BASIC ASSESSMENT FOR THE PROPOSED ESKOM SEKGAME-BULKOP-SISHEN POWER LINES, NORTHERN CAPE

VISUAL IMPACT SPECIALIST REPORT: BASIC ASSESSMENT

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Document prepared for Landscape Dynamics (Pty) Ltd;
On behalf of ESKOM (PTY) Ltd

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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.'

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
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
SAHRA	South African National Heritage Resources Agency
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

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:

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1 INTRODUCTION

VRM Africa was appointed by Landscape Dynamics (PTY) Ltd to undertake a Basic Visual Assessment for the proposed Sekgame-Bulkop-Sishen Power Line on behalf of ESKOM (PTY) Ltd. The site is located near the town of Kathu in the Northern Cape province. A site visit was undertaken on the 19th of September 2016.

1.1 Terms of Reference

The scope of the study is to cover the entire proposed project area, and the terms of reference for the study are as follows:

- Collate and analyse all available secondary data relevant to the affected proposed project area. This includes a site visit of the full site extent, as well as of areas where potential impacts may occur beyond the site boundaries.
- Consider all cumulative effects in all impact reports.
- Specific attention is to be given to the following:
  - Quantifying and assessing existing scenic resources/visual characteristics on, and around, the proposed site.
  - Evaluation and classification of the landscape in terms of sensitivity to a changing land use.
  - Determining viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Determining visual issues, including those identified in the public participation process.
  - Reviewing the legal framework that may have implications for visual/scenic resources.
  - Assessing the significance of potential visual impacts resulting from the proposed project for the construction, operation and decommissioning phases of the proposed project.
  - Assessing the potential cumulative impacts associated with the visual impact.
  - Identifying possible mitigation measures to reduce negative visual impacts for inclusion into the proposed project design, including input into the Environmental Management Plan (EMP).

1.2 Assumptions and Limitations

- Information pertaining to the specific heights of activities proposed for the development was limited and, where required, generic heights will be used to define the visibility of the project.
- 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 open source satellite imagery was utilised for base maps in the report.
- The viewsheds were generated using ASTER elevation data. (NASA, 2009)
- 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 Enterprise framework.
- 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.

1.3 Methodology Summary

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 (USDI., 2004). This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using standard assessment criteria.

The VRM process involves the systematic classification of the broad-brush landscape types within the receiving environment into one of four VRM Classes. Each VRM Class is associated with management objectives that serve to guide the degree of modification of the proposed site. The Classes are derived by means of a simple matrix with the three variables being the scenic quality, the expected receptor sensitivity to landscape change, and the distance of the proposed landscape modification from key receptor points. The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity, where they represent the relative value of the visual resources of an area. Classes I and II are the most valued, Class III represents a moderate value; and Class IV is of least value.

To determine impacts, a degree of contrast exercise is required. This is an assessment of the expected change to the receiving environment in terms of the form, line, colour and texture, as seen from the surrounding Key Observation Points. This is to determine if the proposed project meets the visual objectives defined for each of the Classes. If the expected visual contrast is strong, mitigations and recommendations are made to assist in meeting the visual objectives. To assist in the understanding of the proposed landscape modifications, visual representation, such as photomontages or photos depicting the impacted areas, can be generated. There is an ethical obligation in the visualisation process, as visualisation can be misleading if not undertaken ethically.

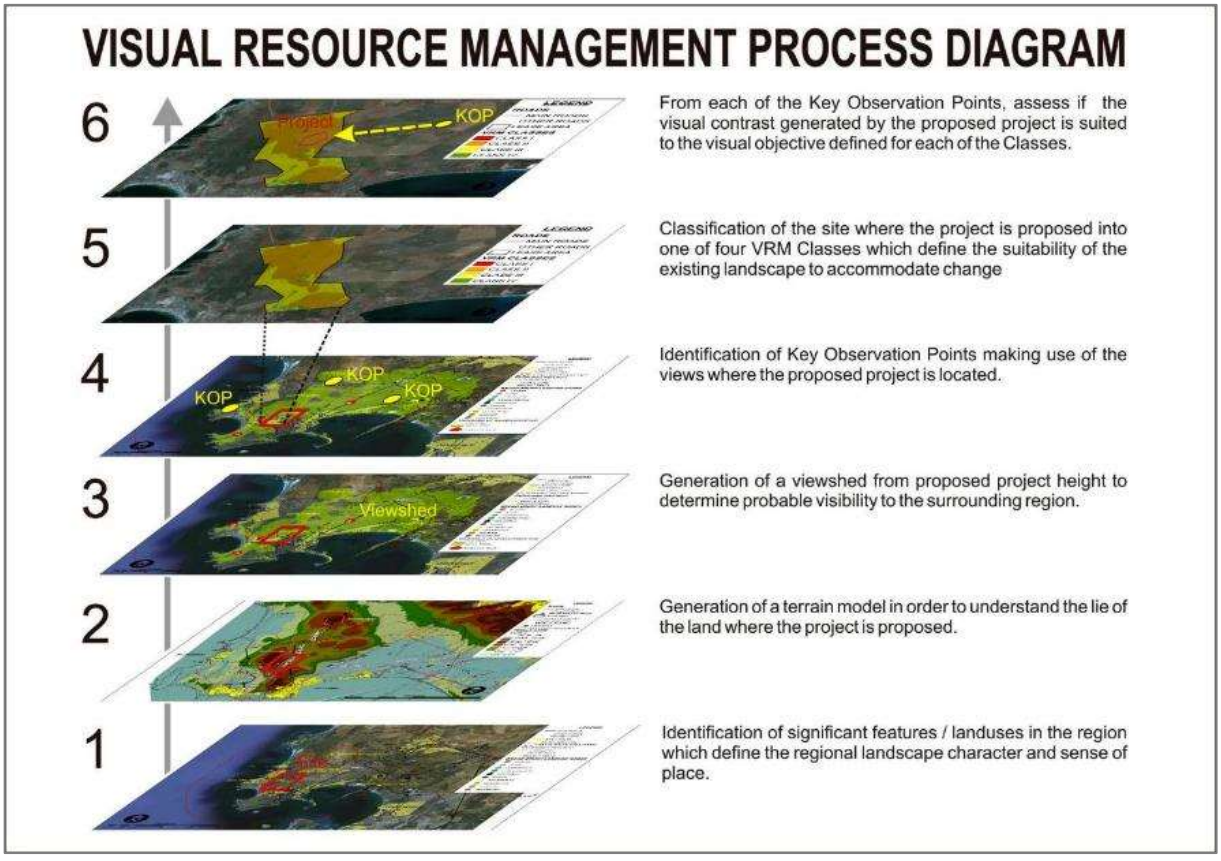

Figure 1: VRM process diagram

2 PROJECT DESCRIPTION

The project involves the construction of two new 132kV power lines:

- A ±6km 132kV power line from the new Sekgame Switching Station to the existing Bulkop/Ferrum 132kV line.
- A ±6km 132kV power line from the new Sekgame Switching Station to the existing Ferrum/Sishen 132kV line.

The above-mentioned lines will be constructed adjacent to each other.

It furthermore entails the decommissioning of two existing power lines:

- A section of the existing 132kV Bulkop-Ferrum powerline line as well as a section of the existing Ferrum-Sishen power line will be decommissioned. The lines to be decommissioned run from the Ferrum Substation up to the connection point of the new lines as proposed with the existing Bulkop-Ferrum and Ferrum-Sishen lines.

Figure 2: Monopole photographic examples.

