderate* exposure as there is some distance between receptors and proposed project. Visibility is *moderate* due to the partial screening offered by the trees on the side of the road, as well as by the proposed mine structures. The ZVI is *low* and it would be screened from receptors by proposed mine structures. Receptors would be the R510 northbound and southbound. The workshops would have a Class IV VRM rating as the ZVI is low and the bulk of the substation would be screened from R510 views by the proposed mine works. The Visual Objectives would therefore be met. The risk would be *possible* and the consequence would be *moderate.* Without mitigation the significance would be ***high*** but would be reduced to ***low*** with mitigation. *See photographs and viewshed of proposed site in Annexure 1.*

*Construction*

- Painting structures a mid-grey colour; and
- Retain as many of the existing acacia trees located on the site periphery to increase screening of the base views of the proposed landscape modification.

*Operation:*

- N/A

*Closure:*

- Removal and recycling of all structure;
- Shaping to allow natural runoff; and
- Rehabilitation and restoration to veld grasses.

Table 5: Impact Summary Table

| Project component | Description | Height (m) | VRM Class | Motivation | Visual Objectives? | Likelihood | Consequence | Significance without mitigation. | Significance with mitigation. |
|---|---|---|---|---|---|---|---|---|---|
| WRD Alt1 | Construction of large grey and textured wedge shaped form over a long period of time | 40 | Class III | Protection of R510 view corridor visual resources | No | Almost Certain | Moderate | High (20) | Medium (11) |
| WRD Alt2 | Construction of large grey and textured wedge shaped form over a long period of time | 40 | Class IV | Maintaining of status quo | Yes | Possible | Minor | Medium 8 | Low 4 |
| Stockpile | Construction of medium sized grey and textured wedge shaped form over a medium period of time | 20 | Class III | Protection of R510 view corridor visual resources | With mitigation | Almost Certain | Moderate | High (20) | Medium (11) |
| Silos | Tall thin cylindrical shaped forms for storage of ore until removed by trains and transported to the concentrated point | 30 | Class III | Protection of R510 view corridor visual resources | No | Almost Certain | Moderate | High (20) | High (17) |
| Headgear | The steel headgear will rise approximately 52m from the surface. Will entail moving parts and lights at night | 52 | Class III | Protection of R510 view corridor visual resources | With mitigation | Almost Certain | Moderate | High (20) | Medium (11) |
| Compressor and Winder house structures | Large factory structure | 10 | Class III | Protection of R510 view corridor visual resources | With mitigation | Likely | Moderate | High (17) | Medium (12) |
| Water reservoir | Construction of low concrete dams | 10 | Class III | Protection of R510 view corridor visual resources | With mitigation | Likely | Moderate | High (17) | Low (5) |
| Workshops | Large factory structure | 10 | Class III | Protection of R510 view corridor visual resources | With mitigation | Possible | Moderate | High (13) | Low (5) |
| Office structures | Offices and building infrastructure for mine | 4 | Class IV | Maintaining of status quo | With mitigation | Unlikely | Minor | Low (5) | Low (4) |
| Parking areas | Large cleared area for parking | N/A | Class IV | Maintaining of status quo | With mitigation | Unlikely | Minor | Low (5) | Low (4) |
| Yards and railway shunting | Large cleared area used for moving trains and railway trucks and well as single storey factory type structures | 3 | Class III | Protection of R510 view corridor visual resources | Yes | Unlikely | Minor | Low (5) | Low (4) |
| Conveyors for WRD Alt 1 | The conveyor bridge will be a metal structure clad in sheet metal | 8 | Class III | Protection of R510 view corridor visual resources | With mitigation | Almost Certain | Moderate | High (20) | Medium (1)1 |
| Conveyors for WRD Alt 2 | The conveyor bridge will be a metal structure clad in sheet metal | 8 | Class III | Protection of R510 view corridor visual resources | With mitigation | Rare | Insig nificant | Low (5) | Low (4) |
| Substation | Electrical substation and Eskom transmission lines | 10 | Class III | Protection of R510 view corridor visual resources | Yes | Possible | Moderate | High (13) | Low (5) |

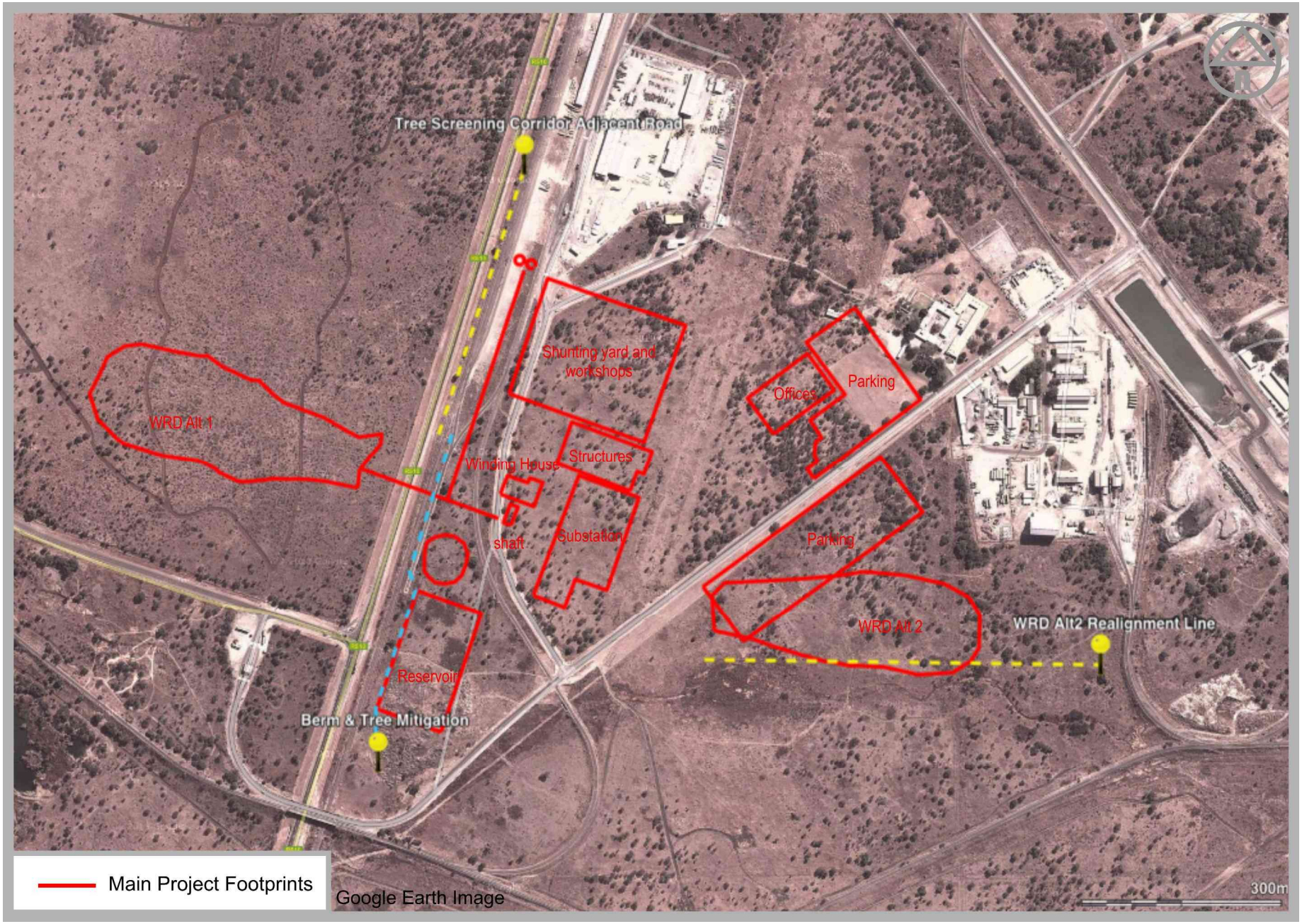



Figure 25: Mitigation Point Locality Map

# 9 FINDINGS

*Zone of Visual Influence*
All of the sites surveyed, with the exception of the northern section of the office buildings and associated parking, were situated on open ground with existing limited landuse. Areas allocated to proposed office buildings and parking sites have been transformed into a playing field and office buildings. The proposed WRD Alt1 site is located in the Madeleine Robinson Game Reserve, which is owned by Amandelbult.

The viewshed generated by the taller proposed landscape modifications will be *high.* This extensive viewshed is due to the height of the proposed structures exceeding the height of the bushveld type vegetation. Existing trees on the perimeter of the proposed sites would offer some baseline screening to R510 receptors. The landscape modifications of a lower height: the water reservoir, the substation and office structures, will generate a *moderate* viewshed. A combination of localised trees adjacent to the R510 would produce a *moderate* visual intrusion.

Due to their location being in close proximity to the R510, the main proposed mining infrastructure and structures will have *high* exposure levels to the R510 receptors. The WRD Alt 2, the substation and office complex will have *moderate* levels of exposure.

The ZVI for the proposed activities will range between *moderate to high,* with the exception of the WRD Alt 1 which will have a low ZVI. The main mining landscape modifications will have a *moderate* ZVI. This is because of their being situated further from the existing high contrast generating landscape of the concentrator plant and TSF. The proximity of the proposed silos and shunting yard to the existing shunting yard would reduce the degree of contrast but only to a *moderate* degree as the size and scale of the proposed landscape modifications would exceed the contrast generated by the existing railway station. The location of the proposed WRD Alt 2 to the west of the road away from the existing concentrator plant and TSF, reduces the ZVI for this proposed landscape modification. The view to the west in the direction of the Alt 2 WRD is more open and does not currently include mining landscape in the fore or middleground.

*Scenic Quality*
For all sites surveyed the scenic quality was found to be *low* due to the close proximity of the proposed sites to existing large scale mining landscapes. In most cases the land is modified to some degree. Areas adjacent to the R510 are in close proximity to the railway line, with rubble dumped on site and clear views of the existing railway shunting yard. The proposed WRD Alt 1 is located to the west of the road and has *moderate* scenic quality levels due to the site having more intact natural vegetation and more prolific trees. Existing cultural modifications are limited as the site is currently utilised as a private nature reserve. This factor also influences the scarcity factor which is rated *higher* as the area does add value to the surrounding landscape character by virtue of the site not being associated with mining activity.

*Receptor Sensitivity*
The R510 is an important tourist route and local spatial planning has identified that tourism is an import factor in the local and regional economy. However, due to the existing mining context created by the process plant, the TSF, the headgear and existing WRD, the receptor sensitivity to landscape change was rated as *moderate*. Receptor sensitivity to the proposed WRD Alt 2 site was rated as *moderate to high* as landscape will change. The current private reserve status of the site acts as a buffer zone to the background mining landscapes and benchmarks the natural vegetation sense of place.

*VRM Classes*
Two VRM Classes were defined for the proposed sites, Class III for the proposed sites in close proximity to the R510 and the WRD Alt 1, in order to ensure some protection of the R510 visual resources. The sites further form the road in closer proximity to the existing mine workshops and concentrator plant were defined as Class IV as they would maintain the status quo and modification of the site would not significantly alter the surroundings sense of place. Class I and Class II were not

defined for the site as no significant landscape features were located on the sites which would require visual protection.

*Visual Objectives*

For most of the proposed landscape modifications, the visual objective were met with mitigation. The yards and railway shunting and WRD Alt2 activities would be met without mitigations due to the close proximity of the sites to the existing railway station and yards (for the former) and the TSF and concentrator plant for the latter. The only activities that will not meet the defined visual objectives were the WRD Alt1 and the Silos. The WRD Alt1 is located away from the concentrator plant and the proposed modification west of the road where there is no strong mining activity and would result in a change to the local area landscape character. The silos generate strong visual contrast in close proximity to the R510 and a moderate change in local landscape character will take place should they be constructed. The planting of screening trees to soften the total mine picture would still assist in reducing the visual intrusion of the proposed landscape modifications.

