ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED HOTAZEL SOLAR, NORTHERN CAPE

SPECIALIST REPORT: VISUAL IMPACT ASSESSMENT

FINAL: 26 OCTOBER 2018

Document prepared for Cape EAPrac (Pty) Ltd;
On behalf of ABO Wind Hotazel PV (PTY) Ltd

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GLOSSARY

Best Practicable Environmental Option (BPEO)
This is the option that provides the most benefit, or causes the least damage, to the environment as a whole, at a cost acceptable to society, in the long, as well as the short, term.

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

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

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

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

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

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

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

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

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

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

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

LIST OF ACRONYMS

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

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

This document was undertaken by the following team:

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1 INTRODUCTION

VRM Africa was appointed by Cape EAPrac (PTY) Ltd to undertake a Visual Impact Assessment for the proposed Hotazel Solar on behalf of ABO Wind Hotazel PV (Pty) Ltd. The proposed project is located in the Joe Morolong Local Municipality, in the Northern Cape Province. The nearest settlement is the small town of Hotazel located. The nearest large town is Kuruman in the Northern Cape province. The project called Hotazel Solar, is proposed to be developed on the Remaining Extent (Portion 0) of the farm York A 279, situated in the District of Hotazel in the Northern Cape Province. The grid connection is proposed to traverse Portion 11 of Farm York A 279 and the Remainder of Farm 280 to connect to the Hotazel substation.

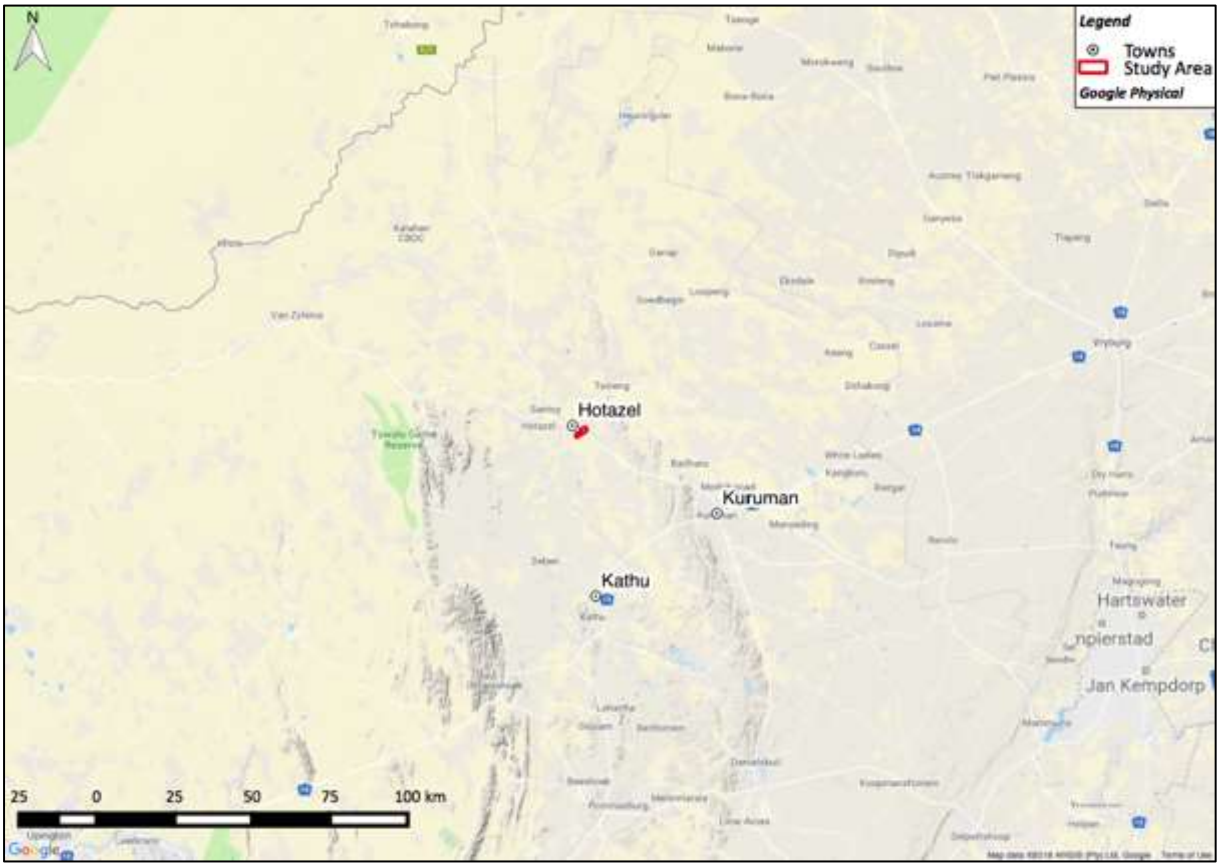

Figure 1: Regional locality map

1.1 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).