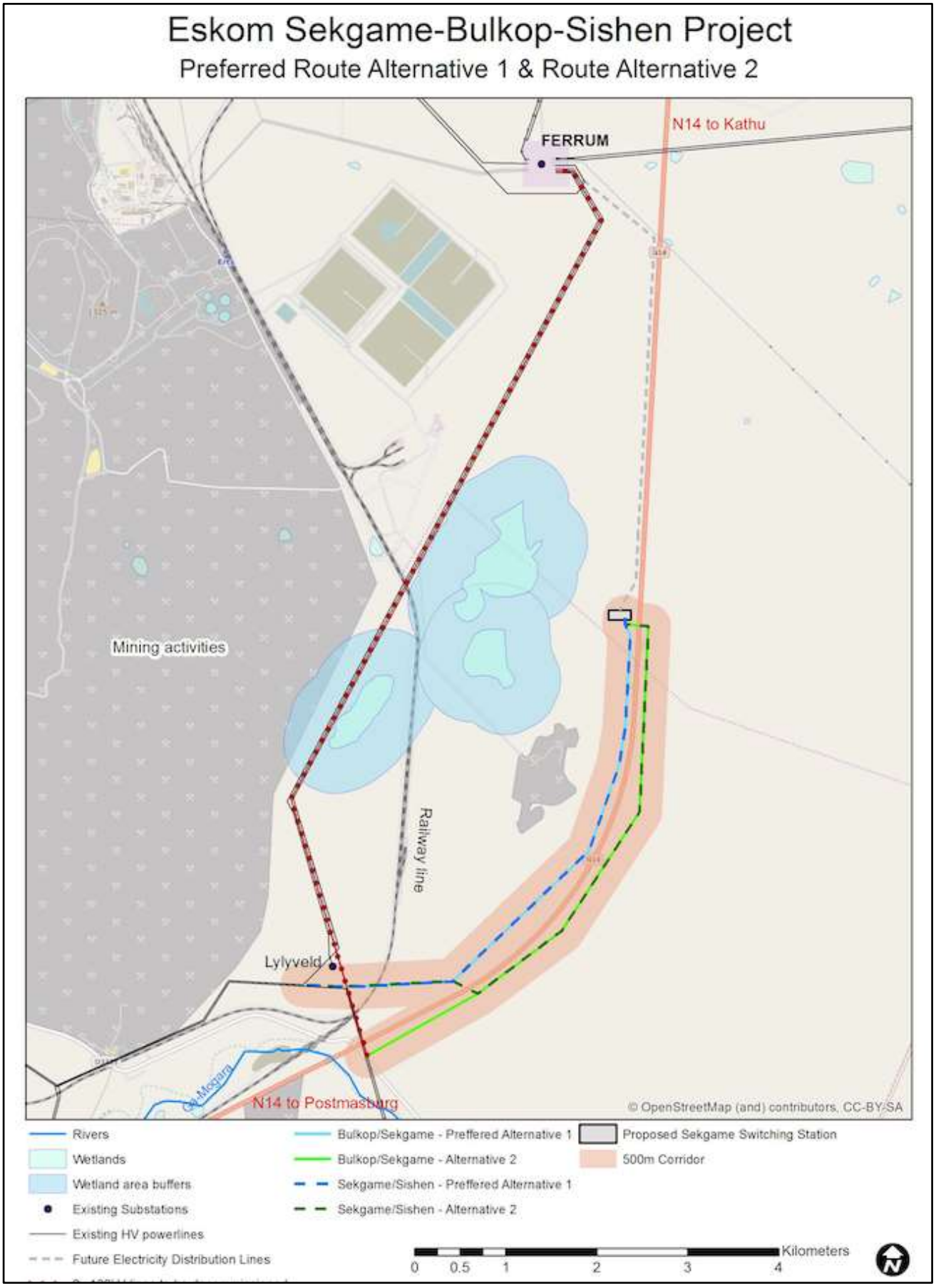

Figure 3: Project Alternative Locality Map (provided by Landscape Dynamics)

3 BASELINE ASSESSMENT

3.1 Project Locality

The proposed project is located on the southern outskirts of the town of Kathu. According to the Gamagara Municipality Spatial Development Plan, Kathu is know as the "town under the trees" due to its close proximity to a camel thorn forest. The town was proclaimed in 1972 "in order to accommodate the large amount of miners and their families entering the area". The report indicated that the need for this development "grew out of the massive development associated with the mining activities of the Sishen Mine (run by Kumba today). Mining is still the most important economic sector in the area today, contributing greatly to the GDP of South Africa. Kathu is still experiencing exponential growth today and is rapidly turning into an important economic growth point in the region". (Gamagara Municipality, 2010)

3.2 Legislative Context

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 organisation guidelines:

3.2.1 *International Finance Corporation (IFC)*

The 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)

3.2.2 *DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes*

As specific Visual Guidelines are not provided by the area we have referred to the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) Guideline for involving visual and aesthetic specialists in EIA processes. This states that the Best Practicable Environmental Option (BPEO) should address the following:

- 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 BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e. to retain open views and vistas).
- "Long term protection of important scenic resources and heritage sites.
- Minimisation of visual intrusion in scenic areas.
- Retention of wilderness or special areas intact as far as possible.
- Responsiveness to the area's uniqueness, or sense of place." (Oberholzer, 2005)

3.2.3 *Gamagara Municipality Spatial Development Framework*

The above mentioned SDF for Kathu was reviewed. No reference was made to the proposed site which is located outside of the urban edge. The report did make the following comment with regard to sufficient energy delivery: "The significant growth in Kathu is placing severe pressure on the electrical capacity of the region, often hindering the provision of electricity to households. It is therefore extremely important that constant inputs of engineering services are used to ensure sufficient energy delivery". (Gamagara Municipality, 2010)

3.3 Project Visibility

The visible extent, or viewshed, is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis is undertaken from the proposed sites at a specified height above ground level as indicated in the below table making use of open source NASA ASTER Digital Elevation Model data (NASA, 2009). The extent of the viewshed analysis was restricted to a defined distance that represents the approximate zone of visual influence (ZVI) of the proposed activities, which takes the scale, and size of the proposed projects into consideration in relation to the natural visual absorption capacity of the receiving environment. The maps are informative only as visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature (Hull & Bishop, 1988). The ZVI for the proposed power lines was restricted to 6km, as the small visual footprint of the monopoles is unlikely to extend beyond this distance. The surrounding landscape visual absorption capacity is also higher due to the Sishen Mine landforms, the Eskom power lines and railway line infrastructure to the west of the proposed site.

Table 1: Proposed Project Heights Table

Project Phase	Proposed Activity	Approx. Max. Height (m)	Approx. ZVI (km)
Construction	Transmission Lines	24 - 30	6
Operation	Transmission Lines	24 - 30	6
Deconstruction	Transmission Lines	24 - 30	6

3.3.1 *Key Observation Points*

Key Observation Points (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 that the proposed landscape modifications will make to the existing landscape be measured from these most critical locations, or receptors, surrounding the property.

Based on the viewshed analysis depicted in the map below, only a single Key Observation Point was identified that would make use of the proposed routing landscape. These KOP's are:

- The N14 National Road and picnics sites (north and south bound)

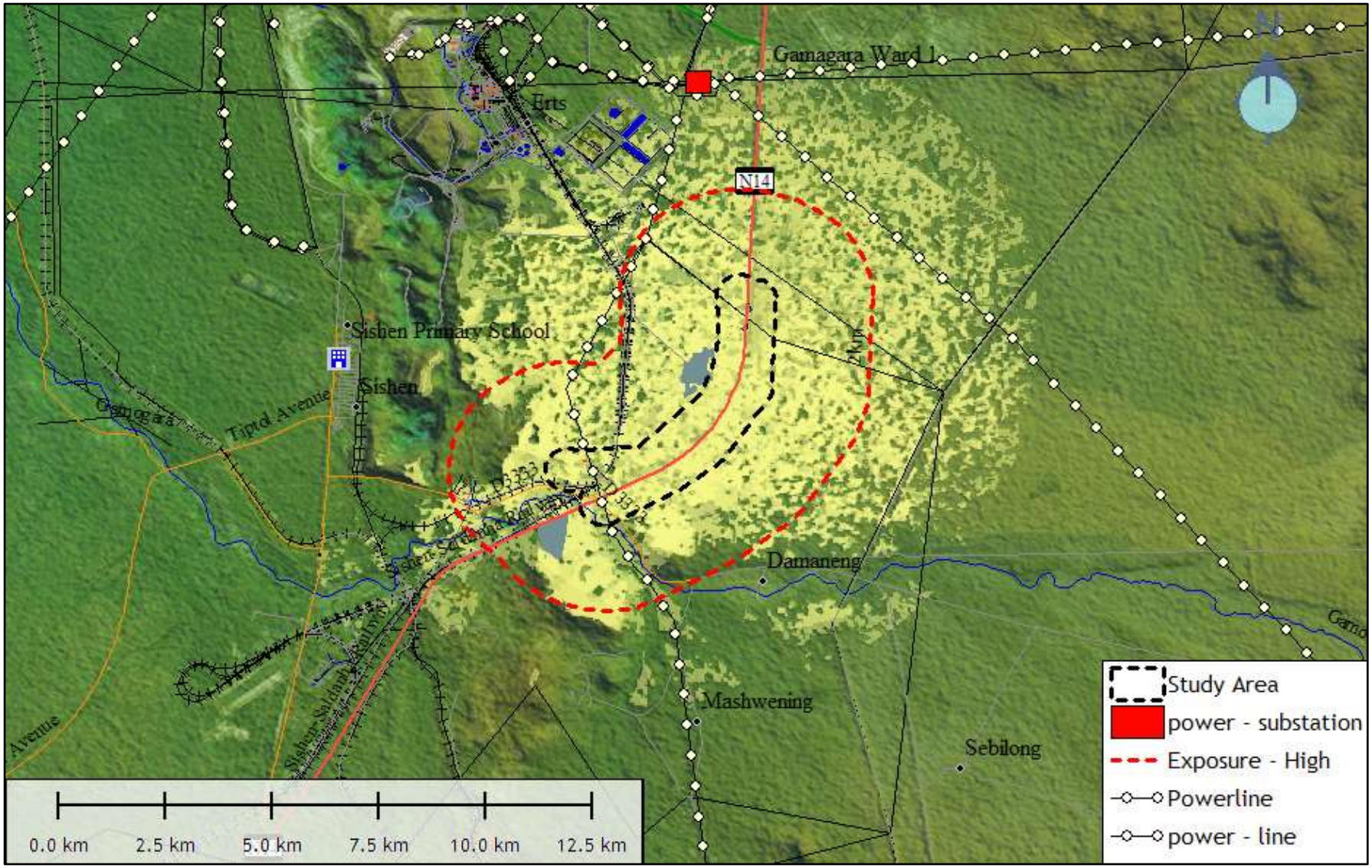

Figure 4: Viewshed generated from the proposed study area with vertical offset 30m overlaid onto OS Satellite Image Map

3.4 Regional Landscape Character

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, landform, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place'. (IEMA, 2002)

The following landmarks defining the surrounding area's characteristic landscape, were identified within the proposed project viewshed, and subsequently surveyed during the site visit:

- The N14 National Road
- Sishen Mine
- Rural agricultural areas
- Eskom regional substation and power lines

3.4.1 *The N14 National Highway*

Figure 5: Photograph taken in a southerly direction of the N14 National Road.

