ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED AMDA STRAUSSHEIM ALPHA PV, NORTHERN CAPE PROVINCE.

VISUAL IMPACT ASSESSMENT: SPECIALIST REPORT

DRAFT: 30 April 2016

Document prepared for Cape EAPrac (Pty) Ltd;
On behalf of AMDA ALPHA (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, which 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

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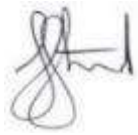
This document was undertaken by the following team:

Stephen Stead	Director/ Visual Impact	APHP accredited VIA Practitioner
Lisa Schultz	Editing and Contrast Rating	Bachelor of Arts, Fine Art



Stephen Stead
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1 EXECUTIVE SUMMARY

Conclusion
It is the recommendation of this visual assessment that the proposed Straussheim Alpha PV development should be authorised. Without mitigation the Visual Significance for all phases of development is likely to be ***medium***. With mitigation, the Visual Significance for all phases is likely to be ***low***. Although the VAC level of the Bushmanland Arid Grassland landscape is low, the location is remote and receptor sensitivity to landscape change is likely to be low. The flat terrain of the surrounding areas does increase the viewshed, but the limited height of the PV structures, and small visual footprint of the monopoles, is likely to contain the zone of visual influence to within a local level. The site scenic quality is rated medium, but does not comprise a significant feature in the overall landscape. Cumulative Effects could arise from the combined visual massing of all the proposed PV power lines converging on the Eskom Nieuwehoop substation. If not effectively integrated by the different projects, congestion could take place. However, due to the remoteness of the locality, the visual significance of the cumulative effects across all phases without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Visual Absorption Capacity
The VAC of the site is rated ***low***. This is due to the very flat nature of the terrain with limited vegetation or built environment, within the Bushmanland Arid Grassland landscape. The existing Eskom substation and power lines do generate some visual contrast, however, these features are located approximately 4 km to the south of the site and as such do not significantly increase the capacity of the site to visually absorb the proposed PV landscape modifications.

Project Visibility
The viewshed generated from 4 corner points of the proposed project area is defined as ***local*** in extent. The 2km buffer distance area depicts a full coverage, with fragmentation of views starting in the medium to high distance where the viewshed is restricted to the southeast. Beyond the 6km distance, larger fragmentation takes place but only to the north. Beyond the 12km distance, partial views could take place from the west but only on higher ground locations.

Project Exposure
The receptor exposure to the proposed landscape modification is defined as ***medium***. Although the Kenhardt – Louisvale road is located within the 2km high exposure distance zone, the area is very remote as the road predominantly services isolated farms in the areas, and as such moderates the exposure.

Scenic Quality
The Scenic Quality rating for the Bushmanland landscape is rated ***Medium to Low***. Landform is rated *low* as it has few interesting landscape features. Vegetation is rated *medium,* as some Quiver Trees (Aloe dichotoma) were located on site that are a protected plant species (subject to Botanical Specialist findings). Water was absent but evident in the few shallow washes found on the site. Colours are grey-browns from the vegetation with the sandy soils being a lighter brown in colour. The subtle colour variations of the browns added some value to the site landscape. Adjacent scenery was rated *medium to high* due to the open and wide views of the Bushmanland Arid Grassland landscape. The routing is moderated by the adjacent scenery with the Eskom substation and power lines located within the foreground / middle ground area. Scarcity was rated *low* as, although interesting in its setting, the landscape is fairly common within the region.

Cultural modifications include farm tracks and fences, and agricultural reservoirs that neither added nor detracted from the site sense of place.

Receptor Sensitivity

Receptor Sensitivity to landscape change was rated ***Low***. The types of users are predominately agricultural with no evidence of tourism, and as such are rated *low*. The Amount of Use and Public Interest is rated *low* as the location is remote and results in very little public usage. Adjacent users are mainly agricultural who will continue with their existing landuses. The area is not defined as a Special Area and as such is rated *low*.

2 INTRODUCTION

VRM Africa was appointed by AMDA Developments (PTY) Ltd to undertake a Level 3 Visual Impact Assessment for the proposed Straussheim Alpha PV Project on behalf of AMDA Alpha (PTY) Ltd. The site is located near the town of Kenhardt in the Northern Cape Province. A site visit was undertaken on the 23th of February 2016.

2.1 Terms of Reference

According to the Bureau of Land Management, U.S. Department of Interior, landscape significance is assessed by differentiating between those landscapes of recognized or potential significance or sensitivity to modification and landscapes that have low sensitivity and scenic value. 'Different levels of scenic values require different degrees of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using standard assessment criteria to describe and evaluate landscapes, and to also describe proposed projects.'
(USDI., 2004)

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).

2.2 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.

2.3 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 be 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.

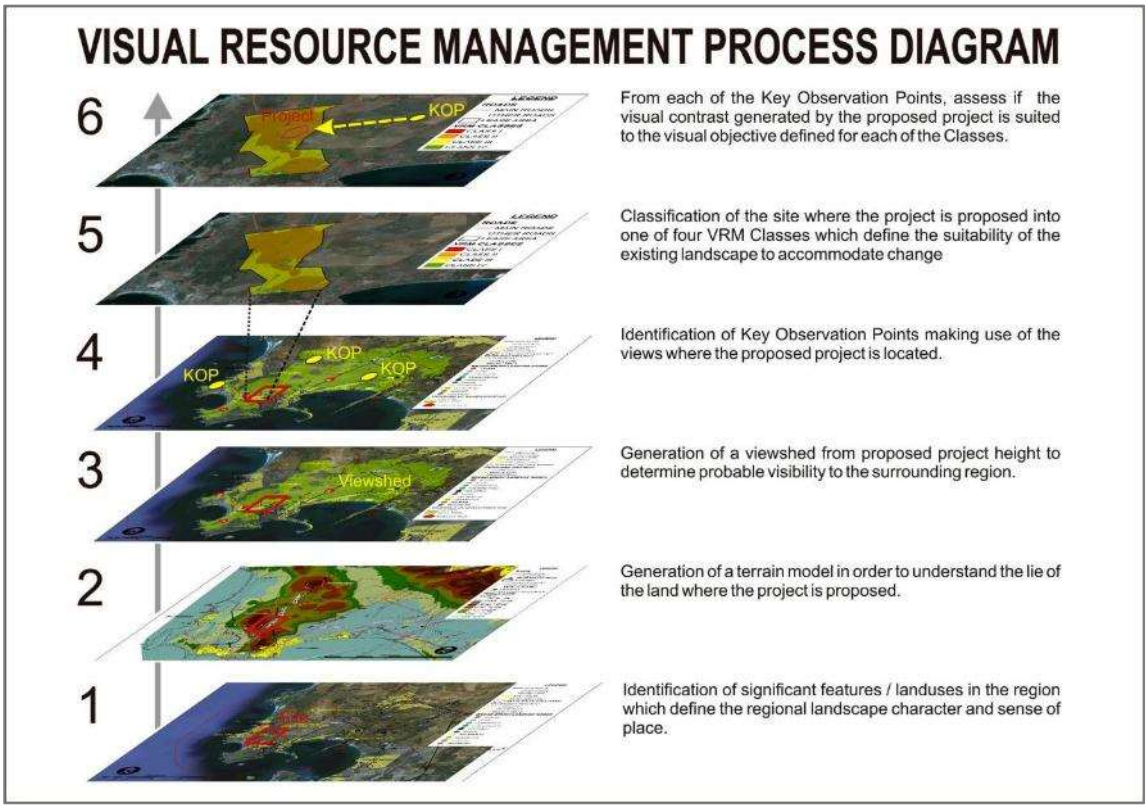

Figure 1: VRM process diagram

3 PROJECT DESCRIPTION

The proposed project is located approximately 85km south of the town of Upington in the North West Province, within the Kai !Garib Local Municipality.