*Significance*

Significance without mitigation ranges between *high* for the larger mining activities in closer proximity to the R510 to *medium* and *low* for the activities located further form the road in closer proximity to the existing concentrator plant and TSF. With mitigation the significance can be reduce to *moderate* for most activities with the exception of the Silos which due to the close proximity to the road, would generate *high* levels of contrast post mitigation.

# 10 CONCLUSION

This VIA has found that **WRD Alternative 2 was the preferred visual alternative**. The reasons for this are the conveyor does not crossing the R510, and the WRD is located away from the road in close proximity to the existing Tumela Concentrator Plant landscape context.

However, it must be noted that the Class III visual objectives which require moderation of landscape change to maintain the existing sense of place along the R510 will not be met. The large height of the proposed the Silos and Headgear in relation to the limited surrounding vegetation and topographic screening as well as close proximity to the R510, would result in a perceived change to the landscape character. This change in landscape character from the context where mining landscapes are currently related to background views, will be contained within a relatively short section of the R510 where receptors will be highly exposured to the proposed Silos and Headgear landscape modificaitons. For distances greater than 1km from the proposed site, the receptor views will be partially obscured by the trees adjacent to the R510. This screening effect would reduce the experience of visual intrusion with the sense of place reverting to views of mines as background features in the landscape.

The overall regional significance of the change in landscape character was found to be *moderate to low.* The impact will be moderated by receptor perceptions of the area as an existing mining landscape surrounded by natural vegetation. Effective implementation of the proposed mitigations would further entrench this perception and assit in reducing the visual intrusion in the high receptor proximity areas. Mitigations included the investigation of the trans-planting of the existing acacia trees species located on the development areas (or planting *Acacia nigrescens*, *Acacia tortilis* and *Acacia nilotica* tree species common to the area) to positions adjacent to the R510 to create partial vegetation screening effects. Also recommended is the construction of a 3 to 5 metre screening berm adjacent the mine site to screen base views of the mine, and the retention of as many as possible of the existing acacia trees on the site. This will allow for the continuation of the existing precedent site on the mine, allow visual continuity of vegetation within the overall landscape context and the creation of natural shade areas.

# 11 REFERENCES


1. Anglo American. 2012. Scope of Work EMPR Amendment Tumela Central Shaft Final.
2. ASTER GDEM. METI / NASA. 2009.Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model Version 2 (GDEM V2 2011). Ministry of Economy, Trade, and Industry (METI) of Japan and United States National Aeronautics and Space Administration (NASA)Source: https://lpdaac.usgs.gov.
3. BLM. USDI. 2004. Bureau of Land Management, U.S. Department of Interior. 2004. Visual Resource Management Manual 8400.
4. Council on Environmental Quality (CEQ). 1997. Considering Cumulative Effects Under the (USA) National Environmental Policy Act. http://ceq.hss.doe.gov/nepa/ccenepa/exec.pdf.
5. Hull, R.B. and Bishop, I.E. (1988), Scenic Impacts of Electricity Transmission Mine: The Influence of Landscape Type and Observer Distance. *Journal of Environmental Management.*1988 (27) Pg 99-108.
6. Lange, E. 1994: Integration of computerized visual Simulation and visual Assessment in environmental Planning. Landscape and Urban Planning.
7. Oberholzer, B. 2005. Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, Cape Town.
8. Sheppard, S.R.J. 2005. Validity, reliability, and ethics in visualization. In: Bishop, I. & Lange, E. (Eds.) *Visualization in Landscape and Environmental Planning: Technology and Applications*. Taylor and Francis, London. Chapter 5, pp. 79-97. Source: www.calp.forestry.ubc.ca/Coe of Ethics_July03.pdf.
9. U.K Institute of Environmental Management and Assessment (IEMA). 'Guidelines for Landscape and Visual Impact Assessment' Second Edition, Spon Press, 2002. Pg 44.
10. WSP. 2013. WSP Environment and Energy. Draft Scoping Report: Tumela Central Shaft Project – Tumela Mine – Amandelbult Section, Rustenburg Platinum Mines. 2013/02/23 Pg 4.
11. WSP BID 2013. WSP Environment and Energy. Background Information Document. Notice of the Environmental Authorisation Processes for the Proposed Tumela Central Shaft Project, Tumela Mine.

# 12 ANNEXURE 1: SITE SURVEY AND VIEWSHED MAPS

## 12.1 Silos

*View north depicting railway siding and mine stores*

*View east depicting mine stores and bush veld*

*View south depicting mine access road*

*View west depicting railway siding and R510 with open views to west and headgear views above trees*