The N14 is a national road located 1.7km to the west of the proposed project boundary. The N14 connects the town of Kathu in the north, to the towns of Upington in the west, and Postmasburg in the south (via the R325). Traffic utilising the road is mainly mining related, but could also include tourist traffic.

3.4.2 *Sishen Mine*

Figure 6: Photograph depicting the Sishen Mine waste rock dumps and factories.

Sishen mine is located approximately 1.5km to the west of the proposed project boundary. The iron ore mine is one of the largest in South Africa and includes large waste rock dump landforms, large infrastructure and buildings. A by-product of the processing of the iron ore is a red-oxide dust that colours the buildings as seen in the photograph above. Contrast to the natural landscape generated by the large man-made landforms and structures is high and dominates the attention of the causal observer. Although the massing of the buildings and infrastructure are reduced by their red colouration against the backdrop of the similarly coloured waste dumps, the overall landscape character of the site and surrounds is influenced negatively, visually degrading the surrounding landscape context within an approximate six kilometre radius, which does include the proposed power line study area.

3.4.3 *Rural agricultural areas*

Figure 7: Photograph of the typical vegetation where livestock are grazed.

The proposed site, as well as the areas to the east and south of the site, are currently utilised for agriculture. The main farming activity is livestock farming with cattle. The proposed site and surroundings (excluding Reitzhof to the north) are zoned for agricultural land uses. Care should be taken to ensure that landuse changes on the site do not negatively influence the property value of the adjacent farming lands.

3.4.4 *Eskom regional substation and power lines*

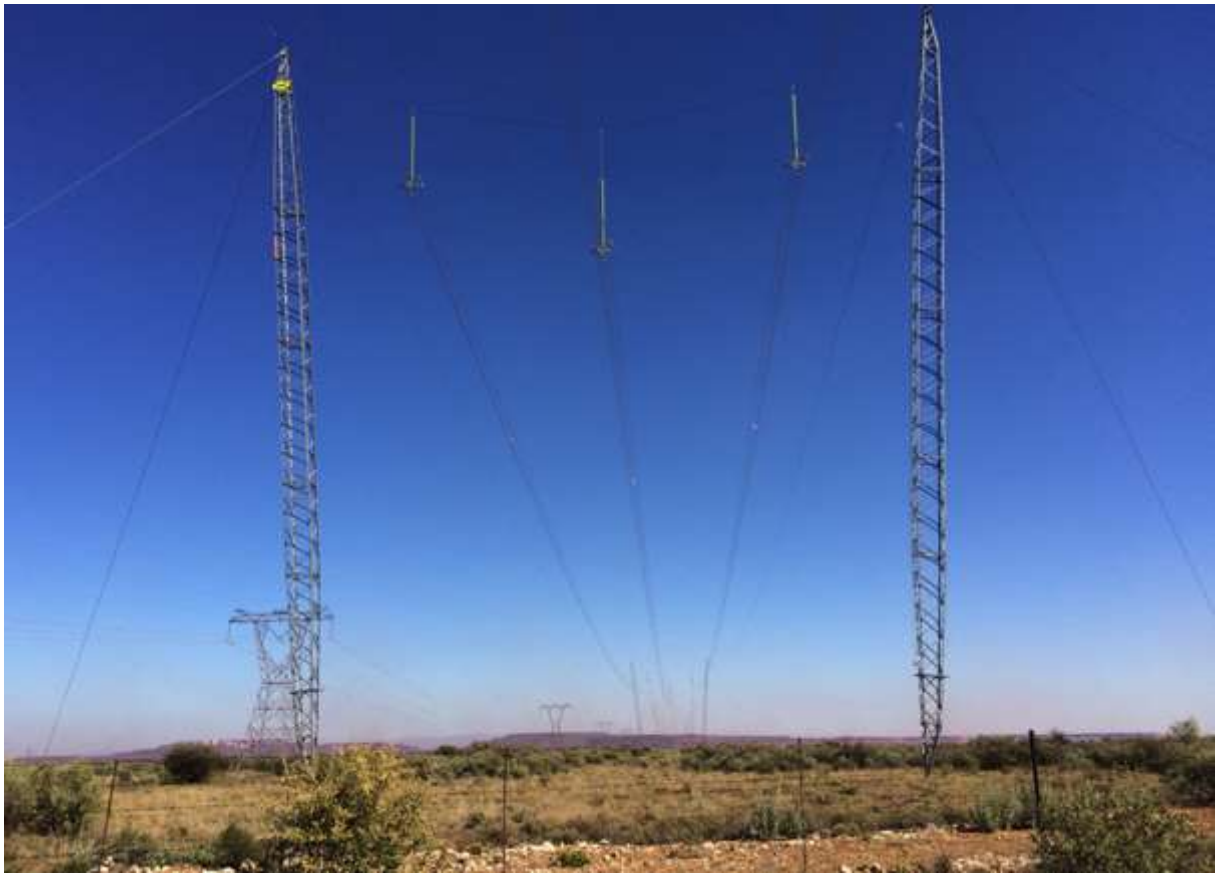

Figure 8: Photograph of the northern Eskom transmission line corridor.

Located to the north of the proposed site, is the Ferrum Substation that is an important regional electrical supply node. As can be seen on the project locality map (Figure 3 on Page 11) numerous power line routings are located within the local visual context of the proposed project study area, which significantly dominate the local sense of place. Strong vertical line elements are found in the landscape created by the vertical lines of the transmission poles and lattice structures. The light grey colour of the transmission structures also increases the colour contrast in the landscape.

3.5 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 distance of the proposed landscape modification from key receptor points. The scenic quality is determined making use of the VRM scenic quality questionnaire (refer to addendum). In order to better understand the visual resources of the site, regional vegetation and terrain influences are described at a broad brush level.

3.5.1 *Site Topography*

Elevation profiles were generated making use of ASTER data Digital Elevation Model. The following slopes and elevation statistics were generated for the proposed property and adjacent surrounds. The minimum elevation is 1194mamsl and is located in the southern extent. The maximum elevation is 12404mamsl and located in the northern section of the site. The average elevation is 1213mamsl. The slope gradients of the site are low with average slope percentage being 6.54%. As indicated on Figure 9 below, there are no steep slopes on the site, with the average aspect towards the west. (Property statistics are all approximate) Local hill features are located to the south of the site and extend in height to approximately 1335mamsl. To the west are the Sishen waste rock dumps, tailings storage facilities created by the excavated void of the mine. These features are large in size and restrict visibility in the west. Small hill located to the south restrict views to the south. The terrain rises in elevation to the east, which in conjunction with the bushveld vegetation, would also limit visibility to some degree to the east.

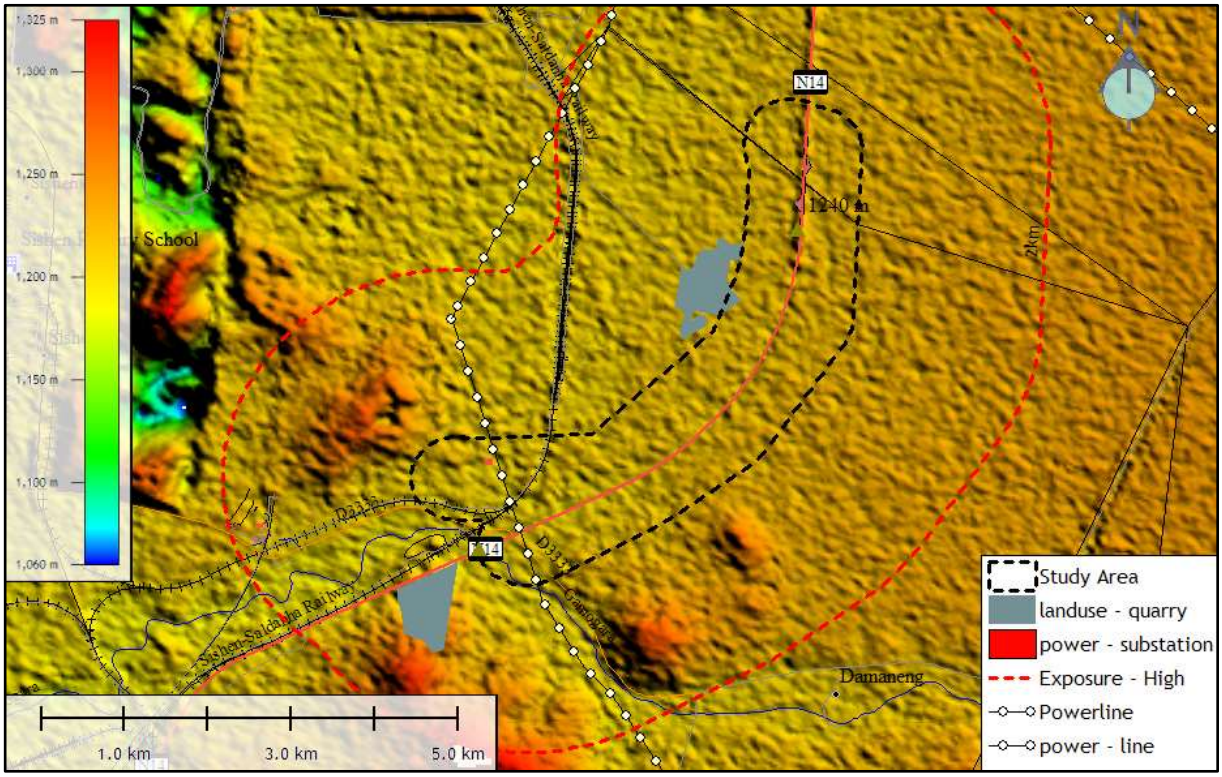

Figure 9: ASTER DEM elevation model map

3.5.2 *Vegetation*

According to the SANBI BGIS broad vegetation types mapping, the northern section of the proposed routing comprises Kathu Bushveld. The southern section of the routing comprises Kuruman Thornveld. These vegetation types fall within the Savanna Biome. According to the PlantZAfrica website, “the Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third the area of South Africa. It is well developed over the lowveld and Kalahari region of South Africa and is also the dominant vegetation in Botswana, Namibia and Zimbabwe. From a visual screening perspective, it is important to note that Savanna type vegetation is “characterized by a grassy ground layer and a distinct upper layer of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld, where it is dense as Woodland, and the intermediate stages are locally known as Bushveld”. (PlantZAfrica.com)