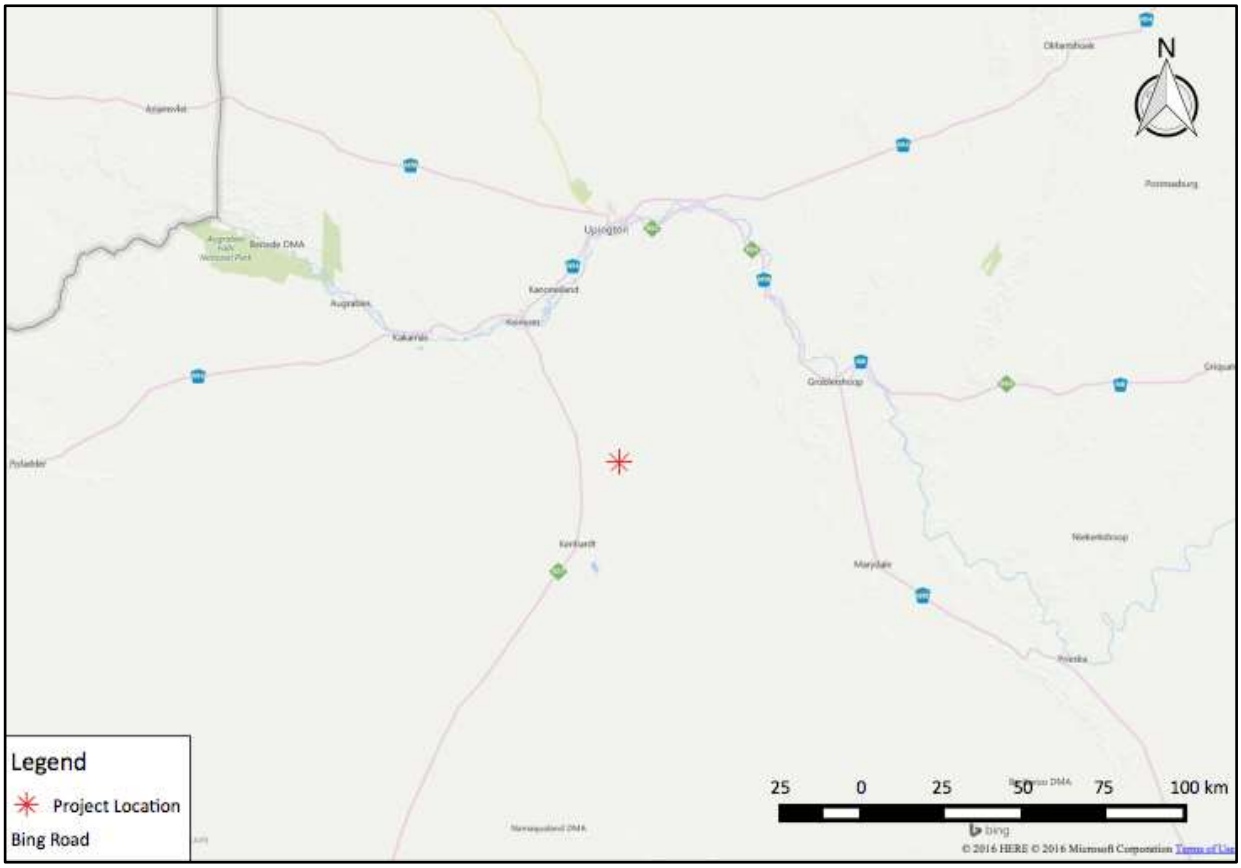

Figure 2: Project regional locality map.

Figure 3: Photographic example of a typical PV energy facility (www.hawaiirenewableenergy.org/Villamesias2)

The developer provided the following table of information.

Table 1: Project Information Table

Company Details		
Company profile	Name and details of Developer	**AMDA Alpha (Pty) Ltd** Co Reg No 2015/300647/07
Site Details		
Project Property	Description and Size in hectares of the affected property.	Farm name and number: Portion 1 of N'Rougas Zuid No 121, Kenhardt Registration Division, Northern Cape Total Property Size: 5232.8138Ha
Development Site	Approximate EIA and development areas	Initial EIA Study Area size: Approx 900Ha Development lease area : Approx 250Ha
Technology Details		
Capacity of the facility	Capacity of facility (in MW)	Net generating capacity (AC): 75MWac Installed capacity (DC): 85MWp
Solar Technology selection	Type of technology	Solar PV on fixed tilt structures or single axis tracking technology.
	Structure orientation	Fixed-tilt in north-facing orientation, or mounted on horizontal axis trackers, tracking from east to west.
	Development component dimensions: Solar PV field footprint Project sub-station Collector sub-station Buildings Roads Permanent laydown areas Construction laydown areas	Approximate dimensions 185Ha 1Ha 1Ha 1.5Ha 22km long @6m wide = 13.2Ha 7Ha 12Ha
	Solar field tracker structure height	Approx.: 3.5m
	Perimeter fence	2.4m high multi-strand electric security fence
Connection to National Grid		
Grid connection	Substation to which project will connect.	Eskom Nieuwehoop MTS near Kenhardt, Northern Cape 29° 8'57.66"S 21°20'16.68"E
	Capacity of substation to connect facility	Confirmed capacity 245MW – Eskom letter for REIPPPP Bid Window 4 Accelerated Programme & 750MW in GCCA 2022 June 2015
Power line/s	Project sub-station to collector sub-station Collector sub-station to Mookodi	A single 132kV overhead line A single 132kV overhead line
	Route/s of power lines	Approx 5.5km from the collector sub-station on the property across Portion 3 of Gemsbok Bult No120 to the Nieuwehoop MTS

	Height of the Power Line	25m
	Servitude Width	50m
Auxiliary Infrastructure		
Other infrastructure	Additional Infrastructure	Water from borehole or transported from Municipal source. Auxiliary electricity supply from Eskom Sewerage by conservancy tank
	Details of access roads	A new access road across the property from the Kenhardt – Louisvale district road.

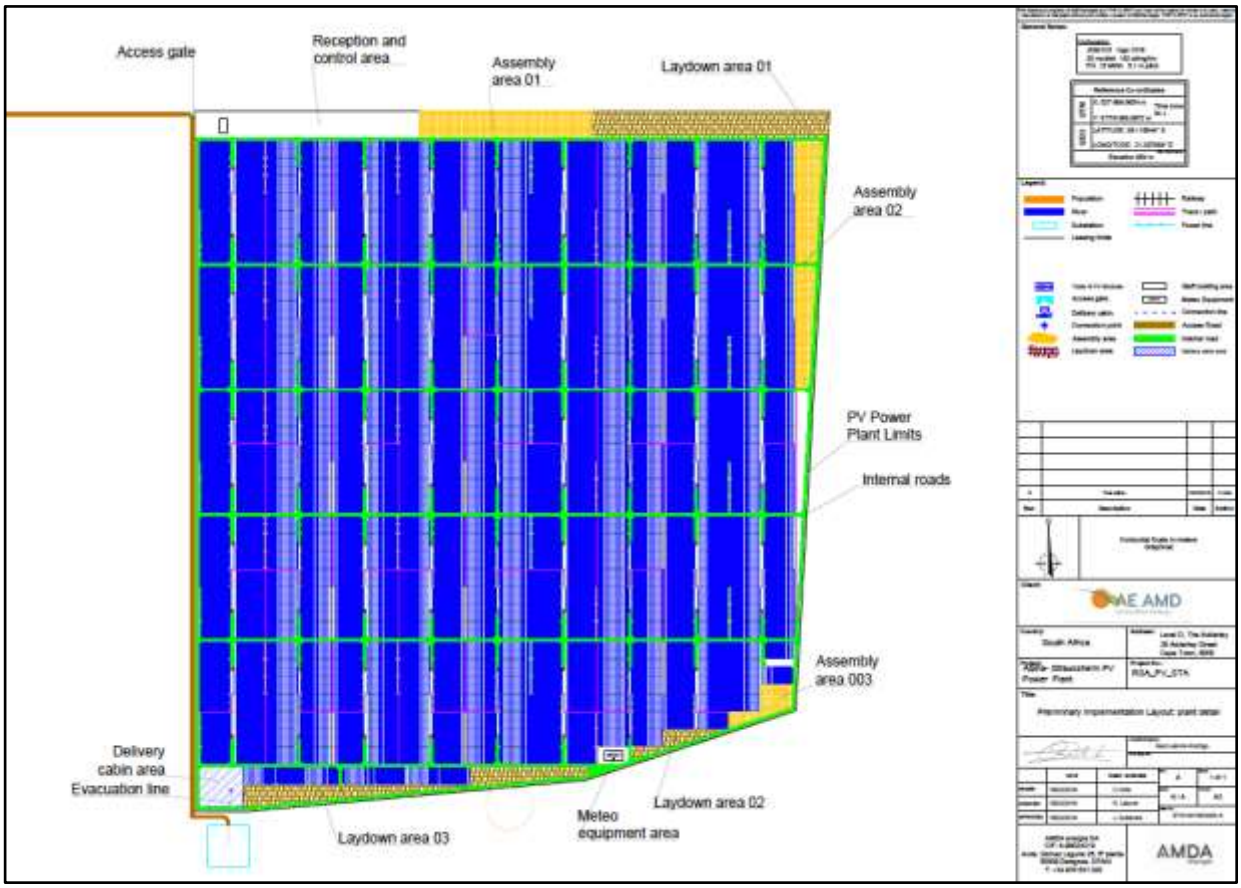

Figure 4: Proposed project layout plan

3.1 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 organization guidelines:

3.1.1 *The Draft Strategic Environmental Assessment Department of Environmental Affairs Guidelines for Solar and Wind Energy Negative Mapping Document*

According to the draft negative mapping undertaken for the Solar and Wind Energy SEA conducted by the CSIR for the Department of Environment Affairs, the following distance criteria were recommended as road buffers for proposed wind and solar projects. (Department of Environment Affairs, 2013).

Roads

Attributes	Wind Buffer	Solar Buffer
Major Roads (national, arterial, main)	500m	500m
Secondary Roads (secondary)	500m	500m
Tourist Routes (WC)	2km	2km

Source: DRDLR 50k Topo, 2006

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

As specific Visual Guidelines are not provided for the area we propose to refer 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)

3.1.3 *Renewable Energy Development Zones (REDZs)*

A Strategic Environmental Assessment commissioned by the Department of Environmental Affairs, undertaken by the CSIR, identified Renewable Energy Development Zones (REDZs). These are gazetted geographical areas in which several wind and solar PV development projects will have the lowest negative impact on the environment while yielding the highest

possible social and economic benefit to the country. The Site falls into the Area 7 around Upington (Department of Environment Affairs, 2013).