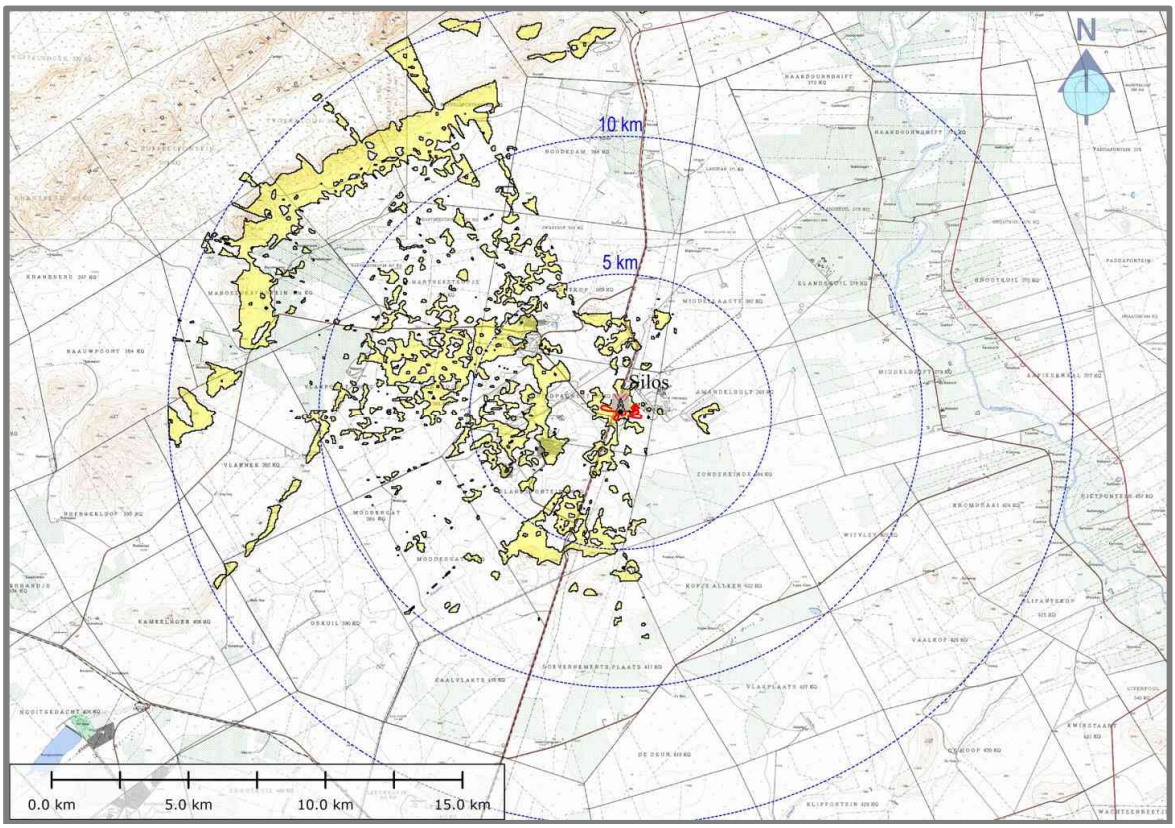



Figure 26: Silo Viewshed Map

## 12.2 Headgear, Compressor and Winder House

*View north depicting road, rail and nature reserve*

*View east depicting vegetation with low trees*

*View south depicting Eskom transmission line*

*View west depicting road*

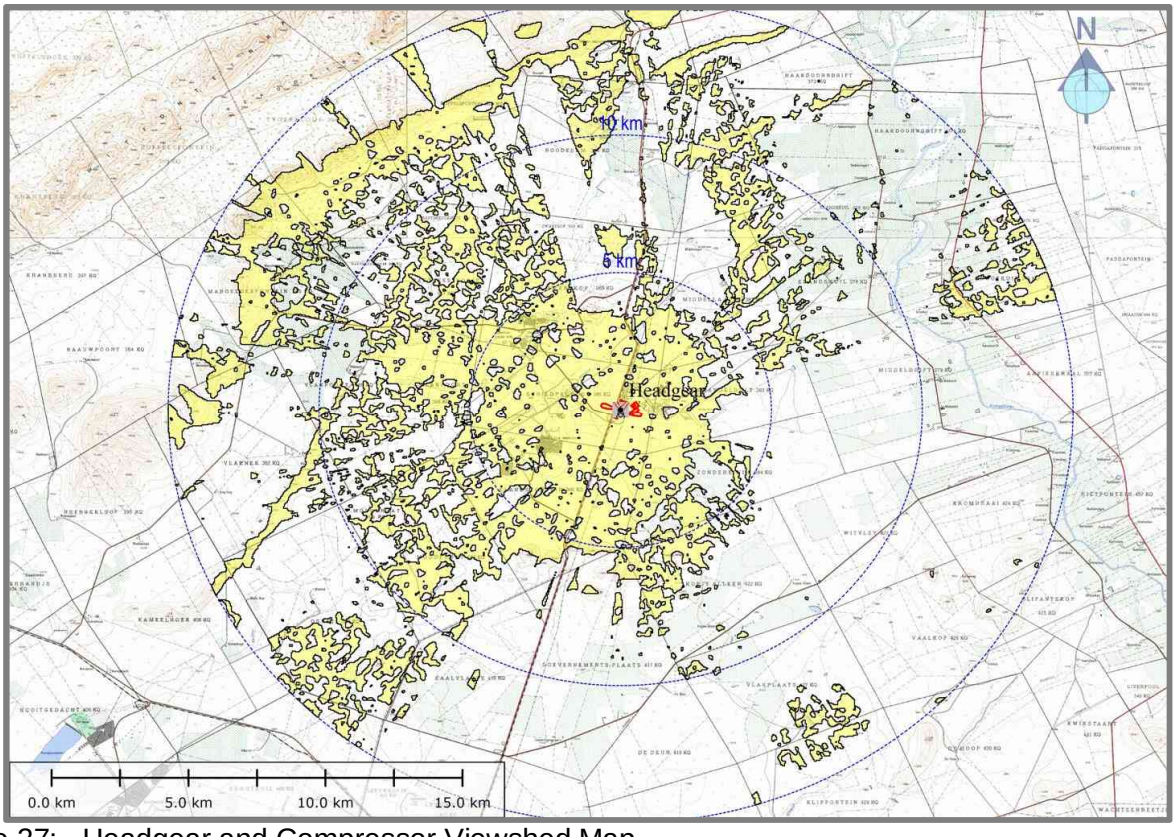



Figure 27: Headgear and Compressor Viewshed Map

## 12.3 WRD Alt 1

*View north depicting veld grasses in foreground*

*View east depicting veld grasses and road in foreground*

*View south depicting veld grasses in foreground*

*View west depicting veld grasses and road in foreground*

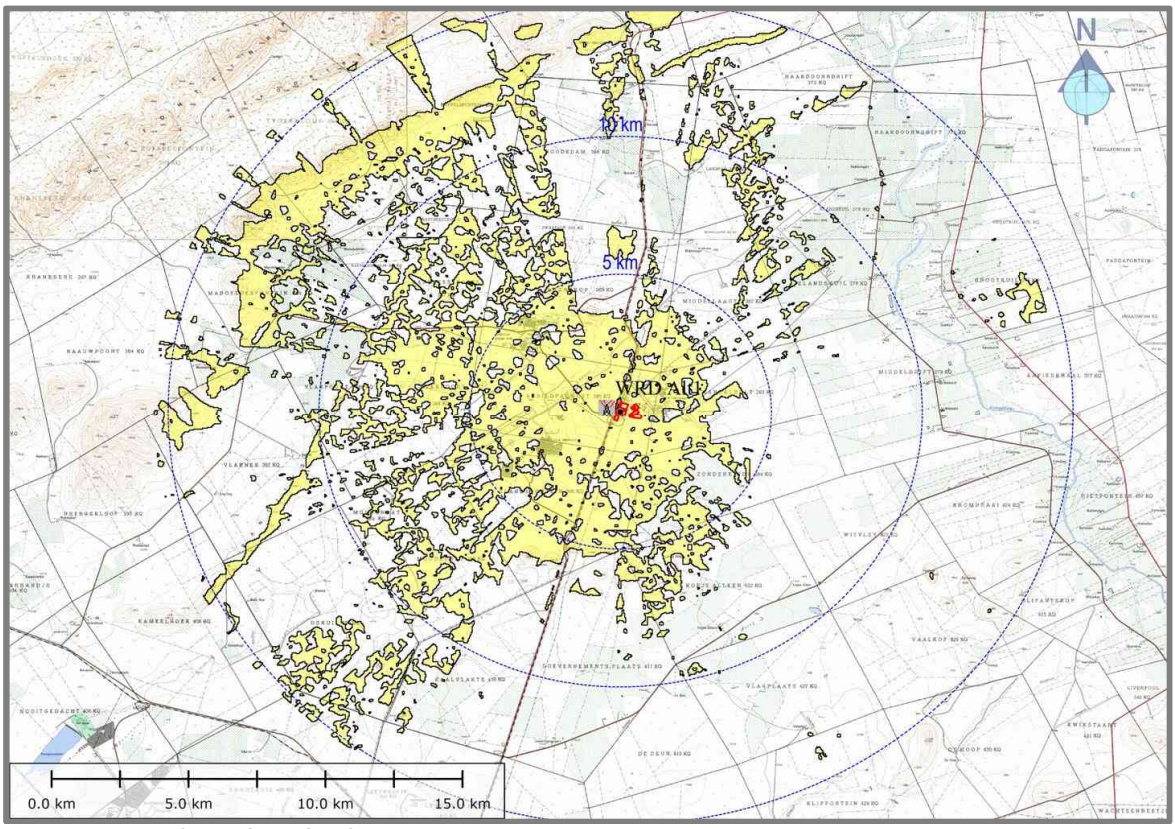



Figure 28: WRD Alt 1 Viewshed Map

## 12.4 WRD Alt 2 and topsoil stockpile

*View north depicting bushveld vegetation screening mine administration buildings*

*View east depicting mine concentrator plant and TSF.*

*View south depicting drainage line and bushveld obscuring the background with views of mine shaft above trees.*

*View west shows terrain drops off to west with veld grasses in foreground, transmission lines in middleground and bushveld in the background*