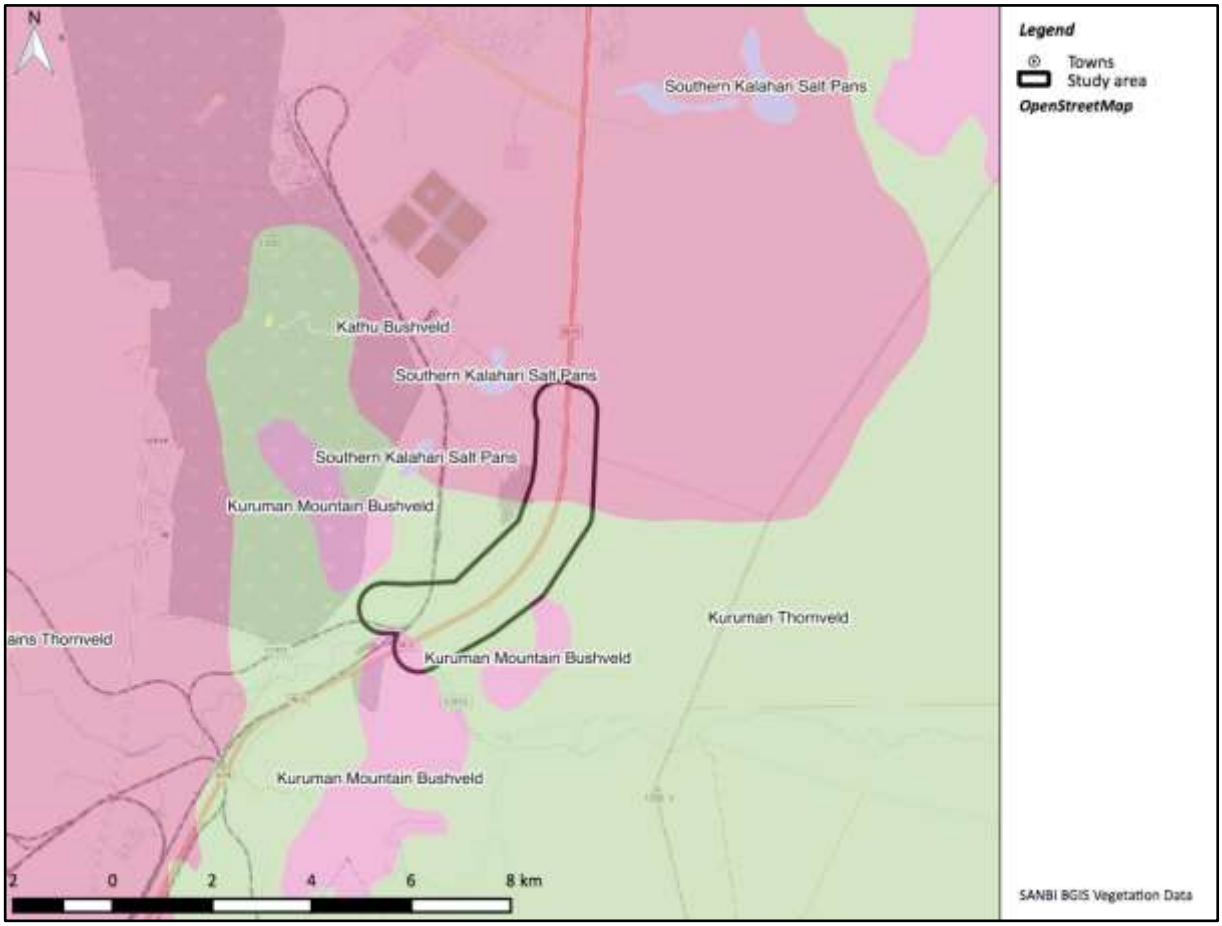

Figure 10: SANBI BGIS Broad Vegetation Type Map. (SANBI, 2014)

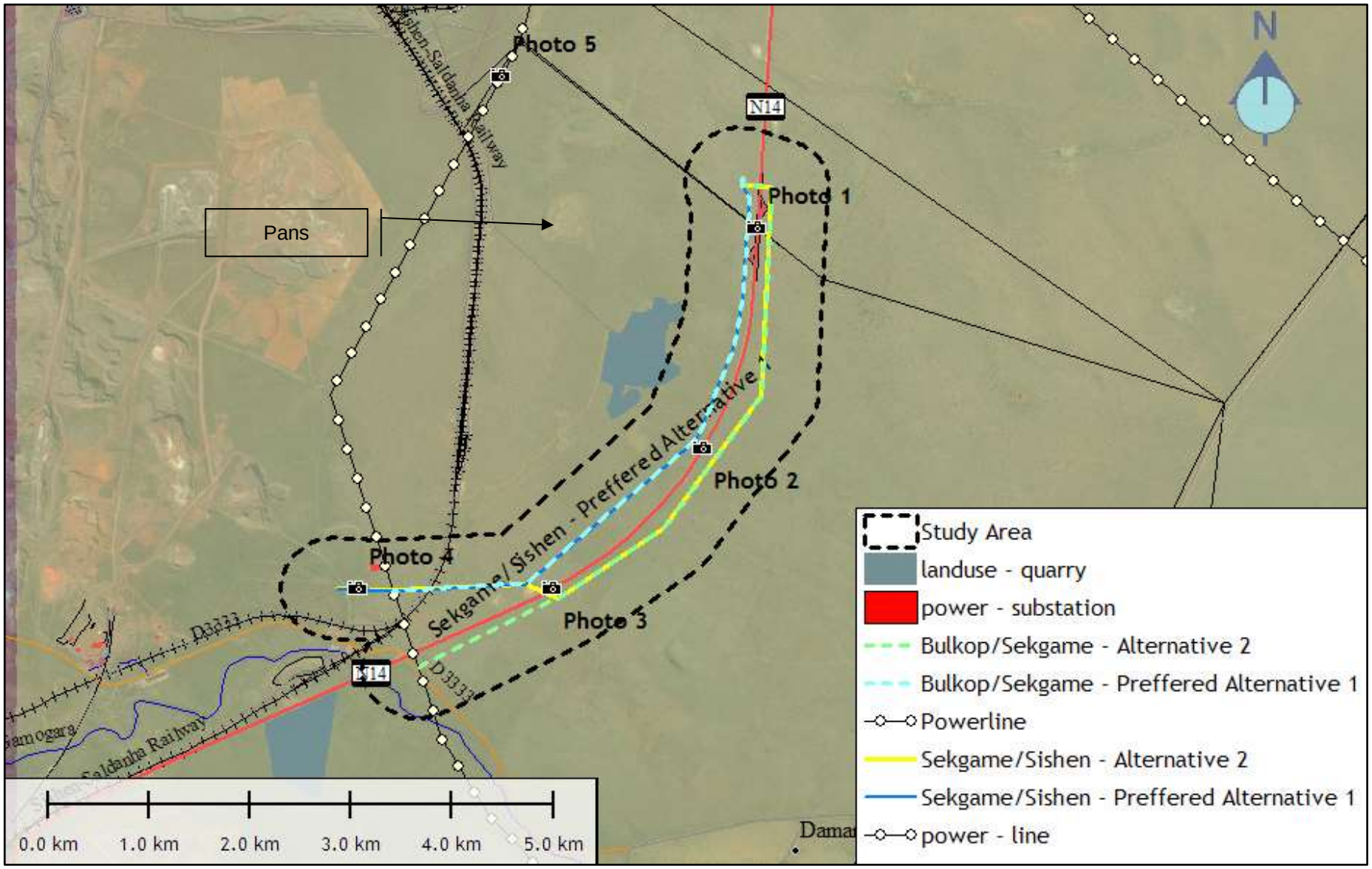

Figure 11: Site landscape character and photograph point locality overlay onto Open Source Satellite image map

3.5.3 *Site Photographs*

Figure 12: View north from Photograph Point 1 of the proposed location where the Bulkop / Sekame and Sekgame / Sishen Alternative routings would cross the N14 road.