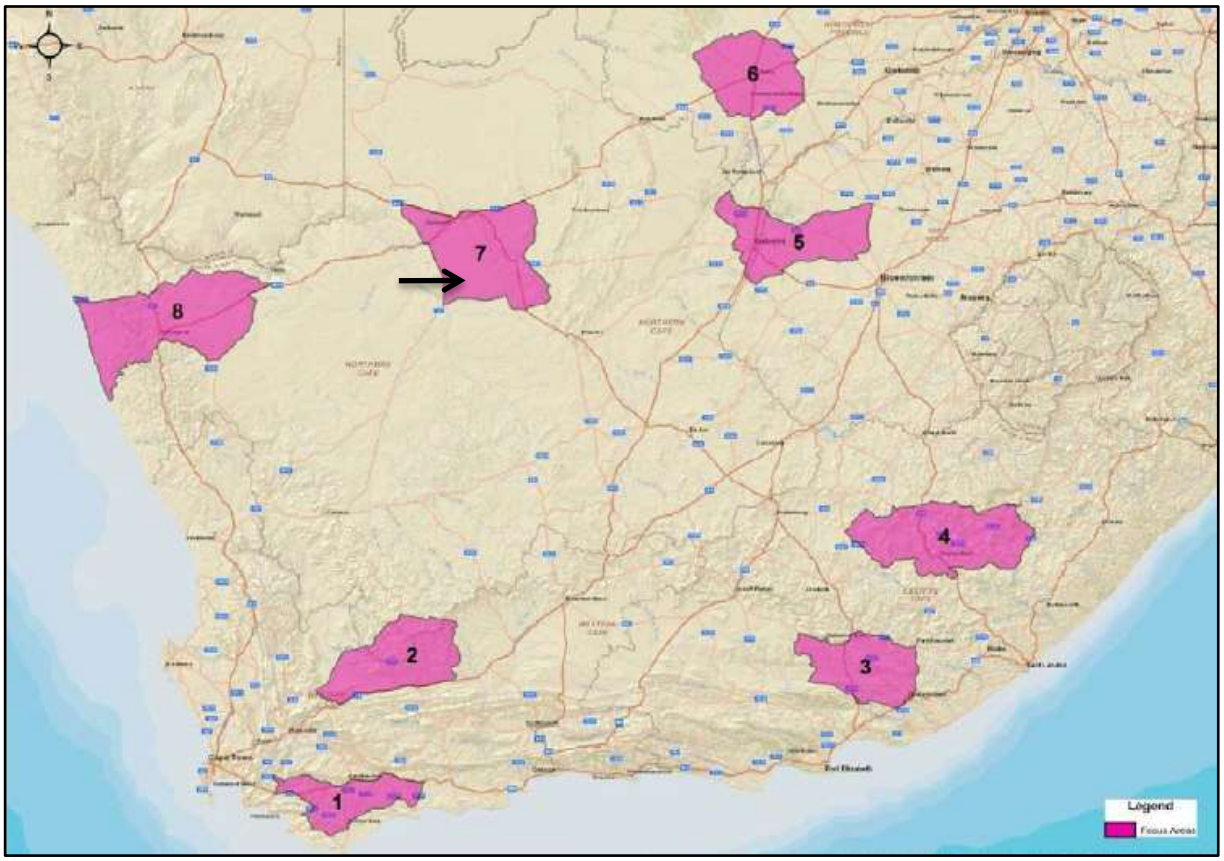

Figure 5: Renewable Energy Development Zones (REDZs) map with the approximate location of the proposed project indicated.

4 BASELINE ASSESSMENT

The baseline section serves to provide an understanding of the extent of the influence of the proposed landscape change, the degree of the change that will take place to the landscape, and the expected intensity by which the proposed landscape change is likely to be experienced by people around the site making use of the common landscape.

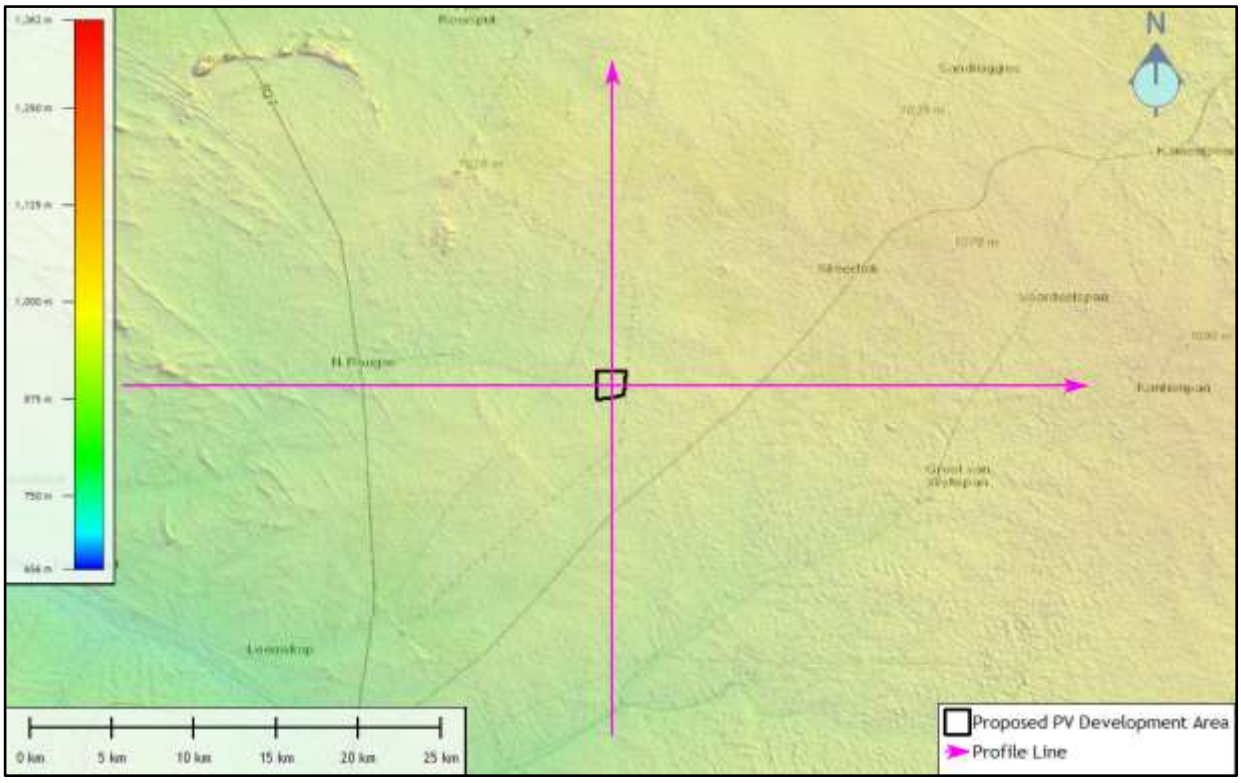

Figure 6: Regional topographic and profile locality map.

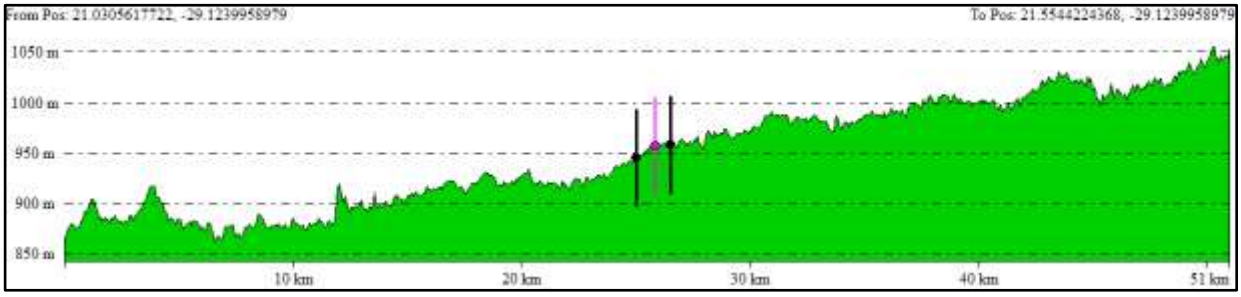

Figure 7: West to East topographic profile.

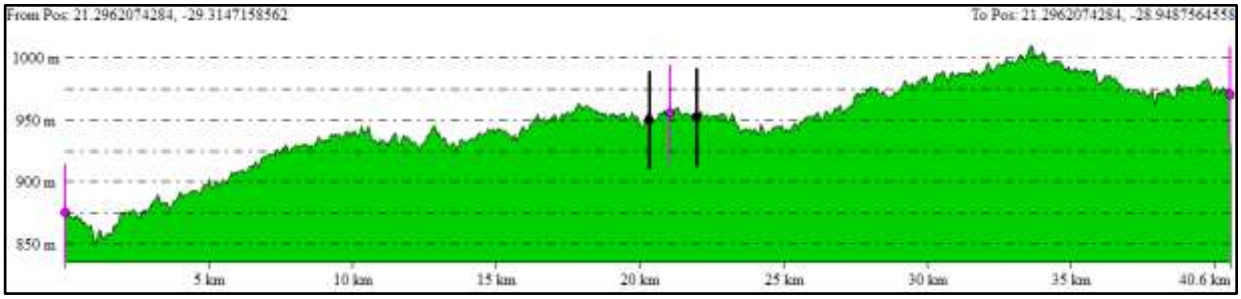

Figure 8: South to North topographic profile.