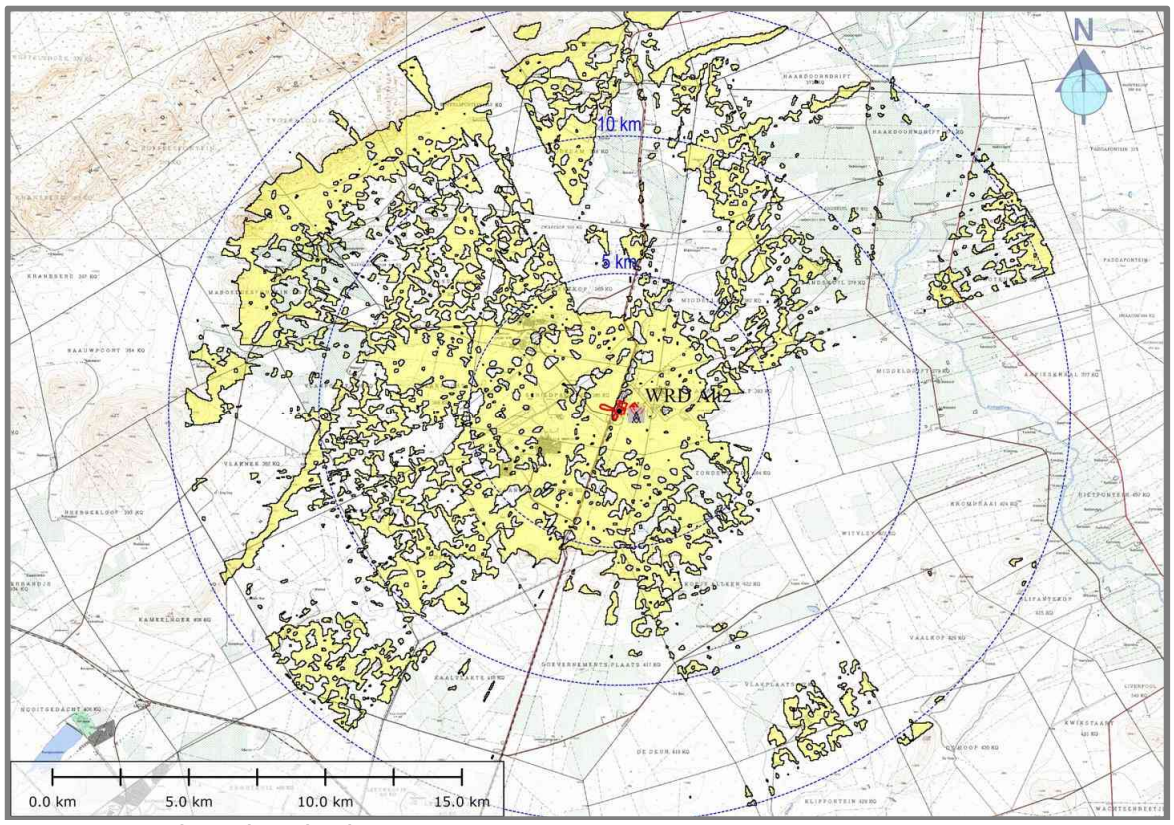



Figure 29: WRD Alt 2 Viewshed Map

## 12.5 Stockpile

*View north depicting Eskom transmission lines*

*View east depicting Eskom transmission lines in the background*

*View south depicting bushveld*

*View west depicting bushveld with conical hills in background*

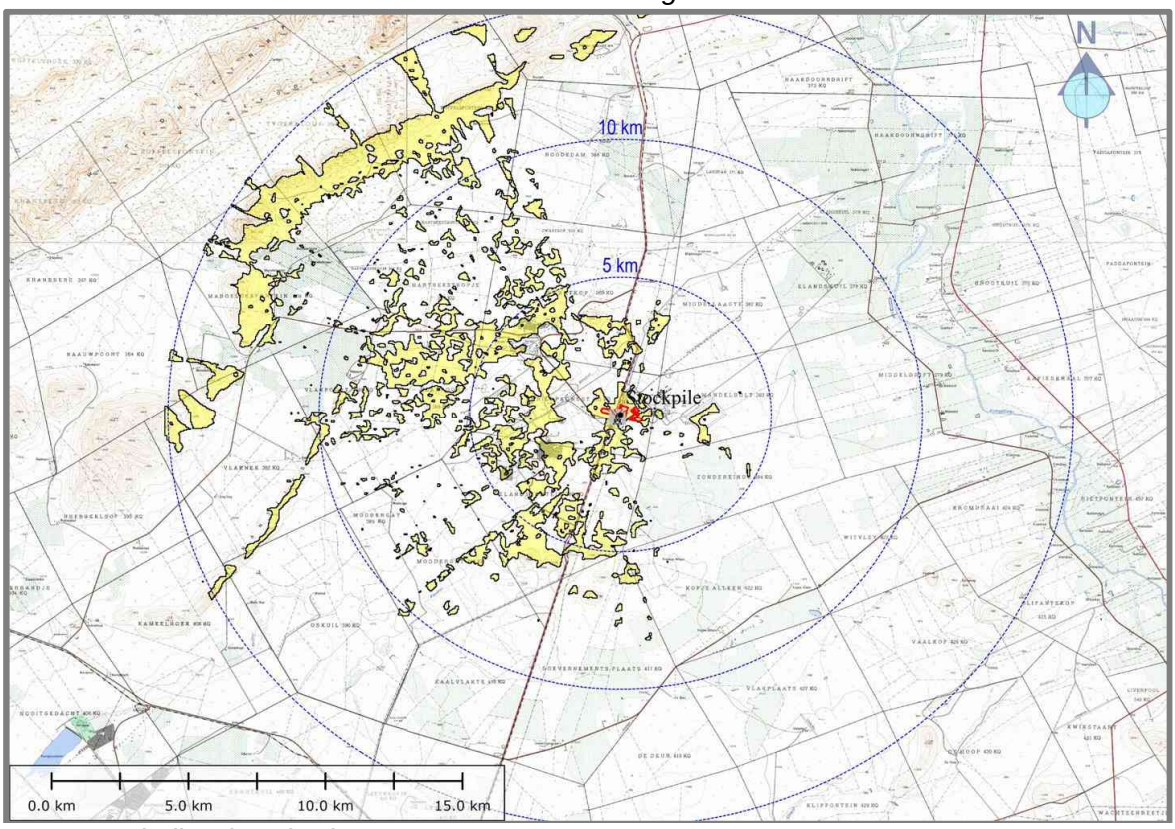



Figure 30: Stockpile Viewshed Map

## 12.6 Water reservoir

*View north depicting bushels trees and veld grasses*

*View east depicting Eskom transmission lines and mine access road*

*View south depicting rubble dump and bridge.*

*View west depicting footpath and R510 road*

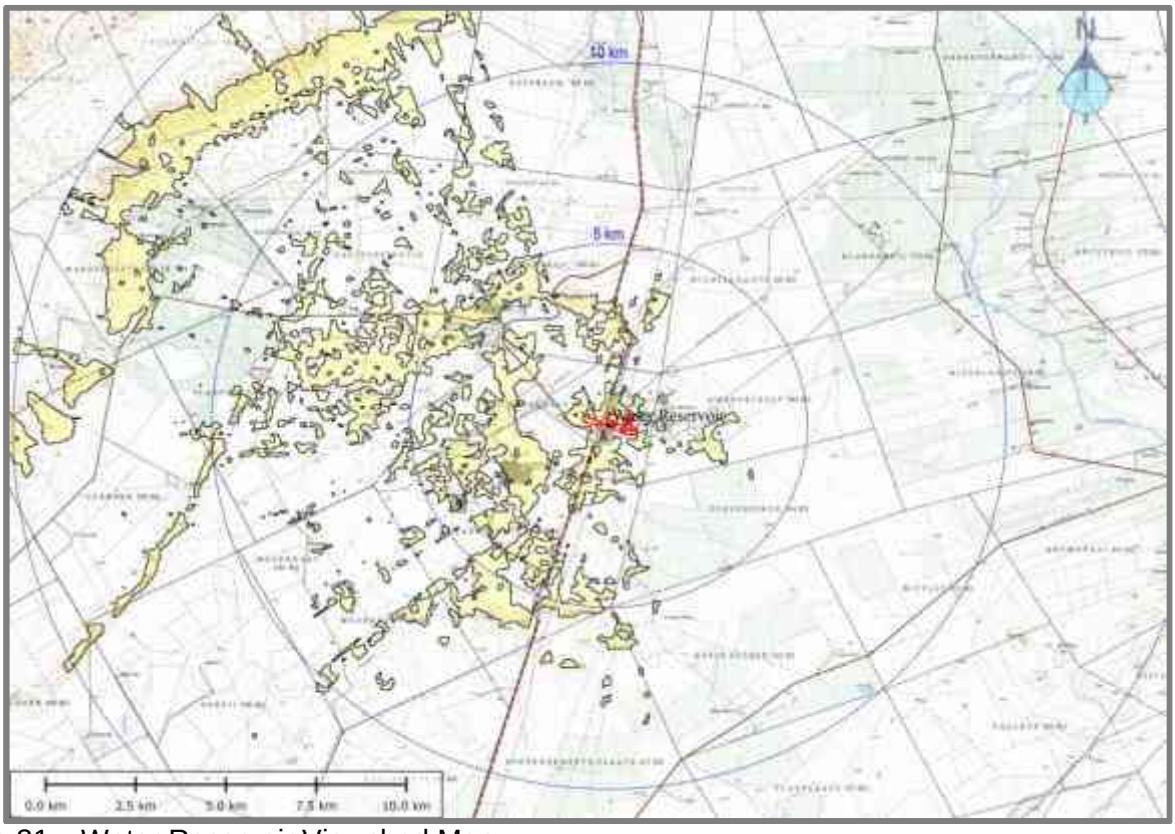



Figure 31: Water Reservoir Viewshed Map

## 12.7 Office structures and Parking

*View north depicting playing field and offices*

*View east depicting mine workshops and administration structures*

*View south depicting mine access road and background obscured by bushveld*

*View west depicting bushveld obscuring views of headgear in the background.*

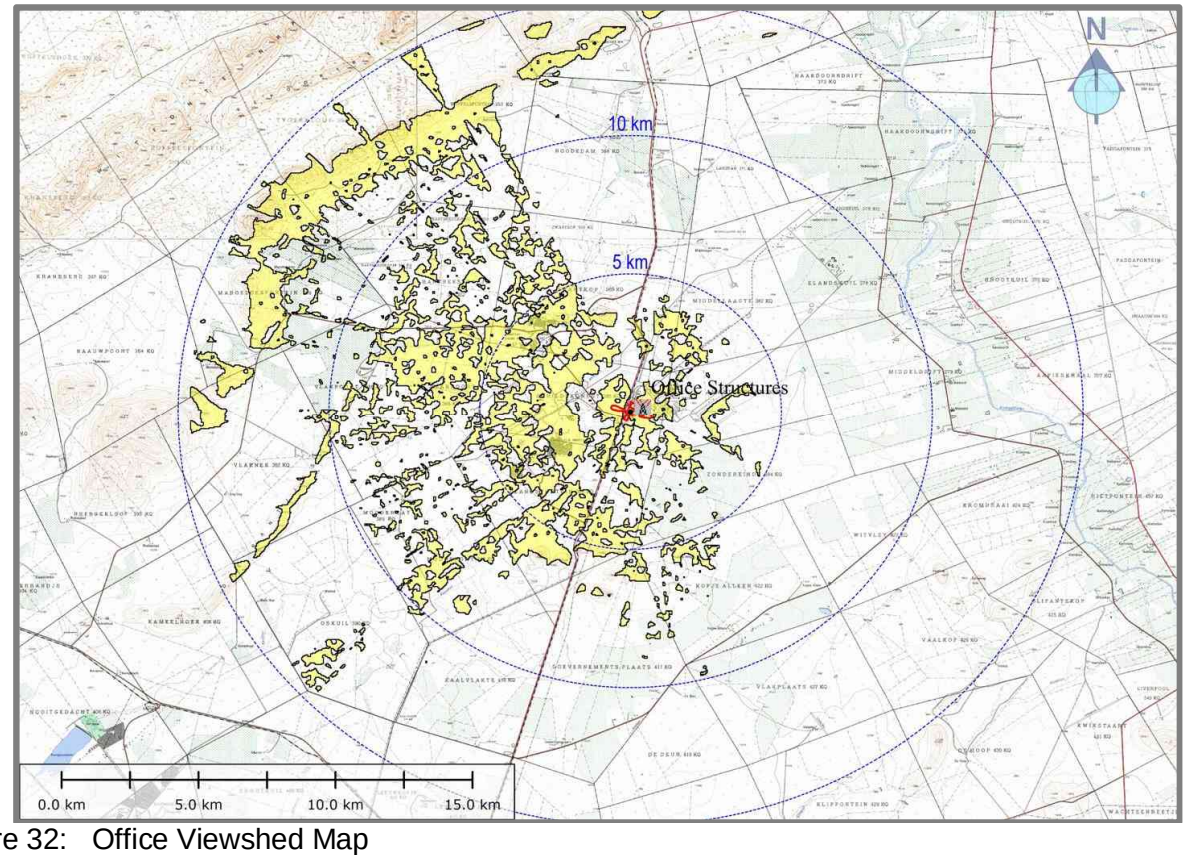



Figure 32: Office Viewshed Map

## 12.8 Yards and railway shunting

*View north depicting mine rail station and road in foreground*

*View east depicting bushveld with views of mine process plant above trees*

*View south depicting mine access road and bushveld with conical peaks of hills in the background*

*View west depicting railway & road in foreground which falls away to lower ground in the valley with bushveld and mine headgear in background*

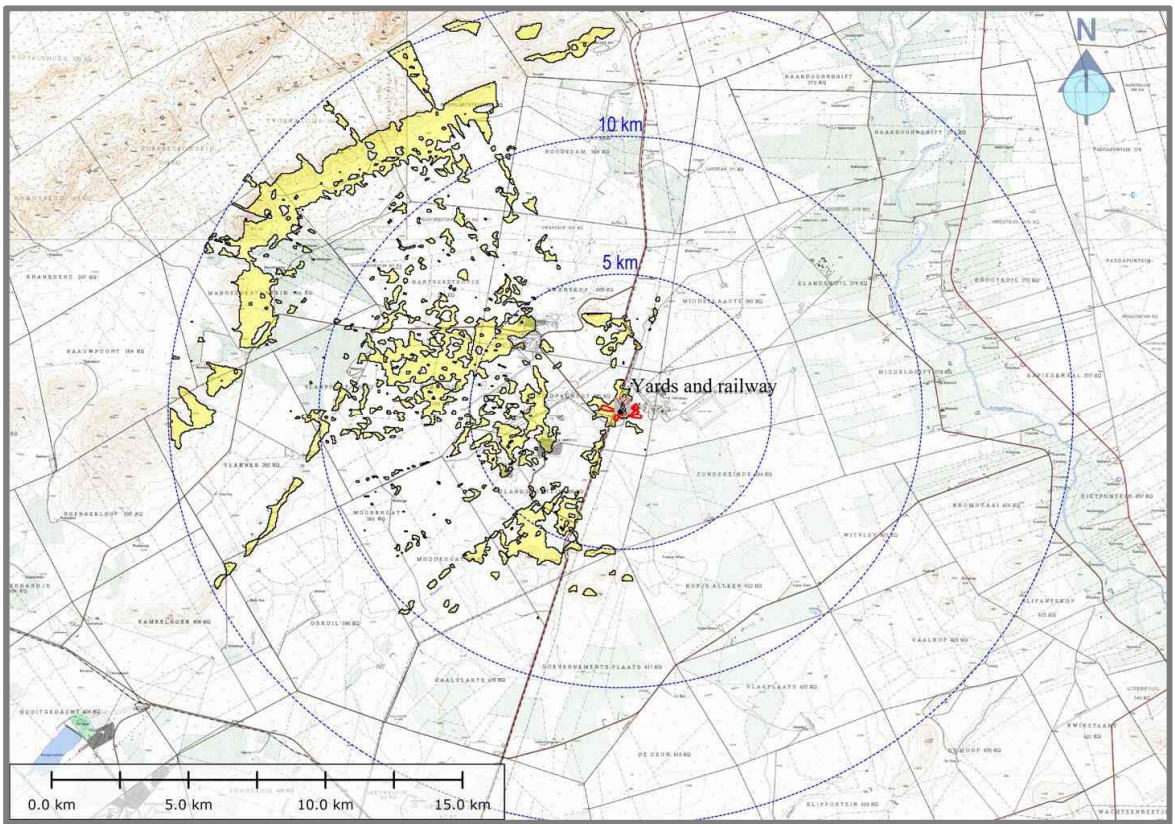



Figure 33: Yards and railway shunting Viewshed Map

## 12.9 Substation

*View north depicting bushveld to mountain background*

*View east depicting Eskom transmission lines in foreground with mine plant in mid ground and TSF in background*

*View south depicting Eskom transmission lines, rail and road. Background obscured by bushveld.*