Figure 13: View south from the road side picnic area location just south of Photograph Point 1 location where the Bulkop / Sekame and Sekgame / Sishen Alternative routings would be located on the left of the picnic site.

Figure 14: View south from Photograph Point 2 with the low hills in the south and the open rural landscape to the east. The existing telecommunication line are located to the west which would help reduce vertical line contrast generated by the Bulkop / Sekame and Sekgame / Sishen Preferred routings.

Figure 15: View west from Photograph Point 3 where the proposed Bulkop / Sekame and Sekgame / Sishen Alternative routings would cross the N14 road, with thornveld vegetation adjacent the road and the low hills and mining landscapes to the south creating some visual absorption.

Figure 16: View from Photo 4 of the existing Lilyveld Substation

Figure 17: View south from Photo 5 of the existing 132kV Bulkop-Ferrum powerline line as well as a section of the existing Ferrum-Sishen power line which will be decommissioned and removed. The higher VAC levels of the adjacent railway line infrastructure would reduce visual contrast generated during de-construction.

3.6 Project Site Visual Resource Management Assessment

In terms of 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. These three criteria are rated in terms of the VRM Scenic Quality and Receptor Sensitivity Questionnaires that are appended to the addendum.

Broad Brush Landscapes are the areas within the defined project study area which have similar physical and graphic attributes. The study area is comprised of the defined 500m buffer area. Each of the below listed landscapes are assessed in terms of Scenic Quality and Receptor Sensitivity to landscape change.

Table 2: Broad Brush Landscape Table

Broad Brush Landscape	Motivation
Bushveld / Thornveld West	Semi-modified Kathu Bushveld and Kuruman Thornveld areas to the West of the N14 along which the preferred power lines options would be routed
N14 Road Crossing areas	The road modified area over which the alternative power line options would be routed
Bushveld / Thornveld East	Semi-modified Kathu Bushveld and Kuruman Thornveld areas to the East of the N14 along which the alternative power lines options would be routed
Existing Power Line Routings	Existing Power Line Routings of the 132kV Bulkop-Ferrum powerline
Wetland Buffers	Wetland buffer area through which the 132kV Bulkop-Ferrum power line is currently routed. Due to wetlands falling with WULA legislation, these areas and the required buffer are classified as Class I.

3.6.1 *Scenic Quality*

The Scenic Quality is determined making use of the VRM Scenic Quality Questionnaire (refer to addendum) that rates the different broad-brush landscape found within the study area. Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale. The seven scenic quality criteria are defined below:

- **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.

The scores are totaled and assigned a A (High), B (Moderate) or C (low) based on the following split:
A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11

Table 3: Landscape Scenic Quality rating table.

PRU	Scenic Quality (1=Low, 5=High)								
	Land Form	Vegetation	Water	Colour	Adjacent Scenery	Scarcity	Cultural Modifications	Total	Rating
Wetland Buffers	CLASS I (Not Applicable)								
Modified Bushveld / Thornveld East	1	3	0	2	2	3	0	11	**B**
N14 Road Crossing	1	2	1	2	2	1	-2	7	**C**
Modified Bushveld / Thornveld West	1	2	1	2	2	1	-4	5	**C**
Existing Power line Corridor	1	1	1	1	2	1	-3	4	**C**

3.6.2 *Receptor Sensitivity*

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

- **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.

Table 4: Landscape Receptor Sensitivity rating table.

PRU	Sensitivity					
	Type of Use	Amount of Use	Public Interest	Adjacent Land Users	Special Areas	Sum
Wetland and WULA Buffers	CLASS I (Not Applicable)					
Modified Bushveld / Thornveld East	L	H	L	H	L	**M**
N14 Road Crossing	M	L	M	M	L	L
Modified Bushveld / Thornveld West	L	H	L	M	L	L
Existing Power line Corridor	L	L	L	L	L	L

3.6.3 *Visual Resource Management (VRM) Classes*

The BLM has defined four Classes that represent the relative value of the visual resources of an area. The VRM Classes are not prescriptive and are utilised as a guideline to determine the carrying capacity of a visually preferred landscape that is utilised to assess the suitability of the landscape change associated with the proposed project. The Visual Inventory Classes are defined making use of the VRM Matrix below. The Visual Management Classes are derived from the Inventory Class, but can be adjusted to take local planning or guidelines into consideration:

Table 5: VRM Class Matrix Table

		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

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

Table 6: VRM Class Summary Table

Landscape Area	Distance Zone	Scenic Quality	Visual sensitivity	Visual Inventory	Visual Resource Management
Wetland and WULA Buffers					**Class I**
Modified Bushveld / Thornveld East	Foreground	B	Medium	Class III	**Class III**
N14 Road Crossing	Foreground	C	Low	Class IV	**Class IV**
Modified Bushveld / Thornveld West	Foreground	C	Low	Class IV	**Class IV**
Existing Power line Corridor	Foreground	C	Low	Class IV	**Class IV**

*** Yellow Highlight = amendment from Visual Inventory to Visual Management**

4 RESULTS

4.1 Visual Extent

The visual extent, or zone of visual influence, of the proposed power lines projects is rated ***Local*** due to surrounding bushveld / thornveld vegetation, as well as the higher VAC levels created by the mining landscapes to the west which include large man-made forms, railway line and power line infrastructure.

4.2 Exposure

Exposure is rated ***High*** with the main receptors, the N14 National Highway, located adjacent to the proposed routings.

4.3 Scenic Quality

Scenic quality for all proposed ***Preferred routings*** areas was rated ***Low***, due to the strong negative influence of the Sishen Mine as well as the Eskom transmission line corridors located in the background.

Scenic quality for all proposed ***Alternative routings*** areas was rated **Medium**, due to the higher ratings for the surrounding rural landscape that add value to the eastern views (away from the Sishen Mine), and the neutral rural relative cultural landscape modifications.

4.4 Receptor Sensitivity to Landscape Change

Receptor sensitivity to landscape change for ***Preferred routings*** areas was rated **Low.** Given the strong mining landscape context of the site and the domination of mining within the local economy, it is likely that public interest in maintaining visual quality is low.

The receptor sensitivity for the ***Alternative routings*** was rated ***Medium*** due to the rural landscape contrasting strongly with the eastern modified mining landscape, which by contrast creates a view 'escape' from the Sishen mining landscapes, increasing the value of the area as a Special Area.

4.5 VRM Objectives

The BLM has defined four Classes that represent the relative value of the visual resources of an area and are defined making use of the VRM Matrix below:

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

The Classes are not prescriptive and are utilised as a guideline to determine the carrying capacity of a visually preferred landscape that is utilised to assess the suitability of the landscape change associated with the proposed project. The Visual Inventory Classes are defined using the matrix below and with motivation, can be adjusted to Visual Resource Management Classes which take zoning and regional planning into consideration if applicable.

4.5.1 *Class I*

Class I is assigned when legislation restricts development in certain areas. A Class I visual objective was assigned to the following features within the proposed development area due to their protected status within the South African legislation:

- The areas of the old Bulkop – Ferrum power lines that intersect with the wetland buffer which triggers a WULA application. These area will need to be handled in terms of the recommendations of the Surface Water Specialist (if applicable).

The visual objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention.

4.5.2 *Class II*

Class II visual objectives were assigned to the following features:

- There are no Class II areas defined for the site.

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.

4.5.3 *Class III*

Class III visual objectives were assigned to the following landscapes:

- The Bulkop / Sekgame - Alternative 2
- Sekgame / Sishen - Alternative 2

The VRM Class for this landscape was rated Class III due to the medium rating for the Scenic Quality and the expected medium receptor sensitivity to landscape change. The Medium scenic quality rating was mainly due to the higher ratings for the surrounding rural landscape that add value to the eastern views (away from the Sishen Mine), and the neutral rural relative cultural landscape modifications. The receptor sensitivity was rated medium due to the rural landscape contrasting strongly with the eastern modified mining landscape, which by contrast creates a view 'escape' from the Sishen mining landscapes, increasing the value of the area as a Special Area.

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.

4.5.4 *Class IV*

Class IV visual objectives were assigned to the following landscapes:

- The Bulkop / Sekgame - Preferred
- Sekgame / Sishen - Preferred

These areas were rated Class IV due to the low rating for the Scenic Quality and the expected low receptor sensitivity to landscape change. The low scenic quality rating was due to the flatter terrain, fragmented and modified vegetation, no water resources and the surrounding landscape context that is strongly associated with mining. The receptor sensitivity was rated low due to the strongly modified mining landscape with is clearly visible in the background, as well as no tourist related activities, or landscape sensitive receptors.

The Class IV objective is to provide for management activities that 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.

5 IMPACT ASSESSMENT

5.1 Contrast Rating

A contrast rating is undertaken from the Key Observation Points to assess if the proposed landscape modification will meet the VRM Class Objectives. The following criteria are utilised in defining the Degree of Contrast:

- **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.