The terrain in which the proposed project is located is predominantly flat and typical of the Northern Cape Bushmanland landscape. Some hill features are located to the northwest of the proposed site but at a distance of approximately 25km and outside of the proposed project landscape context. As depicted in the West to East profile, the elevation fall is to the west with a total drop in elevation of 150m over a distance of 50km. The south to north profile depicts some variation with higher ground to the north, draining to the south. The total elevation fall across this profile is also similar to the West to East profile.

4.1 Project Visibility and Exposure

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).

Table 2: Proposed Project Heights and Viewshed Constraints Table

Project Phase	Proposed Activity	Approx. Max. Height (m)	Approx. ZVI (km)
Construction	PV	5	12
Operation	Monopoles	25	6

As depicted in Figure 9 below, the (4) viewsheds generated for the proposed PV structures have a constrained regional extent and as such is rated ***Medium***. The 2km buffer distance area depicts a full viewshed coverage, with fragmentation of views starting within the medium to high distance zone, where the viewshed is restricted to the southeast. Beyond the 6km distance, larger fragmentation takes place but only to the north. Beyond 12km, partial views could take place to the west but only on higher ground locations.

As depicted in Figure 10 below, the (3) viewsheds generated along the proposed power line routing have a local extent and as such is rated ***Low***. The 2km high exposure area depicts full coverage, but views start to fragment in the 2km to 6km distance zone, limiting visual extent to the southeast areas. The 6km to 12km distance zone depicts fragmented views mainly from the north and a small section from the south.

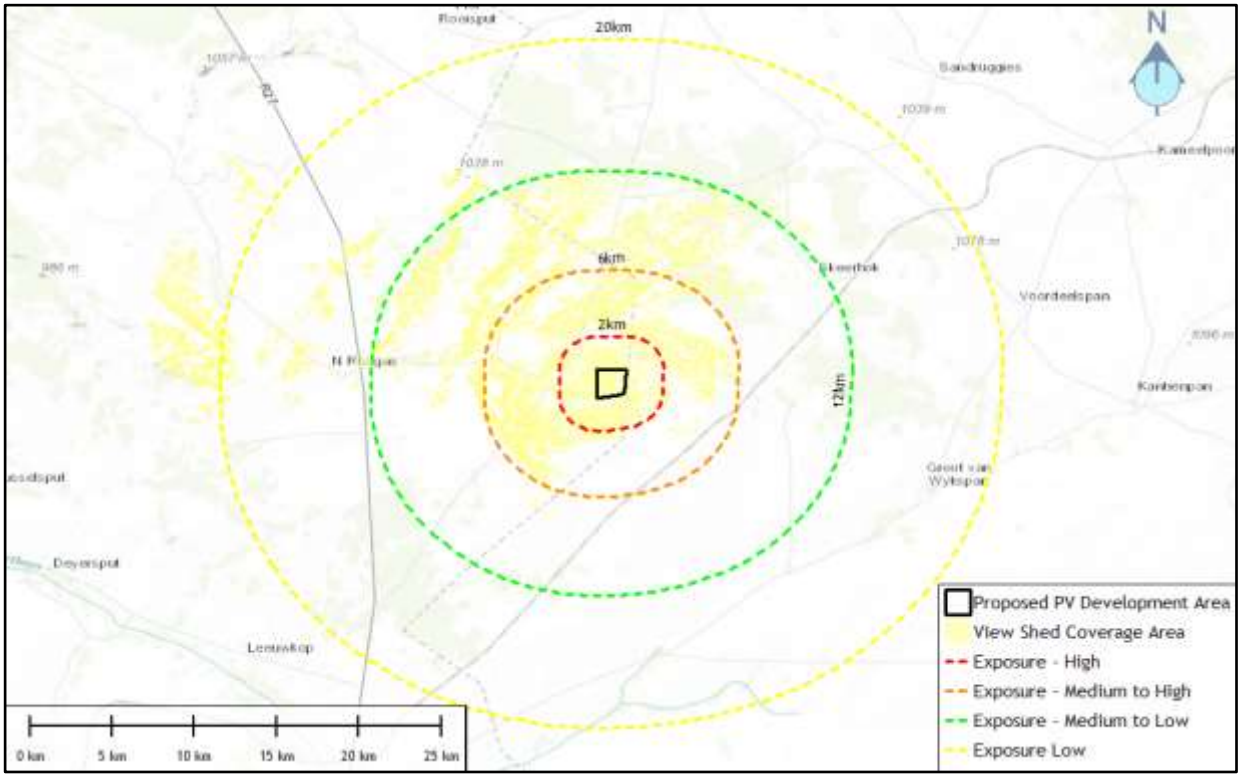

Figure 9: Viewshed for the PV structures at the high points generated from a 5m offset overlaid onto OS terrain Image.

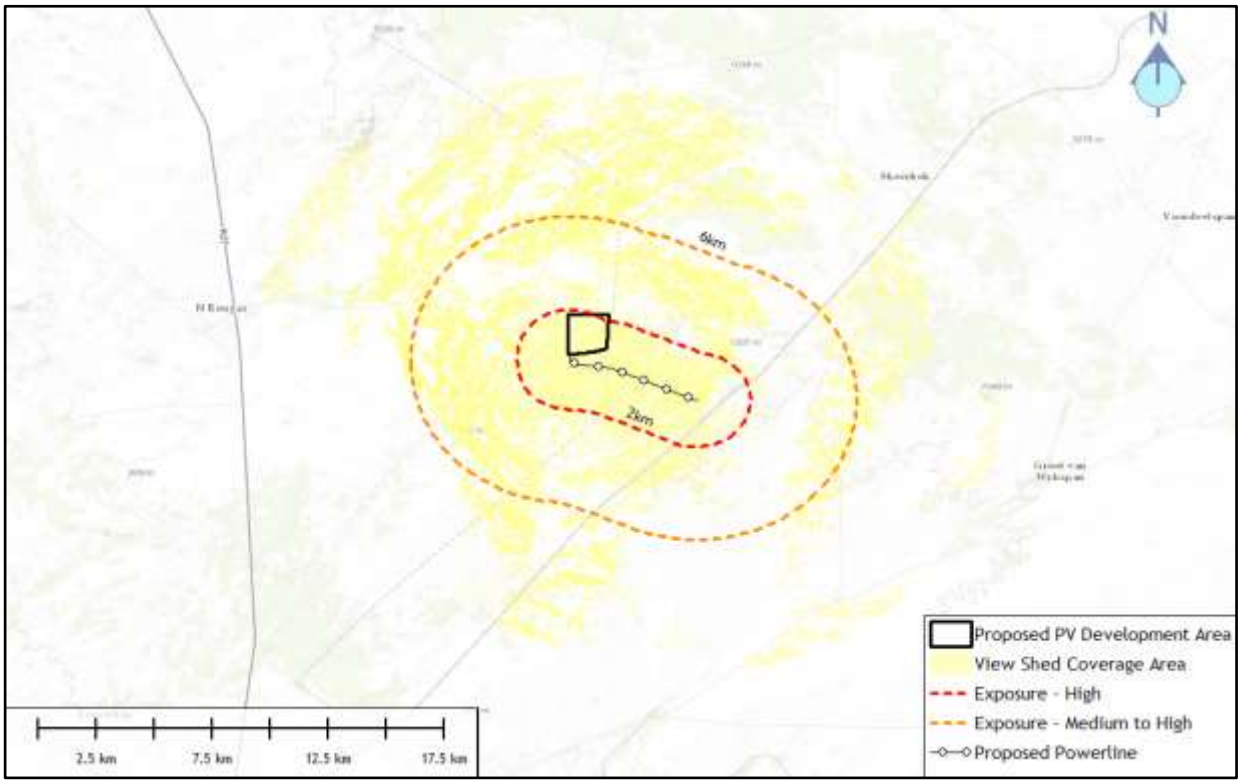

Figure 10: Viewshed for the power line structures at the high points generated from a 25m offset overlaid onto OS terrain Image.

Receptors and key landmarks located within the viewshed include:

High Exposure

- Kenhardt – Louisvale district road;
- Railway line.

Medium Exposure

- Isolated farmsteads.

The overall visual exposure of the proposed landscape modification to the surrounding receptors is defined as ***medium***. Although the Kenhardt – Louisvale road is located within the 2km high exposure distance zone, the area is very remote and the road predominantly services isolated farms in the areas, and as such moderates receptor exposure.