*View west depicting bush veld withies shaft in background*

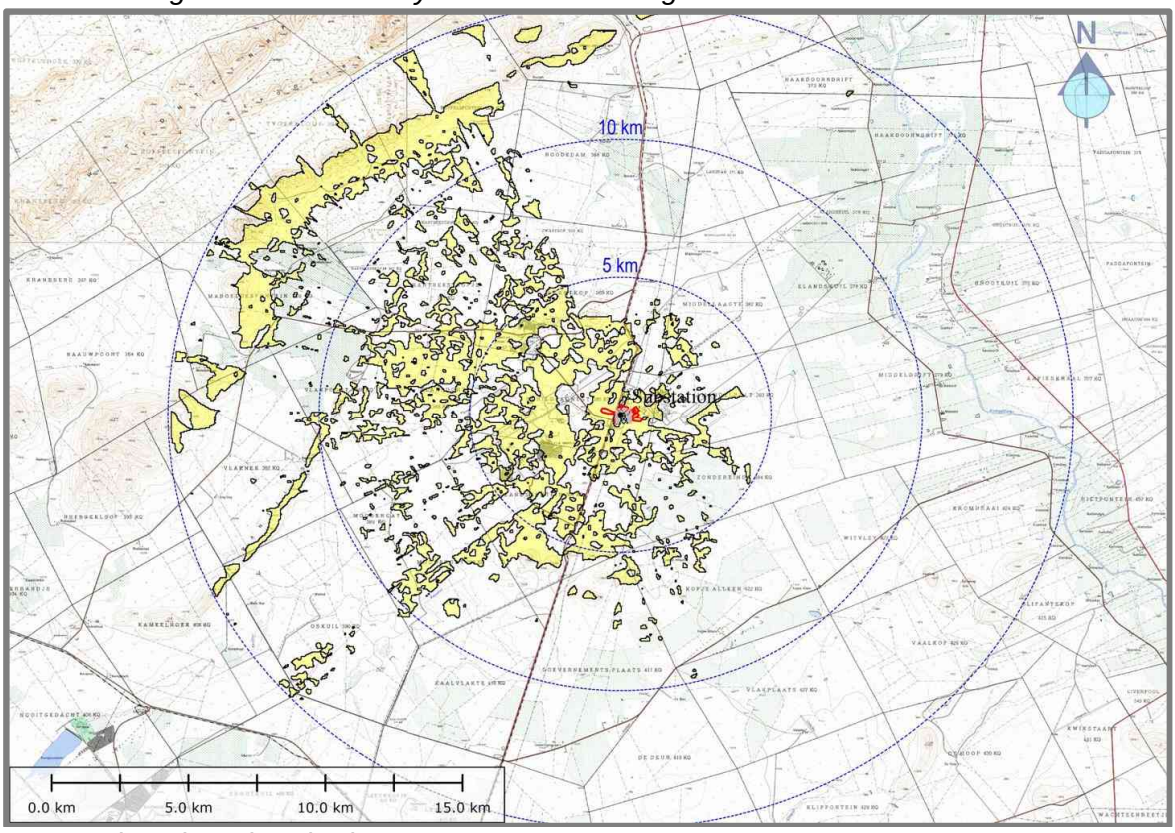



Figure 34: Substation Viewshed Map

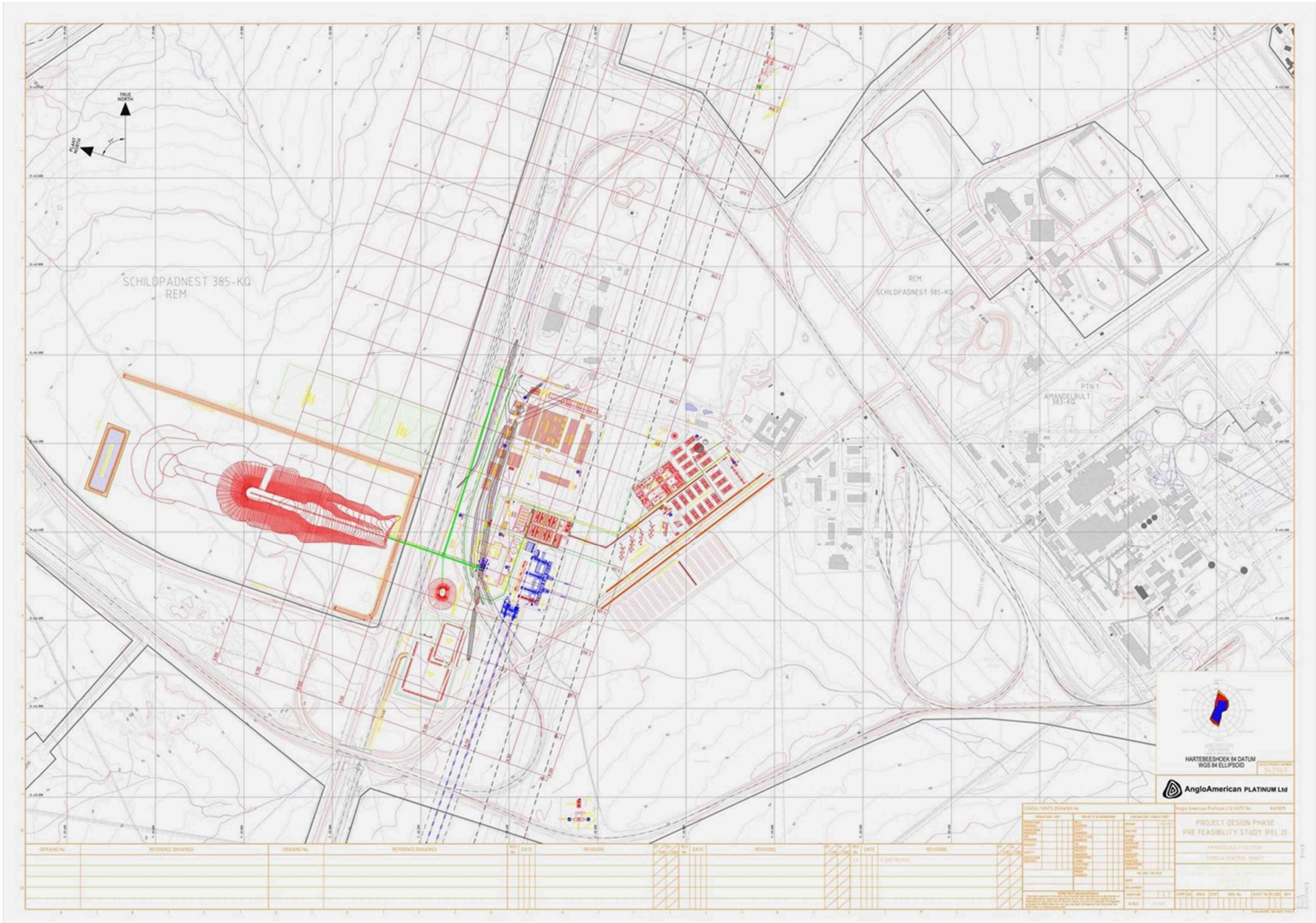



Figure 35: Project Layout Plan (A3)

# 13 ANNEXURE 2: SPECIALIST DETAILS

## 13.1 Declaration of Independence

**DETAILS OF SPECIALIST AND DECLARATION OF INTEREST**

| | | | |
|---|---|---|---|
| Specialist: | VRM AFRICA CC | | |
| Contact person: | STEPHEN STEAD | | |
| Postal address: | P.O BOX 7233, BLANCO | | |
| Postal code: | 6531 | Cell: | 083 560 9911 |
| Telephone: | 044 874 0020 | Fax: | 086 653 3738 |
| E-mail: | steve@vrma.co.za | | |
| Professional affiliation(s) (if any) | Association of Professional Heritage Practitioners South Africa (APHP) | | |

The specialist appointed in terms of the Regulations

I, **STEPHEN STEAD**, declare that ---

General declaration:

- 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, 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;
  and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

**SILVER SOLUTIONS TRADING AS VRM AFRICA**

Name of company (if applicable):

**23 JANUARY 2013**

Date:

## 13.2 Curriculum Vitae

# Curriculum Vitae (CV)

1. **Position**: Owner / Director
2. **Name of Firm**: Visual Resource Management Africa cc *(www.vrma.co.za)*
3. **Name of Staff**: Stephen Stead
4. **Date of Birth**: 9 June 1967
5. **Nationality:** South African
6. **Contact Details:** **Tel: +27 (0) 44 876 0020**
   **Cell: +27 (0) 83 560 9911**
   **Email: steve@vrma.co.za**

7. **Educational qualifications**:
   - University of Natal (Pietermaritzburg): Bachelor of Arts: Psychology and Geography; andBachelor of Arts (Hons): Human Geography and Geographic Information Management Systems.

8. **Professional Accreditation**
   - Association of Professional Heritage Practitioners (APHP) Western Cape
     - Accredited VIA practitioner member of the Association (2011)

9. **Association involvement:** :
   - International Association of Impact Assessment (IAIA) South African Affiliate
     - Past President (2012 - 2013);
     - President (2012);
     - President-Elect (2011);
     - Conference Co-ordinator (2010);
     - National Executive Committee member (2009); and
     - Southern Cape Chairperson (2008).

10. **Conferences Attended:**
    - IAIAsa 2012;
    - IAIAsa 2011;
    - IAIA International 2011 (Mexico);
    - IAIAsa 2010;
    - IAIAsa 2009; and
    - IAIAsa 2007.

11. **Continued Professional Development:**
    - Integrating Sustainability with Environment Assessment in South Africa (IAIAsa Conference, 1 day)
    - Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)
    - Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

12. **Countries of Work Experience**:
    - South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

13. **Relevant Experience:**
    Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa which specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. In association with ILASA qualified landscape architect Liesel Stokes, he has assessed of over 100 major landscape modifications through-out southern and eastern

Africa. The business has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

**14. Languages:**

- English – First Language
- Afrikaans – fair in speaking, reading and writing

**15. Projects:**

A list of ***some*** of the large scale projects that VRMA has assessed has been attached below with the client list indicated per project (Refer to www.vrma.co.za for a full list of projects undertaken).

| YEAR | NAME | DESCRIPTION | CLIENT | LOCATION |
|---|---|---|---|---|
| 2013 | Houwhoek Eskom Substation | Substation | Eskom | W Cape |
| 2013 | Drennan PV | PV | | E Cape |
| 2013 | Mulilo PV Project | PV | Mulilo | N Cape |
| 2013 | CWDM Landfill Site | Landfill | CWDM | W Cape |
| | | | | |
| 2012 | Afrisam Saldanha | Mine | AfriSAM | Saldana (W Cape) |
| 2012 | Ncondezi Power Station | Plant | Ncondezi Coal | Mozambique |
| 2012 | MET Housing Etosha Amended MCDM | Residential | Millennium Challenge | Namibia |
| 2012 | Kangnas Wind | Energy | Mainstream Renewable Power SA | N Cape |
| 2012 | Kangnas PV | Energy | Mainstream Renewable Power SA | N Cape |
| 2012 | Rossing Z20 Infrastructure Corridor | Infrastructure | Rio Tinto | Namibia |
| 2012 | MET Housing Etosha | Housing | MET | Namibia |
| 2012 | Qwale Mineral Sands | Mine | Base Resources | Kenya |
| 2012 | Houhoek Substation | Transmission | Eskom | Western Cape |
| 2012 | Bannerman Etango Mine Phase 2 | Mining | Bannerman | Namibia |
| 2012 | Letseng Diamond Transmission Line Upgrade | Powerline | Gem Diaminds | Lesotho |
| 2012 | Letseng Diamond Mine Projet Kholo | Mine | Gem Diamonds | Lesotho |
| 2012 | Drennan PV | PV | | Eastern Cape |
| 2012 | George Social Infrastructure | Analysis | George Municipal Area | George |
| 2012 | Lunsklip Windfarm | Windfarm | Bergwind | Stilbaai |
| 2012 | Hoodia Solar | PV expansion | | Beaufort West |
| 2012 | Bitterfontein | Energy | WEPTEAM | N Cape |
| 2012 | Bitterfontein slopes | Slopes Analysis | WEPTEAM | N Cape |
| 2012 | Knysna Affordable Housing | Residential | Knysna Municipality | Knysna |
| 2012 | KAH Hornlee Project | Residential | Knysna Municipality | Knysna |
| 2012 | Kobong Hydro | Dam / Powerline | Lesotho Highlands Water | Lesotho |
| 2012 | Otjikoto Gold Mine | Mining | ASEC | Namibia |
| 2012 | Mozambique Gas Engine Power Plant | Plant | Sasol | Mozambique |
| 2012 | SAPPI Boiler Upgrade | Plant | SAPPI | Mpumalanga |
| 2012 | Upington CSP | solar Power | Sasol | Northern Cape |
| 2012 | Rossing Z20 Mine | Mining | Rio Tinto | Namibia |
| 2012 | Eastern Cape Mari-culture | Mari-culture | Department of Agriculture, forestry and Fisheries | Western Cape |
| | | | | |
| 2011 | Vodacom Mast | Structure | Vodacom | Reichterbosch |
| 2011 | Weldon Kaya | Residential | Private | Plettenberg Bay |
| 2011 | Hornlee | Housing | ABSA | Knysna |
| 2011 | Erongo Uranium Rush SEA | SEA | SAIEA | Namibia |
| 2011 | Damkoppie | Residential | Private | Western Cape |
| 2011 | Moquini Hotel | Structure | Costa Zeerva Developments | Western Cape |
| 2011 | Bon Accord Nickel Mine | Mine | African Nickel | Barbeton |
| 2011 | Rossing Uranium Mine Phase 2 | Mining | Rio Tinto | Namibia |
| 2011 | Rossing South Board Meeting | Mining | Rio Tinto | Namibia |