5.2 Impact Assessment Rating Criteria

Visual impact significance impacts were defined making use of the DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA processes. (Oberholzer, 2005)

Table 7: DEA&DP Visual Impact Rating Criteria Table

Extent	**Geographical area of influence.** **Site Related (S):** *extending only as far as the activity* **Local (L):** limited to i*mmediate surroundings.* **Regional (R):** *affecting a larger metropolitan or regional area* **National (N):** *affecting large parts of the country* **International (I):** *affecting areas across international boundaries*
Duration	**Predicted lifespan** **Short term (S):** *duration of the construction phase.* **Medium term (M):** *duration for screening vegetation to mature.* **Long term (L):** *lifespan of the project.* **Permanent (P):** *where time will not mitigate the visual impact.*
Magnitude	**Magnitude of impact on views, scenic or cultural resources** **Low (L):** *where visual and scenic resources are not affected.* **Moderate (M)**: *where visual and scenic resources are affected* **High (H)**: *where scenic and cultural resources are significantly affected.*
Probability	**Degree of possible visual impact:** **Improbable (I):** *possibility of the impact occurring is very low.* **Probable (P):** *distinct possibility that the impact will occur.* **Highly probable (HP):** *most likely that the impact will occur.* **Definite (D):** *impact will occur regardless of any prevention measures.*
Significance	**A synthesis of nature, duration, intensity, extent and probability** **Low (L):** will not have an influence on the decision. **Moderate (M):** should have an influence on the decision unless it is mitigated. **High (H):** would influence the decision regardless of any possible mitigation.
Confidence	Key uncertainties and risks in the VIA process, which may influence the accuracy of, and confidence in, the VIA process.

Source: DEA&DP Guideline for involving Visual and Aesthetic Specialists in EIA Processes

Table 8: Key Observation Point Contrast Rating Table

Key Observation Points / Landscapes	Class I				Class II				Class III				Class IV			
	Project Activities															
	Wetland Buffer								Modified Bushveld / Thornveld East				Modified Bushveld / Thornveld West			
													Existing Power line Corridor			
													N14 Road Crossing			
	Contrast															
	None	**Weak**	**Medium**	**Strong**	**None**	**Weak**	**Medium**	**Strong**	**None**	**Weak**	**Medium**	**Strong**	**None**	**Weak**	**Medium**	**Strong**
N14 National Road Southbound		**X**										**X**		**X**		
N14 National Road Northbound		**X**										**X**		**X**		
Contrast	Weak								Strong				Weak			
Visual Objectives Met	With Mitigation								With Mitigation				Yes			

Table 9: Landscape Impact Assessment Table

Impacts	Class I	Class II	Class III	Class IV
Activity Descriptions	Decommissioning of the two 66kV power line within the Wetland Buffer area	No Class II Landscape	Bulkop / Sekgame - Alternative 2; Sekgame / Sishen - Alternative 2 (located on Modified Bushveld / Thornveld East of the N14)	Bulkop / Sekgame - Preferred; Sekgame / Sishen – Preferred; Decommissioning of the two 66kV lines (located on Modified Bushveld / Thornveld West of the N14)
Extent	Local		Local	Local
Duration	Permanent		Permanent	Permanent
Magnitude	Medium		Medium	Low
Probability	Good		Good	Low
Cumulative Effects	No		Yes	Low
Significance w/o Mit.	Medium		Medium to High	Low
Significance with Mit.	Very Low		Medium to Low	Very Low
Mit. Confidence	Good		Good	Good

5.3 Bulkop / Sekgame

5.3.1 *Preferred*

The proposed Bulkop / Segame Preferred power line routing is located to the west of the N14 on modified Kathu Bushveld and Kuruman Thornveld. The VRM Class for this landscape is rated Class IV due to the Low rating for the Scenic Quality and the expected Low receptor sensitivity to landscape change. The low Scenic Quality rating is due to the flatter terrain, fragmented and modified vegetation, no water resources and the surrounding landscape context which is strongly associated with mining. The Receptor Sensitivity to this alternative is rated low due to the strongly modified mining landscape with is clearly visible in the background, as well as no tourist related activities, or landscape sensitive receptors.

The main receptors that would use this landscape are limited to the N14 road users traveling in a north and south direction. Due to the strong vertical line element in the existing landscape created by the telecommunication poles in the immediate foreground, and existing Eskom lattice mast in the background, the contrast generated by the proposed monopoles is expected to be weak. The modified mining landscape forms in the background also further increase the VAC levels in this westerly view direction, resulting in less noticeable form contrast from the monopoles.

Due to the higher VAC levels of the site, as well as the mining landscape context, the Extent of the visual impact is expected to remain contained to local levels. Although the structures are likely to become permanent features, Magnitude of this Preferred Alternative is rated Low due to the expected weak levels of visual contrast. Due to the already strongly modified mining landscape in the background (which will become more modified by the expansion of the proposed Sishen Tailings Dam), Cumulative Risks to the area from further landscape degradation are rated as Low. Without Mitigation, the proposed power line landscape modification is rated Medium and Low with Mitigation. Mitigation is recommended and would include the following actions:

Mitigation

- Planning Phase:
    - Maintain a 100m buffer from the N14 Road servitude to create a visual buffer as well as to allow for future expansion of the N14 should this become necessary.
- Construction Phase:
    - Utilising existing access roads as much as possible.
- Operation Phase:
    - On-going maintenance for soil erosion along maintenance access routes.

5.3.2 *Alternative*

The proposed Bulkop / Segame Alternative power line routing is located to the east of the N14 on modified Kathu Bushveld and Kuruman Thornveld. The VRM Class for this landscape is rated Class III due to the Medium rating for Scenic Quality and the expected Medium Receptor Sensitivity to landscape change. The Medium Scenic Quality rating for this route area is mainly due to the higher rating for the surrounding rural landscape which adds value to the eastern views (away from the Sishen Mine), and the relatively neutral rural cultural landscape modifications which are farm related. The Receptor Sensitivity is rated Medium, due to the rural landscape contrasting strongly with the eastern modified mining landscape, which by contrast, creates a view 'escape' from the Sishen mining landscapes, increasing the value of the area as a Special Area.

The predominant receptors that would use this landscape are limited to the N14 road users traveling in a north and south direction. Due to the lack of strong vertical line elements in the existing landscape, the contrast generated by the proposed monopoles is expected to be Strong especially if located in close proximity to the road. The rural landscapes in the foreground and background have a low VAC levels, resulting in noticeable form and line contrast generated by the monopoles in contrast to the landscape.

Due to the surrounding bushveld type landscape, the Extent of the visual impact is expected to be contained within the local levels. As the structures are likely to become permanent features, Magnitude has been rated Medium due to the expected Strong levels of visual contrast. As the eastern areas surrounding the proposed routing are rural, the probability of cumulative risks from landscape degradation are rated as Good, as landscape degradation and loss of property value could be expected. Without Mitigation, the proposed power line landscape modification is rated Medium to High, and Medium to Low with Mitigation. Due to the cumulative risks associated with landscape degradation resulting in property devaluation, this routing option is ***Not Recommended*** and should only be considered should the Preferred Routing be fatally flawed. Mitigation is recommended and would include the following actions.

Mitigation

- Planning Phase:
    - Maintain a 50m buffer from the N14 Road servitude to create a visual buffer as well as to allow for future expansion of the N14 should this become necessary.
- Construction Phase:
    - Utilising existing access roads as much as possible.
    - Planting of Kuruman Thornveld vegetation 20m from the road servitude to create a tree-screening buffer. The services of a qualified landscape architect should be utilised to create a detailed planting plan, making use of the most suitable local indigenous, endemic tree species.
- Operation Phase:
    - On-going maintenance for soil erosion along maintenance access routes.
    - Ongoing maintenance to ensure that the tree screening vegetation growth is successful over the first 2 years.

5.4 Sekgame / Sishen

5.4.1 *Preferred*

As for Bulkop / Segame Preferred routing.

5.4.2 *Alternative*

As for Bulkop / Segame Alternative routing.

5.5 Decommissioning 132kV Bulkop-Ferrum powerline

The study area for the proposed decommissioning of the old Bulkop – Ferrum power lines was mostly defined as a Class IV due to the Low rating for Scenic Quality and the expected Low Receptor sensitivity to landscape change. However, the section of the routing which intersects with the wetland buffer area is defined as Class I due to the intersection with the wetland buffer. The Class IV areas have a low Scenic Quality rating due to flatter terrain, fragmented and modified vegetation, no water resources and a surrounding landscape context that is strongly associated with mining. The Receptor Sensitivity was rated low due to the existing strongly modified mining landscape which is clearly visible in the background, as well as there being no potential of tourist related activities. The Class I area has a similarly degraded landscape context, but falls within the WULA legislation and requires special conditions for the deconstruction process which will need to be defined by the Surface Water Specialist (if applicable).

The main Receptors that would use this landscape are limited to the N14 road users traveling in a north and south direction. Due to the strong vertical line element in the existing landscape created by the telecommunication poles in the immediate foreground, and existing Eskom lattice structures in the background, the contrast generated by the removal of the existing monopoles is expected to be weak and a short term impact. The modified mining landscape forms in the background also further increase the VAC levels in this westerly view direction, resulting in less noticeable form contrast from the deconstruction of the power line structures.

Due to the higher VAC levels of the site as well as the mining landscape context, the Extent of the visual impact is expected to be contained to within the Local level. Magnitude was rated Low due to the expected weak levels of visual contrast. Due to the already strongly modified mining landscape in the background (which will become more modified by the expansion of the proposed Sishen Tailings Dam), Cumulative Risks from landscape degradation are rated as Low. Without Mitigation, the proposed power line deconstruction is rated Medium, and Very Low with Mitigation. Mitigation is recommended and would include the following actions:

Mitigation

- Planning Phase:
    - Generation of a detailed management plan on how to access the wetland buffer area so as to reduce site specific impacts during the deconstruction process, using only existing access roads during dry season periods.