4.2 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)

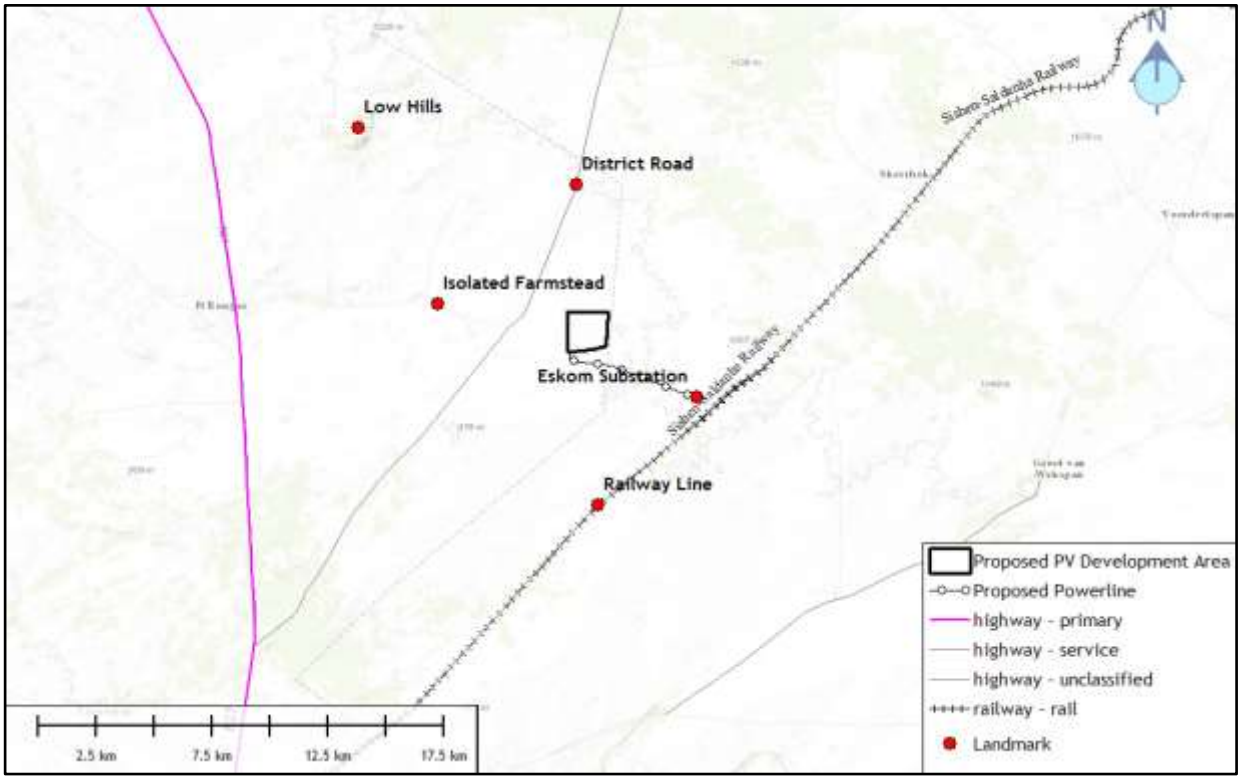

Figure 11: Surrounding landmark photograph location point and profile lines map.

Figure 12: Photograph 1 looking south from the proposed power line route towards the Eskom Nieuwehoop substation.

Figure 13: Photograph 2 looking south of Eskom power line corridor that links to the Nieuwehoop substation.

Figure 14: Photograph 3 looking west towards the Straussheim farmstead cluster of buildings and low hills in the background.

Figure 15: Photograph 4 looking north from the Kenhardt – Louisvale district road with telephone poles routed on the eastern side.

4.2.1 *Vegetation*

According to Mucina & Rutherford, the broad vegetation is described as Bushmanland Arid Grasslands, which forms a part of the Nama-Karoo Biome (Macina & Rutherford, 2006). The Plantzafrica website, the Nama Karoo Biome occurs on the central plateau of the western half of South Africa, at altitudes between 500 and 2000m, with most of the biome falling between

1000 and 1400m. “The geology underlying the biome is varied, as the distribution of this biome is determined primarily by rainfall. The rain falls in summer, and varies between 100 and 520mm per year. This also determines the predominant soil type - over 80% of the area is covered by a lime-rich, weakly developed soil over rock. Although less than 5% of rain reaches the rivers, the high erodibility of soils poses a major problem where overgrazing occurs. The dominant vegetation is a grassy, dwarf shrubland. Grasses tend to be more common in depressions and on sandy soils, and less abundant on clayey soils.” (Plantzafrica)

4.2.2 *Other Projects*

As depicted in Figure 16 below, due to the location of the proposed site in the Northern Cape within the Renewable Energy Development Zones (REDZs) Area 7, other renewable projects are also located within the vicinity. Located due east of the proposed project site is a Mulilo PV project that is currently in EIA process. The location of many renewable projects around the Eskom substation is likely to create a strong cumulative change to the landscape character.

Figure 16: Google Earth map depicting the Department of Environmental Affairs Renewable Energy projects.

4.2.3 *Infrastructure*

Three main linear infrastructure elements were identified within the surrounding areas: Sishen –Saldanha Railway Line, the Eskom power line corridors and the Kenhardt – Louisvale district road. The railway line is low in profile and offers a limited visual footprint and does not carry any passengers. The Eskom power line currently comprises a single 400kV power line which links to the Nieuwehoop substation located approximately 4km to the southeast of the proposed site. A second parallel line is currently being constructed. The large size of the 400kV power line do create a strong visual presence and dominate the landscape character within the foreground / middle ground distance zones. The Kenhardt – Louisvale district road is gravel and links the small agricultural towns of Kenhardt in the south, to Loiusvale in the

north (on the Orange River). The road is scenic in its setting, but is not an important tourist route due to the almost 60km length of the gravel road.

4.2.4 *Landuses*

The predominant land use in the area is dryland agriculture, with all properties zoned agricultural. Due to the low carrying capacity of this dryland area, the farms are large in scale.

4.2.5 *Tourism*

No tourism activities were identified during the field survey or making use of a Google Earth tourism search.

4.3 Site Landscape Character

Topographic statistics indicate that the site comprises an area of 2.4 sq. km. The minimum elevation is 939 mamsl and the maximum elevation is 966 mamsl, with the average elevation set as 953 mamsl. The maximum slope percentage indicated 10 degrees and the average slope is a gradual 3.2 degrees. The dominant aspect is to the west. Following the north-south extent of the site is a drainage line that drains to the north. The vegetation is mainly comprised of Bushmanland Arid Grasslands and shallow washes.

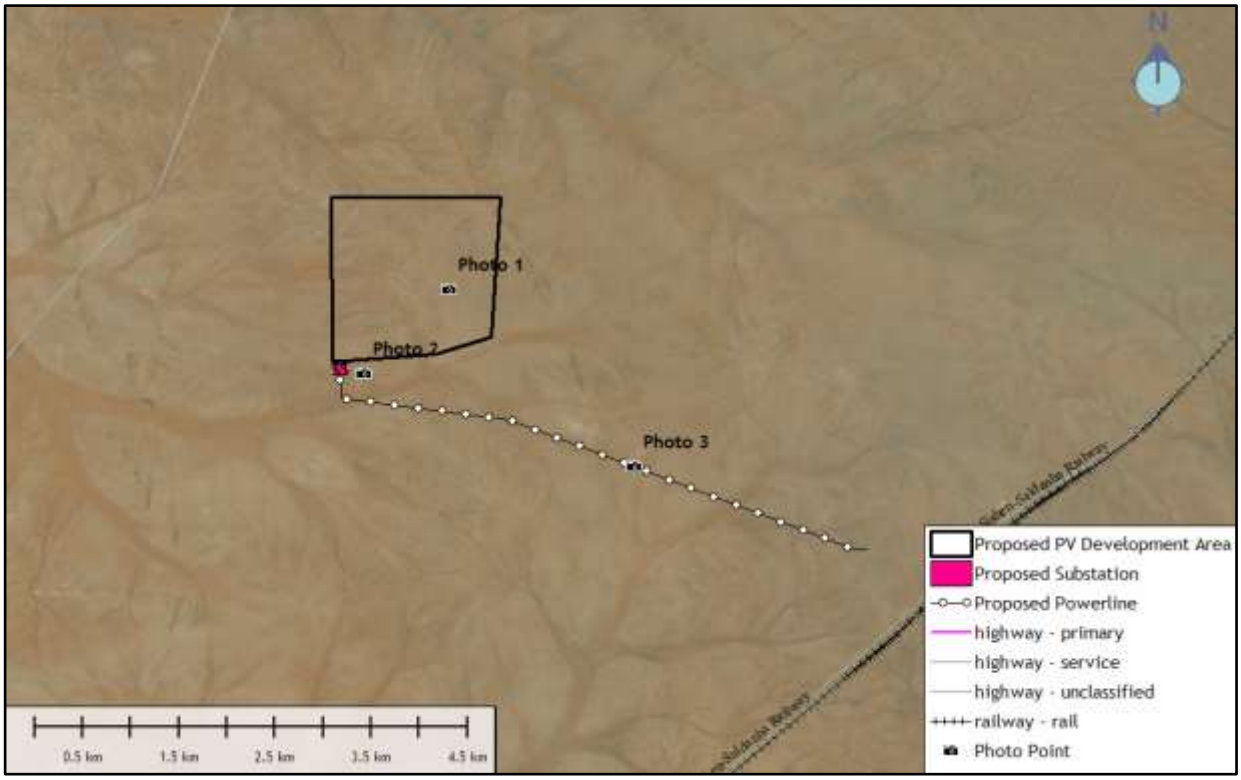

Figure 17: Site photograph locality overlay only OS satellite image map.

Figure 18: Photograph 1 in a south-easterly direction showing the isolated quiver trees (Aloe dichotoma) with the substation and cell phone tower in the background.

Figure 19: Photograph 2 in a westerly direction towards the proposed substation site with low hills visible in the background.

Figure 20: Photograph 3 taken in a south-easterly direction along the proposed power line routing towards the existing Eskom substation, power lines and the cell tower.

4.4 Visual Resource Management (VRM) Classes

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. These three criteria are rated in terms of the VRM scenic quality and receptor sensitivity questionnaires that are appended to the addendum. 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. Due to the uniformity of the site, only a single landscape was defined for the Bushmanland Arid Grassland area.