| | | | | |
|---|---|---|---|---|
| 2011 | Floating Liquified Natural Gas Facility | Structure | PetroSA | Mossel Bay |
| 2011 | Khanyisa Power Station | Power Station | Anglo Coal | Western Cape |
| 2011 | PPC Rheebieck West Upgrade | Industrial | PPC | Western Cape |
| 2011 | Vale Moatize Railway 1 | Mining_rail | VALE | Mozambique |
| 2011 | Vale Moatize Coal Mine | Mining_rail | VALE | Mozambique |
| 2011 | Vale Moatize Railway 2 | Mining_rail | VALE | Mozambique |
| 2011 | Vale Moatize Railway 3 | Mining_rail | VALE | Mozambique |
| 2011 | Vale Moatize Railway 4 | Mining_rail | VALE | Mozambique |
| 2011 | Olvyn Kolk PV | Solar Power | | Northern Cape |
| 2011 | Beaufort West Urban Edge | Mapping | Willem de Kock Planners | Beaufort West |
| 2011 | ERF 7288 PV | PV | | Beaufort West |
| 2011 | Erf 7288 Beaufort West | Slopes | | Beaufort West |
| 2011 | N2 Herolds Bay Residental | Residential | MMS Developers | Herolds Bay |
| 2011 | Southern Arterial | Road | George Municipality | George |
| 2011 | De Bakke Cell Phone Mast | Mast | Vodacom | Western Cape |
| 2011 | Ruitesbosch | Mast | Vodacom | Western Cape |
| 2011 | Wadrif Dam | Dam | Plett Municipality | Western Cape |
| 2011 | George Western Bypass | Road | George Municipal Area | George |
| 2011 | Gecko Namibia | Industrial | Vision Industrial Park | |
| 2011 | Hartenbos Quarry Extension | Mining | Onifin(Pty) Ltd | Mossel Bay |
| 2011 | Wadrif Dam | Dam | Plettenberg Municipality | Beaufort West |
| 2011 | Kathu CSP | Solar Power | | Northern Cape |
| 2011 | Sasolburg CSP | Solar Power | | Free State |
| | | | | |
| 2010 | George Open Spaces System | George SDF | George Municipal Area | George |
| 2010 | Sedgefield Water Works | Structure | Knysna Municipality | Sedgefield |
| 2010 | George Visual Resource Management | George SDF | George Municipal Area | George |
| 2010 | George Municipality SDF | George SDF | George Municipal Area | George |
| 2010 | Green View Estates | Residential | | Mossel Bay |
| 2010 | Wolwe Eiland Access Route | Road | Theo Ciliers | Victoria Bay |
| 2010 | Asazani Zinyoka UISP Housing | Residential | Mossel Bay Municipality | Mossel Bay |
| 2010 | MTN Lattice Hub Tower | Structure | MTN | George |
| 2010 | Destiny Africa | Residential | KDFM | George |
| 2010 | Farm Dwarsweg 260 | Residential | Hoogkwatier Landgoed | Great Brak |
| 2010 | Bantamsklip GIS Mapping | Mapping | Eskom | Western Cape |
| 2010 | Bantamsklip Transmission Revision | Transmission | Eskom | Eastern Cape |
| 2010 | Le Grand Golf and Residential Estate | Residenti | Private | George |
| 2010 | Ladywood Farm 437 | Residential | Private | Plettenberg Bay |
| 2010 | Pezula Infill (Noetzie) | Residential | Pezula Golf Estate | Knysna |
| 2010 | Stonehouse Development | Residential | Private | Plettenberg Bay |
| | | | | |
| 2009 | Eden Telecommunication Tower | Tower | Africon Engineering | George |
| 2009 | Walvis Bay Power Station | Structure | NamPower | Namibia. |
| 2009 | OCGT Power Plant Extension | Power Plant | Eskom | Mossel Bay |
| 2009 | Rossing Uranium Mine Phase 1 | Mining | Rio Tinto | Namibia |
| 2009 | RUL Sulpher Handling Facility | Mining | Rio Tinto | Walvis Bay |
| 2009 | Boggomsbaai | Slopes | Private | Boggomsbaai |
| 2009 | Still Bay East | Mapping | DelPlan | SA, WC |
| 2009 | Bannerman Etango Uranium Mine | Mining | Bannerman | Namibia |
| 2009 | George Municipality Densification | George SDF | George Municipal Area | George |
| 2009 | Oudtshoorn Municipality SDF | Mapping | Oudtshoorn Municipality | Oudtshoorn |
| 2009 | Harmony Gold Mine | Mining | Harmony | Mpumalanga. |
| 2009 | Ryst Kuil/Riet Kuil Uranium Mine | Mining | Turgis | Beaufort West |
| 2009 | Trekkopje Uranium Mine | Mining | Trekkopje Uranium Mine | Namibia |
| 2009 | Calitzdorp Retirement Village | Residential | Pretorius Family Trust | Calitzdorp |
| 2009 | Wilderness Erf 2278 | Residential | Albert Hanekom | Wilderness |
| 2009 | Wolwe Eiland Eco & Nature Estate | Residential | Theo Ciliers | Victoria Bay |
| 2009 | Zebra Clay Mine | Mining | Private | Zebra |
| 2009 | Fancourt Visualisation Modelling | Visualisation | Fancourt Golf Estate | George |
| 2009 | Erf 251 Damage Assessment | Residential | Private | Great Brak |
| 2009 | Lagoon Bay Lifestyle Estate | Residential | Lagoon Bay Estate | Glentana |

| | | | | |
|---|---|---|---|---|
| 2009 | Lagoon Garden Estate | Residential | Dreamveldt | Great Brak |
| 2009 | Moquini Beach Hotel | Resort | Kostas Zervas | Mossel Bay |
| 2009 | Knysna River Reserve | Residential | Private | Knysna |
| 2009 | Paradyskloof Residential Estate | Residential | Private | Stellenbosch |
| | | | | |
| 2008 | Trekkopje Desalination Plant | Structure | Trekkopje Uranium Mine | Namibia |
| 2008 | Hartenbos Landgoed Phase 2 | Residential | Willem van Rensburg | Hartenbos |
| 2008 | Hartenbos River Park | Residential | Adlequelle | Hartenbos |
| 2008 | Hersham Security Village | Residential | Private | Great Brak |
| 2008 | Kaaimans Project | Residential | Fritz Fenter | Wilderness |
| 2008 | Kloofsig Development | Residential | Muller Murray Trust | Vleesbaai |
| 2008 | Rheebok Development Erf 252 Apeal | Residential | Farm Searles | Great Brak |
| 2008 | Riverhill Residential Estate | Residential | Theo Cilliers | Wilderness |
| 2008 | Camdeboo Estate | Resort | Private | Graaff Reinet |
| 2008 | Oasis Development | Residential | Private | Plettenberg Bay |
| 2008 | Outeniquabosch Safari Park | Residential | Private | Mossel Bay |
| 2008 | George Airport Radar Tower | Tower | ACSA | George |
| 2008 | Lakes Eco and Golf Estate | Residential | Private | Sedgefield |
| 2008 | Pinnacle Point Golf Estate | Residential | Private | Mossel Bay |
| 2008 | Paradise Coast | Residential | Private | Mossel Bay |
| 2008 | Fynboskruin Extention | Residential | Ballabarn Three | Sedgefield |
| 2008 | Gansevallei | Residential | Pieter Badenhorst | Plettenberg Bay |
| 2008 | Hanglip Golf and Residential Estate | Residential | Pieter Badenhorst | Plettenberg Bay |
| 2008 | Proposed Hotel Farm Gansevallei | Resort | Wendy Floyd Planners | Plettenberg Bay |
| 2008 | Uitzicht Development | Residential | Private | Knysna |
| 2008 | Hansmoeskraal | Slopes Analysis | Private | George |
| 2008 | Kruisfontein Infill | Mapping | SetPlan George | Knysna |
| 2008 | Mount View Tourist Distination | Mapping | SetPlan | Western Cape |
| 2008 | Welgevonden | Visualisation | SetPlan George | De Rust |
| 2008 | Pierpoint Nature Reserve | Residential | Private | Knysna |
| 2008 | West Dunes | Residential | Private | Knysna |
| | | | | |
| 1998 | Greater Durban Informal Housing Analysis | GIS | Durban Municipality | Durban |

**Certification:**
*I confirm that the above CV is an accurate description of my experience and qualifications and that I am available to serve in the position indicated for me in the proposal for this project.*

Yours faithfully,

_____
Stephen Stead, Director

# 14 ANNEXURE 3: METHODOLOGY

Visual impact is defined as '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.' *(Oberholzer, B., 2005)*. As identified in this definition, 'landscapes are considerably more than just the visual perception of a combination of landform, vegetation cover and buildings, as they embody the history, landuse, human culture, wildlife and seasonal changes to an area.' *(U.K IEMA, 2002)*. These elements combine to produce distinctive local character that will affect the way in which the landscape is valued and perceived.

VRM Africa's objective is to provide Interested and Affected Parties (I&APs) and decision-makers with sufficient information to take "early opportunities for avoidance of negative visual effects." This is based on the U.K. and Assessment's(IEMA), and South Africa's Western Cape Department of Environmental Affairs and Development Planning's (DEA&DP), guidelines:

- "The ideal strategy for each identifiable, negative effect is one of avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation may be explored. If the consideration of mitigation measures is left to the later stages of scheme design, this can result in increased mitigation costs because early opportunities for avoidance of negative visual effects are missed."*(U.K IEMA, 2002)*.
- "In order to retain the visual quality and landscape character, management actions must become an essential part of the guidelines throughout construction and operation. Proper management actions ensure that the lowest possible impact is created by the proposed project.
- Ongoing monitoring programmes, with regard to the control of aesthetic aspects, for all stages of the proposed project, are a vital component, ensuring that the long-term visual management objectives are met."*(Oberholzer, B., 2005)*.

The impact assessment methodology that VRM Africa uses is based on the VRM methodology developed by the United States Bureau of Land Management (BLM) in that the study involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification, against the same elements found in the natural landscape. The contrast rating is a systematic process undertaken from KOPs surrounding the proposed project site, and the assessment of the degree of contrast (DoC) is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The method is based on the premise that the degree to which a proposed landscape modification affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape *(USA Bureau of Land Management, 2004)*.

*Landscape Significance*

Landscape significance is assessed in order to highlight the nature and degree of significance of the landscape context by differentiating between those landscapes of recognized or potential significance or sensitivity to modification to those landscape contexts that have low sensitivity and scenic value. 'Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.' *(USA Bureau of Land Management,2004)*.

*Viewshed Analysis*

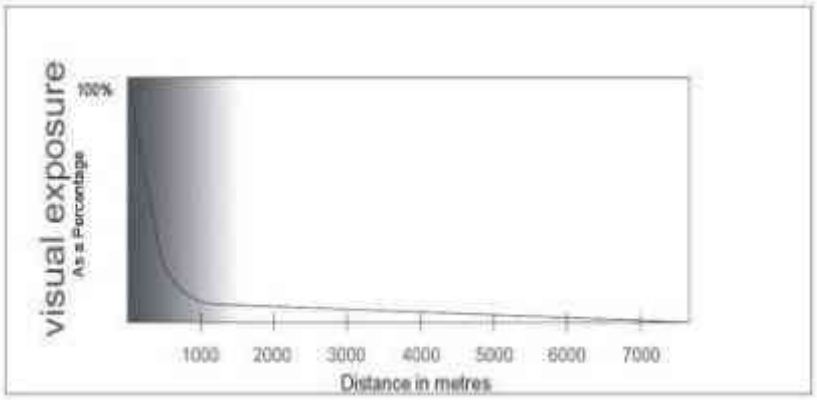
A viewshed is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, B., 2005)*. This reflects the area within which, or the extent to which, the landscape modification is likely to be seen. It is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape, as a point of departure for defining the shared landscape context, and to identify the receptors making use of the common views.

Viewshed analyses are not absolute indicators of the level of significance, but an indication of potential visibility*(Centre for Advanced Spatial Analysis, 2002)*. Once the sites and heights of the proposed activities have been finalised, the viewshed analysis will be undertaken.

*Receptor Exposure*

The area where a landscape modification starts to influence the landscape character is termed the Zone of Visual Influence (ZVI) and is defined by the U.K. and Assessment's (IEMA) *'Guidelines for Landscape and Visual Impact Assessment'* as 'the area within which a proposed development may have an influence or effect on visual amenity (of the surrounding areas).'

The inverse relationship of distance and visual impact is well recognised in visual analysis literature *(Hull, R.B. and Bishop, I.E., 1988)*. According to Hull and Bishop, exposure, or visual impact, tends to diminish exponentially with distance. The areas where most landscape modifications would be visible are located within 2 km from the site of the landscape modification. Thus the potential visual impact of an object diminishes at an exponential rate as the distance between the observer and the object increases due to atmospheric conditions prevalent at a location, which causes the air to appear greyer, thereby diminishing detail. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.




## 14.1 Distance Zones

The VRM methodology also takes distance from a landscape modification into consideration in terms of understanding visual resource. Three distance categories are defined by the Bureau of Land Management. The distance zones are:

1. ***Foreground / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
2. ***Background areas***, from 6km to 24km, where there is some potential for change in the sense of place, but where change would only occur in the case of very large landscape modifications; and
3. ***Seldom seen areas***, which fall within the Foreground / Middle ground area but, as a result of no receptors, are not viewed or are seldom viewed.

## 14.2 Scenic Quality

In the VRM methodology, scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors. During the rating process, each of these factors is ranked on a comparative basis with similar features in the region *(USA Bureau of Land Management, 2004)*. These seven elements are:

1. **Landform:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
2. **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. Also consider smaller-scale vegetation features which add striking and intriguing detail elements to the land.

3. **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.
4. **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.
5. **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.
6. **Adjacent Land Use:** Degree to which scenery, outside the scenery unit being rated, enhances the overall impression of the scenery within the rating unit. The distance at which adjacent scenery will start to influence scenery within the rating unit ranges, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
7. **Cultural Modifications:** Cultural modifications in the landform, water, and 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.