- Deconstruction Phase:
    - Utilising existing access roads as much as possible.
    - If the power line structures and cables can't be reused or recycled, then disposing of the materials according to South Africa waste regulations.
- Post Deconstruction Phase:
    - On-going maintenance for soil erosion along previous maintenance access routes.

6 CONCLUSION

VRM Africa was appointed by Landscape Dynamics (PTY) Ltd to undertake a Basic Visual Assessment for the proposed Sekgame-Bulkop-Sishen Power Line on behalf of ESKOM (PTY) Ltd. The site is located near the town of Kathu in the Northern Cape province. A site visit was undertaken on the 19th of September 2016.

The Visual Extent of the proposed power lines routings is rated **Local** due to surrounding Kathu Bushveld / Kuruman Thornveld vegetation, as well as the high VAC created by the mining landscapes to the west which include large man-made forms, railway line and power line infrastructure. Exposure is rated **High** with the main receptors, the N14 National Highway, located directly adjacent to the proposed routings. Scenic quality for all proposed Preferred routing areas was rated **Low**, due to the strong negative influence of the Sishen Mine as well as the Eskom transmission line corridors located in the background. Scenic quality for all proposed Alternative routings areas was rated **Medium**, due to the higher ratings for the surrounding rural landscape which add value to the eastern views (away from the Sishen Mine), and the relatively neutral rural cultural landscape modifications.

Receptor Sensitivity to landscape change for the Preferred routing areas was rated **Low.** Given the strong mining landscape context of the site and the domination of mining within the local economy, it is likely that public interest in maintaining visual quality is low. Receptor Sensitivity to the Alternative routings was rated **Medium** due to the rural landscape contrasting strongly with the western modified mining landscape, which by contrast, creates a view 'escape' from the Sishen mining landscapes, increasing the value of the area as a Special Area.

The visual preference for the proposed routings are the Bulkop / Segame and Sekgame / Sishen Preferred power line routings. This is due to the higher VAC levels of the site as well as the mining landscape context, with the Extent of the visual impact expected to be contained at the Local level. Although the structures are likely to become a permanent features, Magnitude was rated Low due to the expected weak levels of visual contrast. Due to the already strongly modified mining landscape in the background (which will become more modified by the expansion of the proposed Sishen Tailings Dam), cumulative risks from further landscape degradation associated with the proposed power line project are rated as Low. Without Mitigation, the **Visual Impact Significance** of the proposed power line landscape modification was rated **Medium**, and **Low with Mitigation**. Mitigation is recommended.

Due to the cumulative risks associated with landscape degradation resulting in property devaluation, the Bulkop / Segame and Sekgame / Sishen Alternative power line option re Not **Recommended**. The options should only be considered should the Preferred Routing be found to be Fatally Flawed. The eastern areas surrounding the proposed routing are rural and construction of the Alternative power line routings would increase the potential for cumulative risks from landscape degradation and the resultant loss of property and aesthetic value. Tree screening mitigation would be required should this alternative routing be required.

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8 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

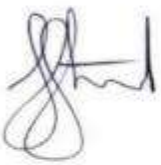
Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa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

8.1 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
   - Bachelor 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)
     - Southern Cape Chairperson (2008)

10. **Conferences Attended:**
    - IAIAsa 2012
    - IAIAsa 2011
    - IAIA International 2011 (Mexico)
    - IAIAsa 2010
    - IAIAsa 2009
    - 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	LOCATION
2014	Joram Solar	Solar Energy	Northern Cape
2014	RERE ##Postmasberg	Solar Energy	Northern Cape
2014	RERE C##Upington	Solar Energy	Northern Cape
2014	Rio Tinto RUL Desalinisation Plant	Industrial	Namibia
2014	NamPower PV	Solar Energy	Namibia
2014	Pemba Oil and Gas Port Expansion	Industrial	Mozambique
2014	Brightsource CSP Upington	Solar Energy	Northern Cape
2013	Cape Winelands DM Regional Landfill	Industrial	Western Cape
2013	Drennan ##Solar Park	##Solar Energy	Eastern Cape
2013	Eastern Cape Mari-culture	Mari-culture	Eastern Cape
2013	Eskom Pantom Pass Substation	Substation /Tx lines	Knysna
2013	Frankfort Paper Mill	Plant	Free State
2013	Gibson Bay Wind Farm Transmission lines	Tranmission lines	Eastern Cape
2013	Houhoek Eskom Substation	Substation /Tx lines	Western Cape
2013	Mulilo ##Solar Energy Sites (x4)	##Solar Energy	Northern Cape
2013	Namies Wind Farm	Wind Energy	Northern Cape
2013	Rossing Z20 Pit and WRD	Mining	Namibia
2013	SAPPI Boiler Upgrade	Plant	Mpumalanga
2013	Tumela WRD	Mine	North West

2013	Weskusfleur Substation (Koeburg)	Substation /Tx lines	Western Cape
2013	Yzermyn coal mine	Mine	Mpumalanga
2012	Afrisam	Mine	Saldana
2012	Bitterfontein	##Energy	N Cape
2012	Bitterfontein slopes	Slopes Analysis	N Cape
2012	Kangnas PV	Energy	N Cape
2012	Kangnas Wind	Energy	N Cape
2012	Kathu CSP Tower	Solar Power	Northern Cape
2012	Kobong Hydro	Hydro & Powerline	Lesotho
2012	Letseng Diamond Mine Upgrade	Mine	Lesotho
2012	Lunsklip Windfarm	Windfarm	Stilbaai
2012	Mozambique Gas Engine Power Plant	Plant	Mozambique
2012	Ncondezi Thermal Power Station	Substation /Tx lines	Mozambique
2012	Sasol CSP Tower	Solar Power	Free State
2012	Sasol Upington CSP Tower	Solar Power	Northern Cape
2011	Beaufort West ##Solar Power Station	Power Station	Beaufort West
2011	Beaufort West Wind Farm	Wind Energy	Beaufort West
2011	De Bakke Cell Phone Mast	Mast	Western Cape
2011	ERF 7288 PV	PV	Beaufort West
2011	Gecko Industrial park	Industrial	Namibia
2011	Green View Estates	Residential	Mossel Bay
2011	Hoodia Solar	##expansion	Beaufort West
2011	Kalahari Solar Power Project	Solar Power	Northern Cape
2011	Khanyisa Power Station	Power Station	Western Cape
2011	Laingsburg Windfarm	Level 4	Mpumalanga
2011	Olvyn Kolk PV	Solar Power	Northern Cape
2011	Otjikoto Gold Mine	Mining	Namibia
2011	PPC Rheebieck West Upgrade	Industrial	
2011	Slopes analysis Erf 7288 Beaufort West	Slopes	Beaufort West
2011	Southern Arterial	Road	George
2010	Bannerman Etango Uranium Mine	Mining	Namibia
2010	Bantamsklip Transmission Revision	Transmission	Eastern Cape
2010	Beaufort West Urban Edge	Mapping	Beaufort West
2010	Bon Accord Nickel Mine	Mine	Barbeton
2010	Herolds Bay N2 Development Baseline	Residential	George
2010	MTN Lattice Hub Tower	Structure	George
2010	N2 Herolds Bay Residental	Residential	Herolds Bay
2010	Onifin(Pty) Ltd Hartenbos Quarry Extension	Mining	Mossel Bay
2010	Rossing South Board Meeting	Mining	Namibia
2010	Still Bay East	Mapping	SA, WC
2010	Vale Moatize Coal Mine and Railwayline	Mining_rail	Mozambique

2010	Vodacom Mast	Structure	Reichterbosch
2010	Wadrif Dam	Dam	Beaufort West
2009	Asazani Zinyoka UISP Housing	Residential Infill	Mossel Bay
2009	Bantamsklip GIS Mapping	Mappig	Western Cape
2009	Eden Telecommunication Tower	Structure Tower	George
2009	George Landscape Characterisation	George SDF	George
2009	George Western Bypass	Structure Road	George
2009	Rossing Uranium Mine Phase 2	Mining	Namibia
2009	Sun Ray Wind Farm	Wind Energy	Still Bay
2008	Bantamsklip Transmission Lines Scoping	Transmission	Western Cape
2008	Erf 251 Damage Assessment	Residential VIA	Great Brak
2008	Erongo Uranium Rush SEA	SEA	Namibia
2008	Evander South Gold Mine Preliminary VIA	Mining	Mpumalanga
2008	George Open Spaces System	George SDF	George
2008	GrooteSchuur Heritage Mapping	Mapping	Cape Town
2008	Hartenbos River Park	Residential VIA	Hartenbos
2008	Kaaimans Project	Residential	Wilderness
2008	Lagoon Garden Estate	Residential VIA	Great Brak
2008	Moquini Beach Hotel	Resort	Mossel Bay
2008	NamPower Coal fired Power Station	Power Station	Namibia
2008	Oasis Development	Residential VIA	Plettenberg Bay
2008	RUL Sulpher Handling Facility	Mining	Walvis Bay
2008	Stonehouse Development	Residential VIA	Plettenberg Bay
2008	Walvis Bay Power Station	Structure	Namibia.
2007	Calitzdorp Retirement Village	Residential VIA	Calitzdorp
2007	Calitzdorp Visualisation	Visualisation	Calitzdorp
2007	Camdeboo Estate	Residential VIA	Graaff Reinet
2007	Destiny Africa	Residential	George
2007	Droogfontein Farm 245	Residential VIA	Danabaai
2007	Floating Liquified Natural Gas Facility	Structure tanker	Mossel Bay
2007	George Municipality Densification	George SDF	George
2007	George Municipality SDF	George SDF	George
2007	Kloofsig Development	Residential VIA	Vleesbaai
2007	OCGT Power Plant Extension	Structure Power Plant	Mossel Bay
2007	Oudtshoorn Municipality SDF	Mapping	Oudtshoorn
2007	Oudtshoorn Shopping Complex	Structure Mall	Oudtshoorn
2007	Pezula Infill (Noetzie)	Residential VIA	Knysna
2007	Pierpoint Nature Reserve	Residential VIA	Knysna
2007	Pinnacle Point Golf Estate	Golf/Residential	Mossel Bay
2007	Rheebok Development Erf 252 Apeal	Residential VIA	Great Brak
2007	Rossing Uranium Mine Phase 1	Mining	Namibia