4.4.1 *Scenic Quality*

The scenic quality is determined making use of the VRM scenic quality questionnaire (refer to addendum). 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

Table 3: Landscape Scenic Quality rating table.

Landscape	Bushmanland Grasslands
Landform	1
Vegetation	3
Water	2
Colour	2
Adjacent scenery	4
Scarcity	1
Cultural modifications	0
Score	13
Category	B

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

4.4.2 *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:

Table 4: Landscape Receptor Sensitivity rating table.

Landscape	Bushmanland Grasses
Type of user	L
Amount of use	L
Public interest	L
Adjacent land users	M
Special areas	L
Score	L

(H = High, M = Moderate, L = Low sensitivity)

4.4.3 *VRM Class 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

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	ZVI	Scenic Quality	Receptor sensitivity	Visual Inventory	Visual Resource Management
Drainage Lines	NA				Class I
Bushmanland Grasslands	FG/MG	B	Low	Class IV	Class III

(Key: FG = Foreground, MG = Middle ground, BG = Background)

Class I

Class I is assigned when legislation restricts development in certain areas. 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. 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:

- Any river / streams and associated flood lines buffers identified as significant in terms of the WULA process.
- Any wetlands identified as significant in terms of the WULA process.
- Any ecological areas (or plant species) identified as having a high significance.

Class II

Class II visual objectives were assigned to the following features:

- No Class II landscape were defined.

Class III

Class III visual objectives were assigned to the following landscapes:

- Bushmanland Grasslands.

Based on the VRM matrix, the inventory landscape was rated Class IV due to the medium scenic quality and the low receptor sensitivity. However, due to the current agricultural zoning of the site and the surrounding areas, the inventory class was changed to Class III to protect the surrounding agricultural sense of place. The Class III visual objective is to partially retain

the existing character of these rural landscapes, 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.

Class IV

Class IV visual objectives were assigned to the following features:

- No Class IV landscape were defined.

4.5 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.

The main receptors for this site, where clear views of the proposed project could result in a change to local visual resources, are:

- Kenhardt – Louisvale district road northbound.
- Kenhardt – Louisvale district road southbound.

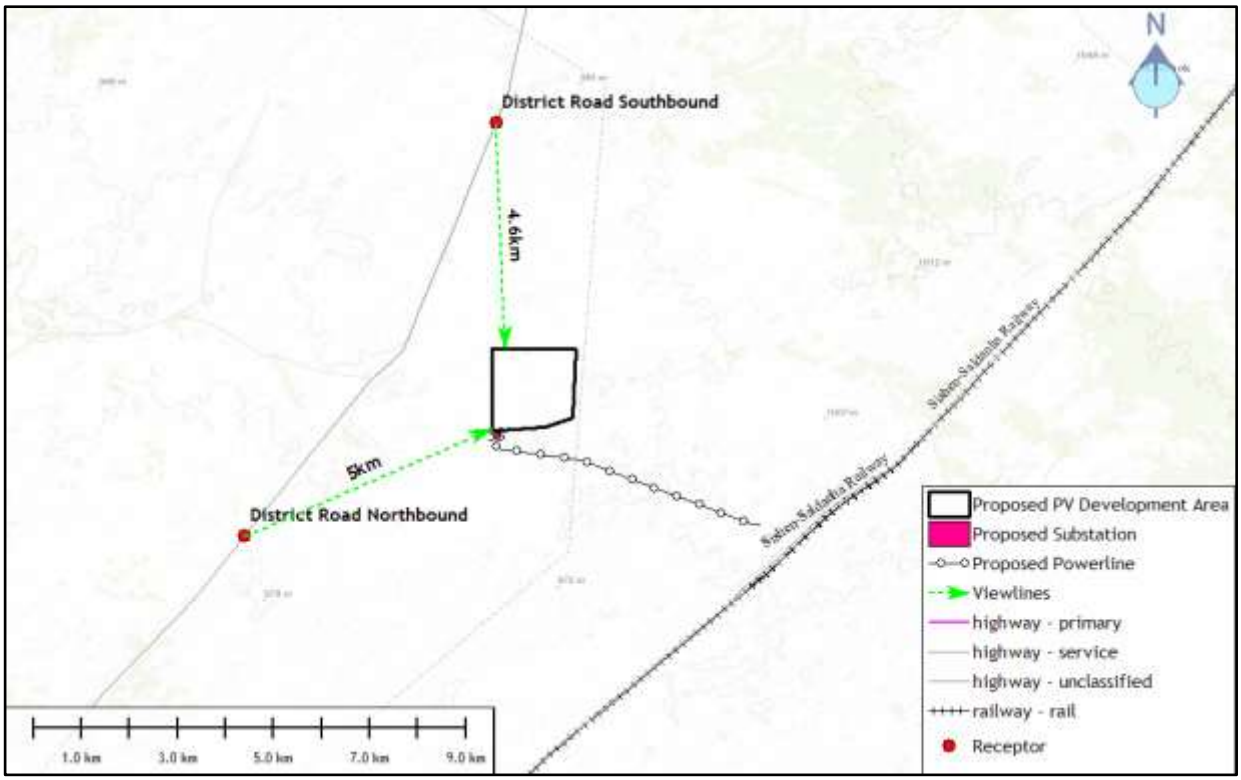

Figure 21: Map depicting the main receptor locations associated with the proposed study area.

Figure 22: Photograph taken from the district road northbound depicting the approximate location of the site.

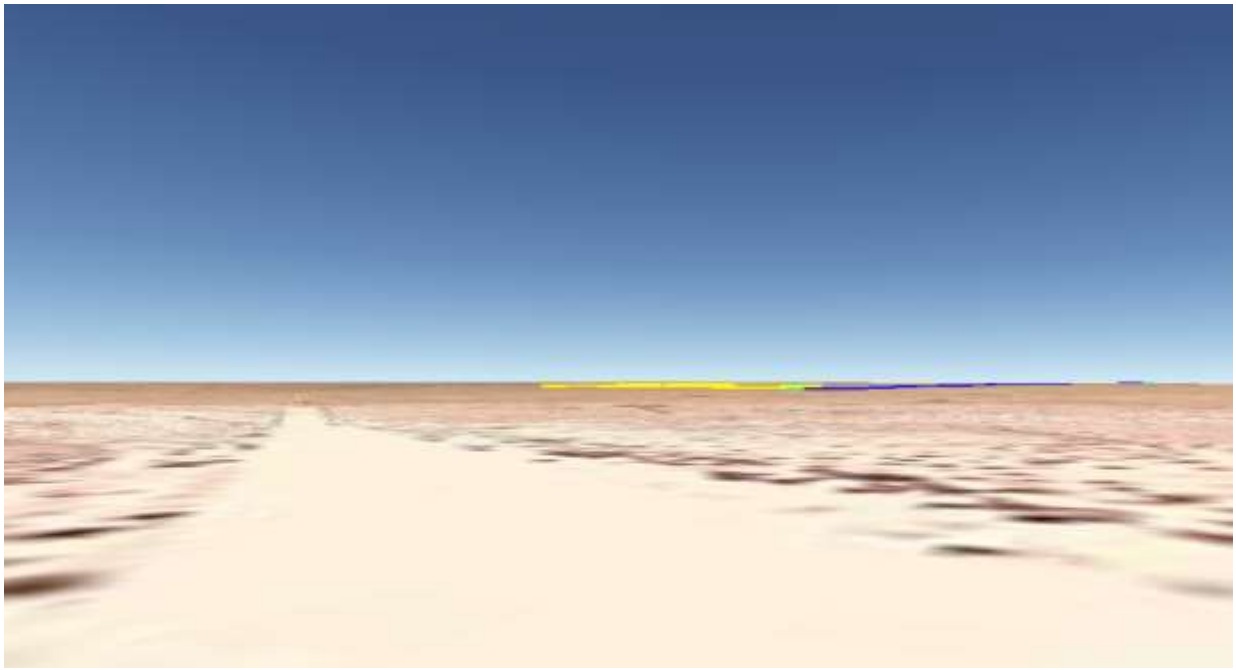

Figure 23: Google Earth 3D perspective view from similar northbound location (Yellow = Alpha PV, Green = Substation, Blue = Power Line).

Figure 24: Photograph taken from the district road southbound depicting the approximate location of the site.