*Receptor Sensitivity Rating Criteria*
*A= scenic quality rating of ≥19;*
*B = rating of 12 – 18; and*
*C= rating of ≤11.*

*Scenic Quality Rating Questionnaire*

| **KEY FACTORS** | **RATING CRITERIA AND SCORE** | | |
|---|---|---|---|
| **SCORE** | **5** | **3** | **1** |
| Land Form | High vertical relief as expressed in prominent cliffs, spires or massive rock outcrops, or severe surface variation or highly eroded formations including dune systems: or detail features that are dominating and exceptionally striking and intriguing. | Steep-sided river valleys, or interesting erosion patterns or variety in size and shape of landforms; or detail features that are interesting, though not dominant or exceptional. | Low rolling hills, foothills or flat valley bottoms; few or no interesting landscape features. |
| Vegetation | A variety of vegetative types as expressed in interesting forms, textures and patterns. | Some variety of vegetation, but only one or two major types. | Little or no variety or contrast in vegetation. |
| Water | Clear and clean appearing, still or cascading white water, any of which are a dominant factor in the landscape. | Flowing, or still, but not dominant in the landscape. | Absent, or present but not noticeable. |
| Colour | Rich colour combinations, variety or vivid colour: or pleasing contrasts in the soil, rock, vegetation, water. | Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. | Subtle colour variations contrast or interest: generally mute tones. |
| Adjacent Scenery | Adjacent scenery greatly enhances visual quality. | Adjacent scenery moderately enhances overall visual quality. | Adjacent scenery has little or no influence on overall visual quality. |
| Scarcity | One of a kind: unusually memorable, or very rare | Distinctive, though somewhat similar to | Interesting within its setting, but fairly |

| | | | |
|---|---|---|---|
| | within region. Consistent chance for exceptional wildlife or wildflower viewing etc. | others within the region. | common within the region. |
| **SCORE** | **2** | **0** | **-4** |
| Cultural Modification | Modifications add favourably to visual variety, while promoting visual harmony. | Modifications add little or no visual variety to the area, and introduce no discordant elements. | Modifications add variety but are very discordant and promote strong disharmony. |

### 14.3 Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium or low sensitivity levels by analysing the various indicators of public concern. The following criteria were used to assess the sensitivity of each of the communities:

- **Public Interest:** The visual quality of an area may be of concern to local, state, or national groups. Indicators of this concern are usually expressed in public meetings, letters, newspaper or magazine articles, newsletters, landuse plans, etc. Public controversy, created in response to proposed activities that would change the landscape character, should also be considered.
- **Special Areas:** Management objectives for special areas such as natural areas, wilderness areas or wilderness study areas, wild and scenic rivers, scenic areas, scenic roads or trails, and Areas of Critical Environmental Concern (ACEC), frequently require special consideration for the protection of visual values. This does not necessarily mean that these areas are scenic, but rather that one of the management objectives may be to preserve the natural landscape setting. The management objectives for these areas may be used as a basis for assigning sensitivity levels.
- **Adjacent Land Uses:** The interrelationship with land uses in adjacent land can affect the visual sensitivity of an area. For example, an area within the viewshed of a residential area may be very sensitive, whereas an area surrounded by commercially developed lands may not be visually sensitive.
- **Type of User:** Visual sensitivity will vary with the type of users. Recreational sightseers may be highly sensitive to any changes in visual quality, whereas workers who pass through the area on a regular basis may not be as sensitive to change.
- **Amount of Use:** Areas seen and used by large numbers of people are potentially more sensitive. Protection of visual values usually becomes more important as the number of viewers increase *(USA Bureau of Land Management, 2004)*.

*Receptor Sensitivity Rating Criteria*

*The level of visual impact considered acceptable is dependent on the types of receptors.*

- *High sensitivity : e.g. residential areas, nature reserves and scenic routes or trails*
- *Moderate sensitivity : e.g. sporting or recreational areas, or places of work*
- *Low sensitivity : e.g. industrial, mining or degraded areas*

*Sensitivity Level Rating Questionnaire*

| **FACTORS** | **QUESTIONS** | |
|---|---|---|
| **Type of Users** | **Maintenance of visual quality is:** | |
| | A major concern for most users | High |
| | A moderate concern for most users | Moderate |
| | A low concern for most users | Low |
| **Amount of use** | **Maintenance of visual quality becomes more important as the level of use increases:** | |
| | A high level of use | High |

| | | |
|---|---|---|
| | Moderately level of use | Moderate |
| | Low level of use | Low |
| **Public interest** | **Maintenance of visual quality:** | |
| | A major concern for most users | High |
| | A moderate concern for most users | Moderate |
| | A low concern for most users | Low |
| **Adjacent land Users** | **Maintenance of visual quality to sustain adjacent land use objectives is:** | |
| | Very important | High |
| | Moderately important | Moderate |
| | Slightly important | Low |
| **Special Areas** | **Maintenance of visual quality to sustain Special Area management objectives is:** | |
| | Very important | High |
| | Moderately important | Moderate |
| | Slightly important | Low |

### 14.4 Key Observation Points (KOPs)

KOPs are defined by the BLM Visual Resource Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are used to assess the suitability of the proposed landscape modifications by means of assessing the degree of contrast of the proposed landscape modifications to the existing landscape, taking into consideration the visual management objectives defined for the area. The following selection criteria were utilised in defining the KOPs:

- Angle of observation;
- Number of viewers;
- Length of time the proposed project is in view;
- Relative proposed project size;
- Season of use;
- Critical viewpoints, e.g. views from communities, road crossings; and
- Distance from property.

### 14.5 VRM Classes

The landscape character of the proposed project site is surveyed to identify areas of common landuse and landscape character. These areas are then evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the site) in order to define the visual objective for the proposed project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the proposed project would be "absorbed" or "disappear" into the landscape). The areas identified on site are categorised into these Classes by using a matrix from the BLM Visual Resource Management method as seen below, which is then represented in a visual sensitivity map

The BLM has defined four Classes that represent the relative value of the visual resources of an area:

iv. **Classes I and II** are the most valued
v. **Class III** represents a moderate value
vi. **Class IV** is of least value

| | | VISUAL SENSITIVITY LEVELS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | High | | | Medium | | | Low | | |
| SCENIC QUALITY | A (High) | II | II | II | II | II | II | II | II | II |
| | B (Medium) | II | III | III/ IV * | III | IV | IV | IV | IV | IV |
| | C (Low) | III | IV | IV | IV | IV | IV | IV | IV | IV |
| DISTANCE ZONES | | fore/middle ground | Background | seldom seen | fore/middle ground | background | seldom seen | fore/middle ground | background | seldom seen |

*(A = scenic quality rating of ≥19; B = rating of 12 – 18, C = rating of ≤11)*

* If adjacent areas are **Class III** or lower, assign **Class III**, if higher, assign **Class IV**

Evaluation of the suitability of a proposed landscape modification is undertaken by means of assessing the proposed modification against a predefined management objective assigned to each class. The VRM class objectives are defined as follows:

1. The **Class I** objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. **Class I** is assigned to those areas where a ***specialist decision*** has been made to maintain a natural landscape.
2. The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
3. The **Class III** objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
4. The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

### 14.6 Photo Montages and 3D Visualisation

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform I&APs and decision-making authorities of the nature and extent of the impact associated with the proposed projectn. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In terms of adhering to standards for ethical representation of landscape modifications, VRM Africa subscribes to the proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (July 2003)*(Sheppard, S.R.J., 2005)*. This code states that professional presenters of realistic landscape visualisations are responsible for promoting full understanding of proposed landscape changes, providing an honest and neutral visual representation of the expected landscape, by seeking to avoid bias in responses and demonstrating the legitimacy of the visualisation process. Presenters of landscape visualisations should adhere to the principles of:

- Access to Information
- Accuracy
- Legitimacy
- Representativeness
- Visual Clarity
- Interest

The Code of Ethical Conduct states that the presenter should:

- Demonstrate an appropriate level of qualification and experience.
- Use visualisation tools and media that are appropriate to the purpose.
- Choose the appropriate level of realism.
- Identify, collect and document supporting visual data available for, or used in, the visualisation process.
- Conduct an on-site visual analysis to determine important issues and views.
- Seek community input on viewpoints and landscape issues to address in the visualisations.
- Provide the viewer with a reasonable choice of viewpoints, view directions, view angles, viewing conditions and timeframes appropriate to the area being visualised.
- Estimate and disclose the expected degree of uncertainty, indicating areas and possible visual consequences of the uncertainties.
- Use more than one appropriate presentation mode and means of access for the affected public.
- Present important non-visual information at the same time as the visual presentation, using a neutral delivery.
- Avoid the use, or the appearance of, 'sales' techniques or special effects.
- Avoid seeking a particular response from the audience.
- Provide information describing how the visualisation process was conducted and how key decisions were taken. *(Sheppard, S.R.J., 2005)*.

### 14.7 Contrast Rating Stage

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed and the proposed landscape modification is assessed from the Key Observation Point. The suitability of landscape modification is assessed by measuring the Degree of Contrast (DoC) of the proposed landscape modification to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape in terms of the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- **None**: The element contrast is not visible or perceived.
- **Weak** :The element contrast can be seen but does not attract attention.
- **Moderate** :The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** :The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for management activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

## 14.8 VRM Terminology

The following terms were used in the Contrast Rating Tables to help define Form, Line, Colour, and Texture. The definitions were a combination of Microsoft Word Dictionary and simple description

Table 5: VRM Terminology Table

| FORM | LINE | COLOUR | TEXTURE |
|---|---|---|---|
| Simple | Horizontal | | Smooth |
| Weak | Vertical | | Rough |
| Strong | Geometric | | Fine |
| Dominant | Angular | | Coarse |
| Flat | Acute | | Patchy |
| Rolling | Parallel | | Even |
| Undulating | Curved | Dark | Uneven |
| Complex | Wavy | Light | Complex |
| Plateau | Strong | Mottled | Simple |
| Ridge | Weak | | Stark |
| Valley | Crisp | | Clustered |
| Plain | Feathered | | Diffuse |
| Steep | Indistinct | | Dense |
| Shallow | Clean | | Scattered |
| Organic | Prominent | | Sporadic |
| Structured | Solid | | Consistent |

| | | | |
|---|---|---|---|
| **Simple** | Basic, composed of few elements | **Organic** | Derived from nature; occurring or developing gradually and naturally |
| **Complex** | Complicated; made up of many interrelated parts | **Structure** | Organised; planned and controlled; with definite shape, form, or pattern |
| **Weak** | Lacking strength of character | **Regular** | Repeatedly occurring in an ordered fashion |
| **Strong** | Bold, definite, having prominence | **Horizontal** | Parallel to the horizon |
| **Dominant** | Controlling, influencing the surrounding environment | **Vertical** | Perpendicular to the horizon; upright |
| **Flat** | Level and horizontal without any slope; even and smooth without any bumps or hollows | **Geometric** | Consisting of straight lines and simple shapes |
| **Rolling** | Progressive and consistent in form, usually rounded | **Angular** | Sharply defined; used to describe an object identified by angles |
| **Undulating** | Moving sinuously like waves; wavy in appearance | **Acute** | Less than 90°; used to describe a sharp angle |
| **Plateau** | Uniformly elevated flat to gently undulating land bounded on one or more sides by steep slopes | **Parallel** | Relating to or being lines, planes, or curved surfaces that are always the same distance apart and therefore never meet |
| **Ridge** | A narrow landform typical of a highpoint or apex; a long narrow hilltop or range of hills | **Curved** | Rounded or bending in shape |
| **Valley** | Low-lying area; a long low area of land, often with a river or stream running through it, that is surrounded by higher ground | **Wavy** | Repeatedly curving forming a series of smooth curves that go in one direction and then another |
| **Plain** | A flat expanse of land; fairly flat dry land, usually with few trees | **Feathered** | Layered; consisting of many fine parallel strands |
| **Steep** | Sloping sharply often to the extent of being almost vertical | **Indistinct** | Vague; lacking clarity or form |
| **Prominent** | Noticeable; distinguished, eminent, or well-known | **Patchy** | Irregular and inconsistent; |
| **Solid** | Unadulterated or unmixed; made of the same material throughout; uninterrupted | **Even** | Consistent and equal; lacking slope, roughness, and irregularity |
| **Broken** | Lacking continuity; having an uneven surface | **Uneven** | Inconsistent and unequal in measurement irregular |
| **Smooth** | Consistent in line and form; even textured | **Stark** | Bare and plain; lacking ornament or relieving features |
| **Rough** | Bumpy; knobbly; or uneven, coarse in texture | **Clustered** | Densely grouped |
| **Fine** | Intricate and refined in nature | **Diffuse** | Spread through; scattered over an area |
| **Coarse** | Harsh or rough to the touch; lacking detail | **Diffuse** | To make something less bright or intense |

## 14.9 Anglo Platinum Impact Rating Matrix

The Environmental Impact Rating was undertaken according the Anglo Platinum's 5x5 Impact Rating Matrix utilised to determine the significance of the potential impact as a result of the proposed project as depicted withinTable 6. The Table is further explained in Table 7.