2007	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Beaufort West
2007	Sedgefield Water Works	Structure	Sedgefield
2007	Sulpher Handling Station Walvis Bay Port	Industrial	Namibia
2007	Trekkopje Uranium Mine	Mining	Namibia
2007	Weldon Kaya	Residential VIA	Plettenberg Bay
2006	Fancourt Visualisation Modelling	Visualisation	George
2006	Farm Dwarsweg 260	Residential VIA	Great Brak
2006	Fynboskruin Extention	Residential VIA	Sedgefield
2006	Hanglip Golf and Residential Estate	Golf/Residential	Plettenberg Bay
2006	Hansmoeskraal	Slopes Analysis	George
2006	Hartenbos Landgoed Phase 2	Residential VIA	Hartenbos
2006	Hersham Security Village	Residential VIA	Great Brak
2006	Ladywood Farm 437	Residential VIA	Plettenberg Bay
2006	Le Grand Golf and Residential Estate	Golf/Residential	George
2006	Paradise Coast	Residential VIA	Mossel Bay
2006	Paradyskloof Residential Estate	Residential VIA	Stellenbosch
2006	Riverhill Residential Estate	Residential VIA	Wilderness
2006	Wolwe Eiland Access Route	Road	Victoria Bay
2005	Harmony Gold Mine	Mining	Mpumalanga.
2005	Knysna River Reserve	Residential VIA	Knysna
2005	Kruisfontein Infill	Mapping	Knysna
2005	Lagoon Bay Lifestyle Estate	Residential VIA	Glentana
2005	Outeniquabosch Safari Park	Residential	Mossel Bay
2005	Proposed Hotel Farm Gansevallei	Resort	Plettenberg Bay
2005	Uitzicht Development	Residential VIA	Knysna
2005	West Dunes	Residential VIA	Knysna
2005	Wilderness Erf 2278	Residential VIA	Wilderness
2005	Wolwe Eiland Eco & Nature Estate	Residential VIA	Victoria Bay
2005	Zebra Clay Mine	Mining	Zebra
2004	Gansevallei Hotel	Residential VIA	Plettenberg Bay
2004	Lakes Eco and Golf Estate	Golf/Residential	Sedgefield
2004	Trekkopje Desalination Plant	Structure Plant	Namibia
1995	Greater Durban Informal Housing Analysis	Photogrametry	Durban

9 ANNEXURE 2: VRM METHODOLOGY, QUESTIONNAIRES AND TERMINOLOGY

9.1 Methodology Detail

Viewshed

The visible extent, or viewshed, is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, 2005).* This reflects the area, or extent, where the landscape modification would probably be seen. However, visibility tends to diminish exponentially with distance, which is well recognised in visual analysis literature. Therefore the views of a landscape modification would not necessarily influence the landscape character within all areas of the viewshed. The information for the terrain used in the 3D computer model on which the visibility analysis is based on the Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data, a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (NASA) in USA. (NASA, 2009)

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. Institute of Environmental Management 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.

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:

i. ***Foreground,*** up to approximately 2km where a change to the sense of place is likely from high exposure views of the landscape modificaiton:
ii. ***Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
iii. ***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
iv. ***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.

Scenic Quality

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 making use of the VRM scenic quality questionnaire (refer to addendum) to grade similar landscape according to these criteria. Seven scenic quality criteria area scored on a 1 (low) to 5 (high) scale. The scores are totalled and assigned a A (High), B (Moderate) or C (low) based on the following split:
A= scenic quality rating of ≥19;
B = rating of 12 – 18,
C= rating of ≤11

The seven scenic quality criteria are defined below:

- **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.

Receptor Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the following factors in terms of Low to High:

- **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.

Visual Resource Management (VRM) Classes

The VRM Classes represent the relative value of the visual resources of an area and are determined making use of the VRM Class Matrix see Table 8 below:

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

The Classes are not prescriptive and are utilised as a guideline to determine visual carrying capacity. The Visual Inventory Classes are defined using the matrix and with motivation, can be adjusted to Visual Resource Management Classes:

The visual objectives of each of the classes is listed below:

- The Class I objective is to preserve the existing character of the landscape, the level of change to the characteristic landscape should be very low, and must not attract attention. Class I is assigned when a specialist decision is made to maintain a natural landscape.
- 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.
- 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.
- 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.

Key Observation Points (KOPs)

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 be measured from these most critical locations, or receptors, surrounding the property.

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.

Contrast Rating

The contrast rating, or impacts assessment phase, is undertaken to determine if the VRM Class Objectives are met. The suitability of landscape modification is assessed by comparing the degree of potential contrast from the proposed activity in comparison to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape by assessing 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 proposed landscape 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.

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 project/development. 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 and 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)*.

9.2 Questionnaires

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 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 within region. Consistent chance for exceptional wildlife or wildflower viewing etc.	Distinctive, though somewhat similar to others within the region.	Interesting within its setting, but fairly 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.

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

9.3 VRM Terminology

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

10 ANNEXURE 3: GENERAL LIGHTS AT NIGHT MITIGATIONS

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.
- 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)*

‘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/).* (NELPAG)

What is good lighting? Good outdoor lights improve visibility, safety, and a sense of security, while minimizing 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.

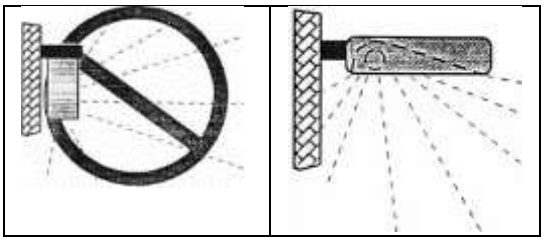
Glare Here’s the basic rule of thumb: If you can see the bright bulb from a distance, it’s a bad light. With a good light, you see lit ground instead of the dazzling bulb. “Glare” is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

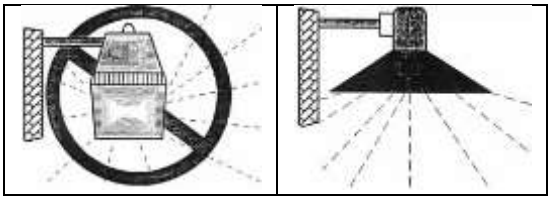
Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

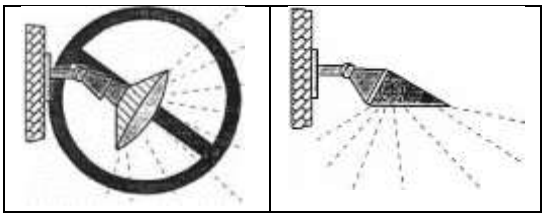
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

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.

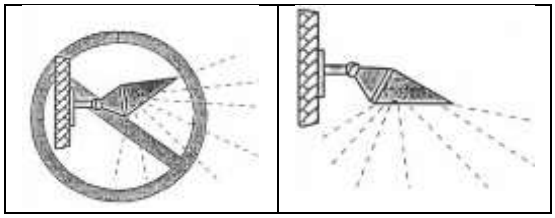
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may 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 colour discrimination is not important, choose energy-efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If “white” light is needed, fixtures using compact fluorescent or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour 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!

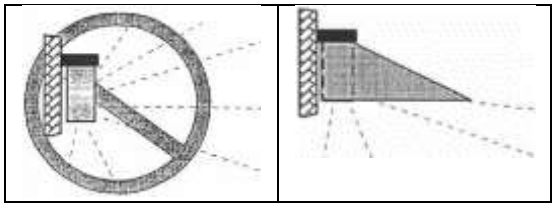
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



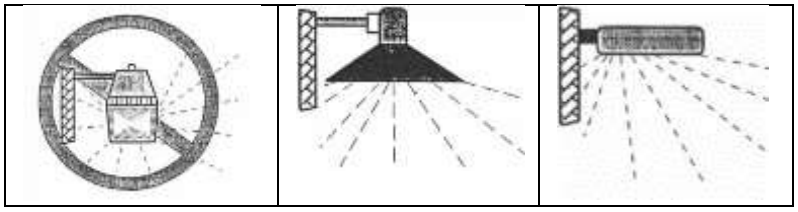
Floodlight:

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.