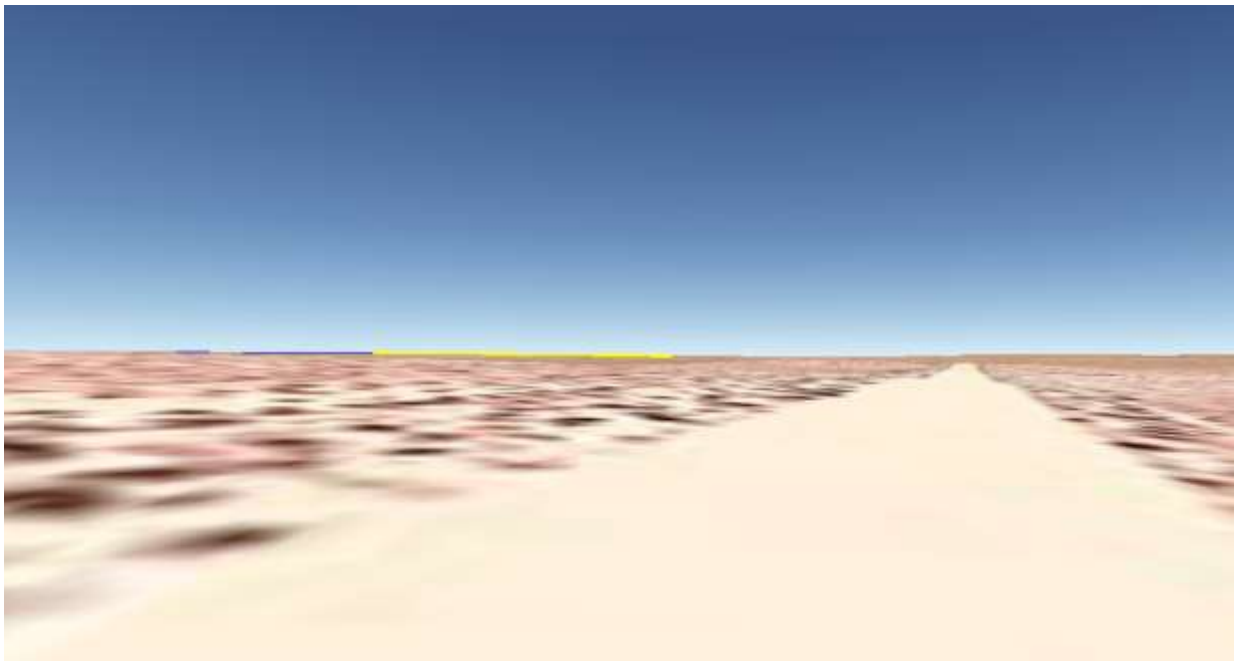

Figure 25: Google Earth 3D perspective view from similar northbound location (yellow = Alpha PV, Green = Substation, Blue = Power Line).

5 FINDINGS

5.1 Visual Absorption Capacity

The VAC of the site is rated ***low***. This is due to the very flat nature of the terrain with limited vegetation or built environment, within the Bushmanland Arid Grassland landscape. The existing Eskom substation and power lines do generate some visual contrast, however, these features are located approximately 4 km to the south of the site and as such do not significantly increase the capacity of the site to visually absorb the proposed PV landscape modifications.

5.2 Project Visibility

The viewshed generated from 4 corner points of the proposed project area is defined as ***local*** in extent. The 2km buffer distance area depicts a full coverage, with fragmentation of views starting in the medium to high distance where the viewshed is restricted to the southeast. Beyond the 6km distance, larger fragmentation takes place but only to the north. Beyond the 12km distance, partial views could take place from the west but only on higher ground locations.

5.3 Project Exposure

The receptor exposure to the proposed landscape modification is defined as ***medium***. Although the Kenhardt – Louisvale road is located within the 2km high exposure distance zone, the area is very remote as the road predominantly services isolated farms in the areas, and as such moderates the exposure.

5.4 Scenic Quality

The Scenic Quality rating for the Bushmanland landscape is rated ***Medium to Low***. Landform is rated *low* as it has few interesting landscape features. Vegetation is rated *medium,* as some Quiver Trees (Aloe dichotoma) were located on site that are a protected plant species (subject to Botanical Specialist findings). Water was absent but evident in the few shallow washes found on the site. Colours are grey-browns from the vegetation with the sandy soils being a lighter brown in colour. The subtle colour variations of the browns added some value to the site landscape. Adjacent scenery was rated *medium to high* due to the open and wide views of the Bushmanland Arid Grassland landscape. The routing is moderated by the adjacent scenery with the Eskom substation and power lines located within the foreground / middle ground area. Scarcity was rated *low* as, although interesting in its setting, the landscape is fairly common within the region. Cultural modifications include farm tracks and fences, and agricultural reservoirs that neither added nor detracted from the site sense of place.

5.5 Receptor Sensitivity

Receptor Sensitivity to landscape change was rated ***Low***. The types of users are predominately agricultural with no evidence of tourism, and as such are rated *low*. The Amount of Use and Public Interest is rated *low* as the location is remote and results in very

little public usage. Adjacent users are mainly agricultural who will continue with their existing landuses. The area is not defined as a Special Area and as such is rated *low*.

6 IMPACT ASSESSMENT

6.1 Contrast Rating from Key Observation Points

In the VRM methodology, the magnitude is defined by means of a contrast rating. The assessment of the Degree of Contrast (DoC) is a systematic process undertaken from Key Observation Points (KOPs) surrounding the project site, and is used to evaluate the potential visual impacts associated with the proposed landscape modifications. The degree of contrast generated by the proposed landscape modifications are measured against the existing landscape context in terms of the elements of form, line, colour and texture. Each alternative activity is then assessed in terms of whether it meets the objectives of the established class category, and whether mitigation is possible *(USA Bureau of Land Management, 2004).*

A visual contrast rating was undertaken to determine the degree of contrast generated by the proposed landscape modification in relation to the defined VRM Class Objective. 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.

Table 7: Power Line Contrast Rating Table

Element	Rating	Motivation
Form	Medium	The form created by the mass of the PV panels is mainly flat and thin as seen from the district road, which reflects the wide horizontal line of the horizon.
Line		
Colour	Medium	The black colour of the PV panels is likely to generate medium colour contrast to the grey-brown colours of the receiving landscape which can be quite dark in colour in areas.
Texture	Strong	The smooth and shiney texture of the panels is likley to generate strong contrast to the matt and rough textures of the receiving environment.
Degree of Contrast	Medium to Strong	The overall degree of contrast to the existing landscape will be medium to strong, moderated by the distance from the receptors.
Recommd. Class	III	Moderate levels of visual contrast recommended due to remoteness of the location, the low receptor sensitivity and the medium to low scenic quality.
Visual Objective Met?	Yes (with mitigation)	Yes, the Class III visual objective will be met with mitigation. Best practice in implementation of the project to reduce dust and soil erosion should be undertaken.
Magnitude	Medium	Although the contrast is likely to be strong for colour and texture, the area is very remote and the site does not comprise a significant visual resrouces that are utilised in landscape based tourism.

Table 8: Power Line Contrast Rating Table

Element	Rating	Motivation
Form	Weak	The small footprint of the monopoles and thin vertical line elements would result in weak form contrast
Line	Weak	Although the monopoles would be taller than the telecommunication poles in the foreground, the location behind with a buffer would reduce their perspective height, reducing the visual line contrast.
Colour	Weak	Initially the monopoles would be a shiny grey, but would fade over time to a medium to strong colour contrast.
Texture	Medium	The metallic structure of the monopoles and cables would result in some glint which would increase the visual contrast.
Degree of Contrast	Weak	The overall degree of contrast to the existing landscape will be weak, mainly due to 6km distance between the site.
Recommd. Class	III	Moderate levels of visual contrast recommended due to remoteness of the location, the low receptor sensitivity and the medium to low scenic quality.
Visual Objective Met?	Yes	Yes, the Class III visual objective will be met. Best practice in implementation of the project to reduce dust and soil erosion should be undertaken.
Magnitude	Low	The intensity is expected to be ***low.***

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 9: DEA&DP Visual and Aesthetic Guideline 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 (Im):** *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

6.2 PV Impact Assessment

Table 10: PV Impacts Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Magnitude	Probability	Significance
PV Project by phase	Cons.	W/Out	-ve	L	S	M	G	M
		With	-ve	L	S	L	G	L
	Ops.	W/Out	-ve	L	L	L	P	M
		With	-ve	L	L	L	P	L
	Close	W/Out	-ve	L	S	M	G	M
		With	-ve	L	S	L	G	L
	Cuml.	W/Out	-ve	L	L	M	P	M
		With	-ve	L	S	L	G	L
PV Project Summary	**All**	**W/Out**	**-ve**	**L**	**L**	**M**	**P**	**M**
		With	**-ve**	**L**	**L**	**L**	**P**	**L**

Without mitigation, the Visual Significance for all phases of development is likely to be ***medium***. With mitigation, the Visual Significance for all phases is likely to be ***low***.

6.2.1 *Construction Phase*

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as to road users. The proposed project is semi-industrial in nature and would be located in an agricultural area with limited man made infrastructure. A new source of lights at night will be introduced to the existing dark sky sense of place, and dust could become a nuisance value from the movement of vehicles or from wind blown dust. Due to the remoteness of the locality, construction phase visual significance without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

<u>Mitigations</u>

- Restrained signage and a single access road;
- The laydown area should be sited away from any drainage lines.
- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- Topsoil (if any) from the footprints of the road and structures should be dealt with in accordance with the EMP.
- Construction should not take place at night-time.
- The buildings and structures should be painted a grey-brown colour.
- Fencing around the laydown and buildings should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked on a monthly basis for the collection of litter caught on the fence.
- Implementation of erosion prevention measures to manage the run-off from the cleared site and the roadways.
- Plant rescue of any significant plant species as specified by the botanical specialist.

6.2.2 *Operation Phase*

During the operation phase, vehicles will frequent the area and may cause a cumulative visual nuisance to landowners and residents in the area, as well as to road users. The proposed project is semi-industrial and would be located in an agricultural area with limited existing man made infrastructure. Due to the remoteness of the locality, operation phase visual significance without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.
- Pro-active management of lights at night so as to ensure security without significantly extending the lights at night context (refer to appendix for generic lights at night recommendations).