Table 6: Environmental Significance Determiniation Table

| **Standardised Risk Matrix** | | **Hazard/Effect Consequence** (Where an event has more than one 'Loss Type', choose the 'Consequence' with the highest rating) | | | | |
|---|---|---|---|---|---|---|
| **Loss Type** (Additional 'Loss Types' may exist for an event; identify & rate accordingly) | | **1 Insignificant** | **2 Minor** | **3 Moderate** | **4 Major** | **5 Catastrophic** |
| (S/H) **Harm to People (Safety/Health)** | | First aid case / Exposure to minor health risk | Medical treatment case / Exposure to major health risk | Lost time injury / Reversible impact on health | Single fatality or loss of quality of life / Irreversible impact on health | Multiple fatalities / Impact on health ultimately fatal |
| (EI) **Environmental Impact** | | Minimal environmental harm - L1 incident | Material environmental harm - L2 incident remediable short term | Serious environmental harm - L2 incident remediable within LOM | Major environmental harm - L2 incident remediable post LOM | Extreme environmental harm - L3 incident irreversible |
| (BI/MD) **Business Interruption/Material Damage & Other Consequential Losses** | | No disruption to operation / R120k to less than R600k | Brief disruption to operation / R600k to less than R6m | Partial shutdown / R6m to less than R60m | Partial loss of operation / R60m to less than R450m | Substantial or total loss of operation / R450m and more |
| (L&R) **Legal & Regulatory** | | Low level legal issue | Minor legal issue; non-compliance and breaches of the law | Serious breach of law; investigation / report to authority, prosecution and/or moderate penalty possible | Major breach of the law; considerable prosecution and penalties | Very considerable penalties & prosecutions. Multiple law suits & jail terms |
| (R/S/C) **Impact on Reputation / Social / Community** | | Slight impact - public awareness may exist but no public concern | Limited impact - local public concern | Considerable impact - regional public concern | National impact - national; public concern | International impact - international public attention |
| **Likelihood** | **Examples** (Consider near-hits as well as actual events) | **Risk Rating** | | | | |
| **5 Almost Certain** | The unwanted event has occurred frequently; occurs in order of one or more times per year & is likely to reoccur within 1 year | **11 (M)** | **16 (H)** | **20 (H)** | **23 (Ex)** | **25 (Ex)** |
| **4 Likely** | The unwanted event has occurred infrequently; occurs in order of less than once per year & is likely to reoccur within 5 years. | **7 (M)** | **12 (M)** | **17 (H)** | **21 (Ex)** | **24 (Ex)** |
| **3 Possible** | The unwanted event has happened in the business at some time; or could happen within 10 years | **4 (L)** | **8 (M)** | **13 (H)** | **18 (H)** | **22 (Ex)** |
| **2 Unlikely** | The unwanted event has happened in the business at some time; or could happen within 20 years | **2 (L)** | **5 (L)** | **9 (M)** | **14 (H)** | **19 (H)** |
| **1 Rare** | The unwanted event has never been known to occur in the business; or it is highly unlikely that it will occur within 20 years. | **1 (L)** | **3 (L)** | **6 (M)** | **10 (M)** | **15 (H)** |

Table 7: Impact Summary Table

| Risk Rating | | Guideline for Matrix |
|---|---|---|
| *21 to 25 (EX)* | *Extreme* | *Eliminate, avoid, implement specific action plans/procedures to manage and Monitor* |
| *13 to 20 (H)* | *High* | *Proactively manage* |
| *6 to 12 (M)* | *Medium* | *Actively manage* |
| *1 to 5 (L)* | *Low* | *Monitor & manage as appropriate* |

# 15 ANNEXURE 4: GENERAL LIGHTS AT NIGHT MITIGATIONS

Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising mine operational safety and security.

*Mitigation:*

- Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the mine, without jeopardising mine operational safety and security (See lighting mitigations by The New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp in 14.2);
- Utilisation of specific frequency LED lighting with a green hue on perimeter security fencing.
- Directional lighting on the more exposed areas of operation, where point light source is an issue;
- No use of overhead lighting and, if possible, locate the light source closer to the operation; and
- If possible, the existing overhead lighting method utilised at the mine should be phased out and replaced with an alternative lighting using closer to source, directed LED technology.

*Mesopic Lighting*

Mesopic vision is a combination of photopic vision and scotopic vision in low, but not quite dark, lighting situations. The traditional method of measuring light assumes photopic vision and is often a poor predictor of how a person sees at night. The light spectrum optimized for mesopic vision contains a relatively high amount of bluish light and is therefore effective for peripheral visual tasks at mesopic light levels *(CIE, 2012).*

The Mesopic Street Lighting Demonstration and Evaluation Report by the Lighting Research Centre (LRC) in New York found that the 'replacement of white light sources (induction and ceramic metal halide) were tuned to optimize human vision under low light levels while remaining in the white light spectrum. Therefore, outdoor electric light sources that are tuned to how humans see under mesopic lighting conditions can be used to reduce the luminance of the road surface while providing the same, or better, visibility. Light sources with shorter wavelengths, which produce a "cooler" (more blue and green) light, are needed to produce better mesopic vision. Based on this understanding, the LRC developed a means of predicting visual performance under low light conditions. This system is called the unified photometry system. Responses to surveys conducted on new installations revealed that area residents perceived higher levels of visibility, safety, security, brightness, and colour rendering with the new lighting systems than with the standard High-Purity Standards (HPS) systems. The new lighting systems used 30% to 50% less energy than the HPS systems. These positive results were achieved through tuning the light source to optimize mesopic vision. Using less wattage and photopic luminance also reduces the reflectance of the light off the road surface. Light reflectance is a major contributor to light pollution (sky glow).' *(Lighting Research Center. New York. 2008).*

## 15.1 'Good Neighbour – Outdoor Lighting'

Presented by the New England Light Pollution Advisory Group (NELPAG) http://cfa/ www.harvard .edu /cfa/ps/nelpag.html) and Sky & Telescope http://SkyandTelescope.com/). NELPAG and Sky & Telescope support the International Dark-Sky Association (IDA) (http://www.darksky.org/).

**What is good lighting?** Good outdoor lights improve visibility, safety, and a sense of security, while minimising energy use, operating costs, and ugly, dazzling glare.

**Why should we be concerned?** Many outdoor lights are poorly designed or improperly aimed. Such lights are costly, wasteful, and distractingly glary. They harm the night-time environment and neighbours' property values. Light directed uselessly above the horizon creates murky skyglow — the "light pollution" that washes out our view of the stars.

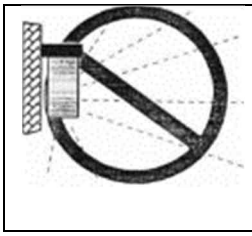
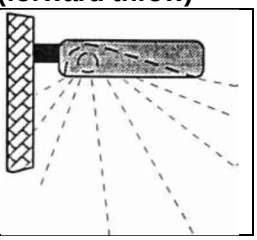
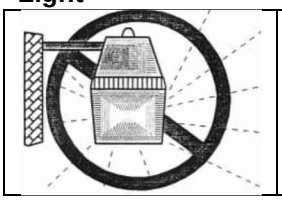
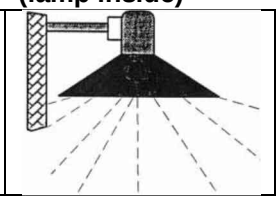
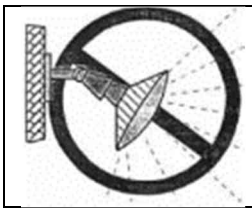
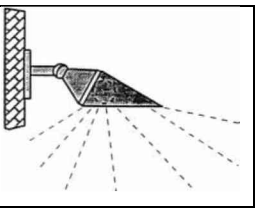
**Glare** Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

**Light Trespass** Poor outdoor lighting shines onto neighbours' properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

**Energy Waste** Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

**Excess Lighting** Some homes and businesses are flooded with much stronger light than is necessary for safety or security.

**Good and Bad Light Fixtures**

| **Typical "Wall Pack"** | **Typical "Shoe Box" (forward throw)** |
|---|---|
|  |  |
| **BAD** Waste light goes up and sideways | **GOOD** Directs all light down |
| **Typical "Yard Light"** | **Opaque Reflector (lamp inside)** |
|  |  |
| **BAD** Waste light goes up and sideways | **GOOD** Directs all light down |
| **Area Flood Light** | **Area Flood Light with Hood** |
|  |  |
| **BAD** Waste light goes up and sideways | **GOOD** Directs all light down |

**How do I switch to good lighting?**

Provide only enough light for the task at hand; don't over-light, and don't spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 100 times more brightly than the full Moon! More importantly, by choosing properly shielded lights, you can meet your needs without bothering neighbours or polluting the sky.

1. Aim lights down. Choose “full-cutoff shielded” fixtures that keep light from going uselessly up or sideways. Full-cutoff fixtures produce minimum glare. They create a pleasant-looking environment. They increase safety because you see illuminated people, cars, and terrain, not dazzling bulbs.

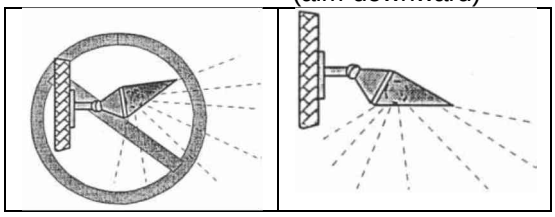
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimise their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may cost more initially, but they save you far more in the long run. They can illuminate your target with a low-wattage bulb just as well as a wasteful light does with a high-wattage bulb.

**3.** If color discrimination is not important, choose energy-efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact flourescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapor bulbs.

4. Where feasible, put lights on timers to turn them off each night after they are no longer needed. Put home security lights on a motion-detector switch, which turns them on only when someone enters the area; this provides a great deterrent effect!

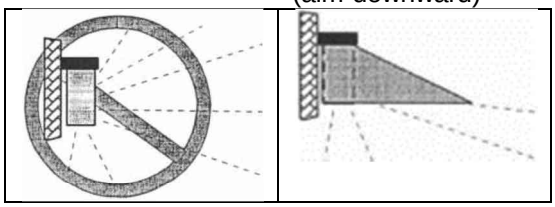
**What You Can Do To Modify Existing Fixtures**

Change this . . . to this (aim downward)



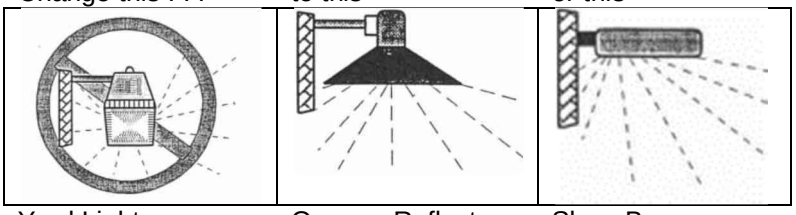
**Floodlight:**

Change this . . . to this (aim downward)



**Wall Pack**

Change this . . . to this or this



Yard Light Opaque Reflecter Show Box

**Replace bad lights with good lights.**
You’ll save energy and money. You’ll be a good neighbour. And you’ll help preserve our view of the stars.