6.2.3 *Closure Phase*

Closure phase would involve the movements of heavy vehicles, components, and equipment and construction crews to disassemble the PV structures, and rehabilitate the area. Due to the remoteness of the locality, closure phase visual significance without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.
- All structures associated with the development need to be dismantled and removed.
- All compacted areas should be rehabilitated according to the rehabilitation specialists' recommendations.

6.2.4 *Cumulative Effects*

Cumulative Effects could arise from the combined visual massing of all the proposed Straussheim projects, as well as the other PV projects that are proposed around the Eskom Nieuwehoop substation. However, due to the remoteness of the locality, the visual significance cumulative effects across all phases without mitigation is rated ***Medium***, which can be reduced to ***Low*** with mitigation.

Mitigations

- Erosion and litter control during construction;
- Erosion monitoring during operation;
- Restrained signage for all Straussheim PV projects preferably making use of a single laydown and a single access road;
- Removal and rehabilitation for deconstruction.

6.3 Power Line Impact Assessment

Table 11: Power Line Impacts Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Magnitude	Probability	Significance
Power Line Project by phase	Cons.	W/Out	-ve	L	S	L	G	L
		With	-ve	L	S	VL	G	VL
	Ops.	W/Out	-ve	L	L	L	P	L
		With	-ve	L	L	VL	P	VL
	Close	W/Out	-ve	L	S	L	G	L
		With	-ve	L	S	VL	G	VL
	Cuml.	W/Out	-ve	L	L	M	P	M
		With	-ve	L	S	VLL	G	L
Power Line Project Summary	**All**	**W/Out**	**-ve**	**L**	**L**	**L**	**P**	**L**
		With	**-ve**	**L**	**L**	**VL**	**P**	**VL**

Without mitigation, the Visual Significance for all phases of development is likely to be ***low***. With mitigation, the Visual Significance for all phases is likely to be ***very low***.

6.3.1 *Construction Phase*

During the construction phase heavy vehicles, components, equipment and construction crews will frequent the area and may cause, at the very least, a cumulative visual nuisance to landowners and residents in the area as well as to road users. The proposed project is semi-industrial in nature and would be located in an agricultural area with limited man made infrastructure. Due to the remoteness of the locality and the close proximity of the existing Eskom substation and power lines, construction phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

<u>Mitigations</u>

- Laydown area should be sited away from any drainage lines.
- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- Topsoil (if any) from the footprints of the road and structures should be dealt with in accordance with the EMP.
- Construction should not take place at night-time.
- Implementation of erosion prevention measures to manage the run-off from the cleared site and the roadways.

6.3.2 *Operation Phase*

During the operation phase, vehicles will frequent the area and may cause a cumulative visual nuisance to landowners and residents in the area, as well as to road users. The proposed project is semi-industrial and would be located in an agricultural area with limited existing man made infrastructure. Due to the remoteness of the locality and the close proximity of the existing Eskom substation and power lines, operation phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- If very dry conditions prevail and dust becomes a nuisance, dust suppression measures need to be implemented.
- On-going maintenance to manage any on-going soil erosion.

6.3.3 *Closure Phase*

Closure phase would involve the movements of heavy vehicles, components, and equipment and construction crews to disassemble the PV structures, and rehabilitate the area. Due to the remoteness of the locality and the close proximity of the existing Eskom substation and power lines, closure phase visual significance without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- All structures associated with the development need to be dismantled and removed.
- All compacted areas should be rehabilitated according to the rehabilitation specialists' recommendations
- On-going maintenance to manage any on-going soil erosion.

6.3.4 *Cumulative Effects*

Cumulative Effects are limited due to the close proximity of the site to the existing Eskom substation and 2 * 400 kV power lines. Cumulative Effects could arise from the combined visual massing of all the proposed PV power lines converging on the Eskom Nieuwehoop. If not effectively integrated by the different projects, congestion could take place. However, due to the remoteness of the locality, the visual significance of the cumulative effects across all phases without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

Mitigations

- Erosion and litter control during construction;
- Erosion monitoring during operation;
- Power line integration planning by DEA / Eskom;
- Removal and rehabilitation for deconstruction.

7 CONCLUSION

It is the recommendation of this visual assessment that the proposed Straussheim Alpha PV development should be authorised. Without mitigation the Visual Significance for all phases of development is likely to be ***medium***. With mitigation, the Visual Significance for all phases is likely to be ***low***. Although the VAC level of the Bushmanland Arid Grassland landscape is low, the location is remote and receptor sensitivity to landscape change is likely to be low. The flat terrain of the surrounding areas does increase the viewshed, but the limited height of the PV structures, and small visual footprint of the monopoles, is likely to contain the zone of visual influence to within a local level. The site scenic quality is rated medium, but does not comprise a significant feature in the overall landscape. Cumulative Effects could arise from the combined visual massing of all the proposed PV power lines converging on the Eskom Nieuwehoop substation. If not effectively integrated by the different projects, congestion could take place. However, due to the remoteness of the locality, the visual significance of the cumulative effects across all phases without mitigation is rated ***Low***, which can be reduced to ***Very-Low*** with mitigation.

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9 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

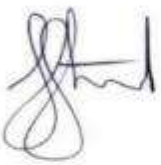
Specialist:	VRM AFRICA CC		
Contact person:	STEPHEN STEAD		
Postal address:	P.O BOX 7233, BLANCO		
Postal code:	6531	Cell:	083 560 9911
Telephone:	044 874 0020	Fax:	086 653 3738
E-mail:	steve@vrma.co.za		
Professional affiliation(s) (if any)	Association of Professional Heritage Practitioners South Africa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

9.1 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, 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 PV Postmasberg	Solar Energy	Northern Cape
2014	RERE CPV 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 PV Solar Park	PV 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 PV Solar Energy Sites (x4)	PV 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	PV 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 PV 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	PV 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

10 ANNEXURE 2: QUESTIONNAIRES AND VRM TERMINOLOGY

10.1 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. For example, viewed from 1000 m from a landscape modification, the impact would be 25% of the impact as viewed from 500 m from a landscape modification. At 2000m it would be 10% of the impact at 500 m. The relationship is indicated in the following graph generated by Hull and Bishop.

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 / Middle ground***, up to approximately 6km, which is where there is potential for the sense of place to change;
ii. ***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
iii. ***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). 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 below and with motivation, can be adjusted to Visual Resource Management Classes:

Table 12: 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**

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)*.

10.2 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

10.3 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

11 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.

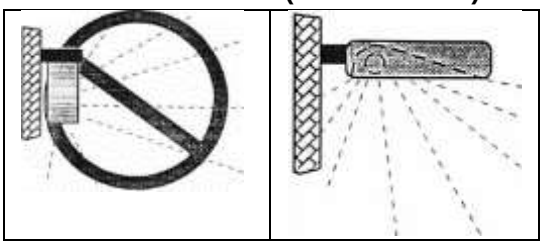
Glare Here’s the basic rule of thumb: If you can see the bright bulb from a distance, it’s a bad light. With a good light, you see lit ground instead of the dazzling bulb. “Glare” is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

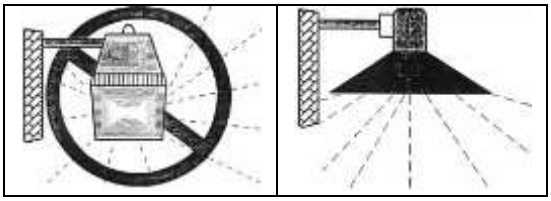
Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

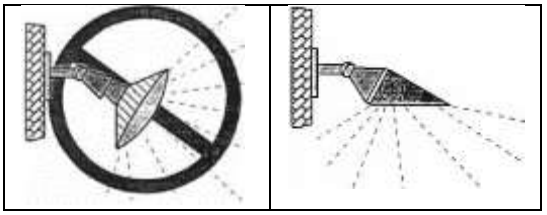
Energy Waste Many outdoor lights waste energy by spilling much of their light where it is not needed, such as up into the sky. This waste results in high operating costs. Each year we waste more than a billion dollars in the United States needlessly lighting the night sky.

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

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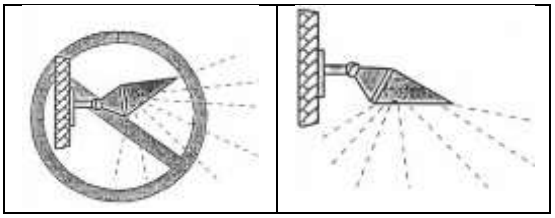

Floodlight:

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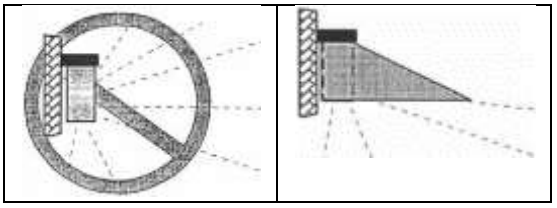

Wall Pack

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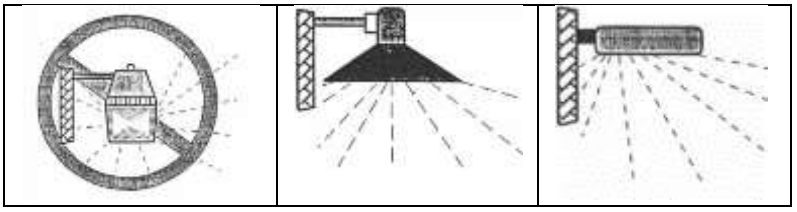

Yard Light | Opaque Reflecter | Show Box

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.