1.2 Assumptions and Limitations

- Information pertaining to the specific heights of activities proposed for the development was limited and, where required, generic heights will be used to define the visibility of the project.
- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The use of open source satellite imagery was utilised for base maps in the report.
- The viewsheds were generated using ASTER elevation data. (NASA, 2009)
- Some of the mapping in this document was created using Bing Maps (previously *Live Search Maps*, *Windows Live Maps*, *Windows Live Local*, and *MSN Virtual Earth*) and powered by the Enterprise framework.
- This study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

1.3 Approach and Methods

According to the Guidelines for Landscape and Visual Impacts by the Institute of Environmental Management and Assessment (United Kingdom), landscape impacts derive from changes in the physical landscape; which may give rise to changes in its character and how this is experienced. This in turn may affect the perceived value attributed to the landscape. Visual impacts relate to changes that arise in the composition of available views as a result of changes to the landscape, to people's response to any changes, and the overall impacts with respect to visual amenity. (U.K Institute of Environmental Management and Assessment (IEMA), 2002)

<u>Approach</u>

A site visit was undertaken on the 18th of June 2018. During the site visit, a visual confirmation of the desktop viewshed mapping was undertaken, to determine the anticipated zone of visual influence. From the property, key landforms and receptor points were identified. These local landforms and receptors points were then visited to determine the extent of the property visibility from the receptor locations. Photographs from the receptor locations in the direction of the property were also taken.

The process that VRMA followed when determining landscape significance 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 following key factors determine the suitability of landscape change:

- *"Different levels of scenic values require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, and management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values".*
- *"Assessing scenic values and determining visual impacts can be a subjective process. Objectivity and consistency can be greatly increased by using the basic design elements of form, line, colour, and texture, which have often been used to describe and evaluate landscapes, to also describe proposed projects. Projects that repeat these design elements are usually in harmony with their surroundings; those that don't create contrast. By adjusting project designs so the elements are repeated, visual impacts can be minimized"* (USDI., 2004).

Methods and Activities

The assessment comprises two main sections: firstly, the Visual Inventory to identify the visual resources along the proposed routing; and secondly, the Analysis Stage. The second impact assessment stage may require a Contrast Rating to assess the expected degree of contrast the proposed project would generate within the receiving landscape in order to define the Magnitude of the impact.

In terms of VRM methodology, landscape character is derived from a combination of scenic quality, receptor sensitivity to landscape change and distance from the proposed landscape change. Scenic Quality and Receptor Sensitivity are defined making use of the BLM check sheets located in the Annexure. These findings are then submitted to a VRM Matrix in Table 1 below. The VRM Classes are not prescriptive and are used as a guideline to determine the carrying capacity of a visually preferred landscape as a basis for assessing the suitability of the landscape change associated with the proposed project.

Table 1: 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 are 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 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. The proposed development 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. The proposed development 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; and

- The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and the proposed development may dominate the view and be the major focus of the viewer's (s') attention without significantly degrading the local landscape character.

Should the landscape character be found to be significant, a contrast rating would be undertaken during the impacts phase to inform the impact ratings. A contrast rating is undertaken from the receptor Key Observation Points, where the level of change to the existing landscape is assessed in terms of line, colour, texture and form, in relation to the visual objectives defined for the area. KOPs are defined by the BLM as the people (receptors) located in strategic locations surrounding the property or development that make consistent use of the views associated with the site where the landscape modifications are proposed.

2 PROJECT DESCRIPTION

The following extract from the Technical Layout Report outlines the project:

The technology under consideration is photovoltaic (PV) modules mounted on either fixed-tilt or tracking structures. Other infrastructure includes inverter stations, internal electrical reticulation, internal roads, an on-site switching station / substation, a 132 kV overhead transmission line (OHL), auxiliary buildings, construction laydown areas and perimeter fencing and security infrastructure.

The on-site switching station / substation will locate the main power transformer/s that will step up the generated electricity to a suitable voltage level for transmission into the national electricity grid, via the OHL. Auxiliary buildings include, inter alia, a control building, offices, warehouses, a canteen and visitors centre, staff lockers and ablution facilities and gate house and security offices.

Hotazel Solar will have a net output of 100 MWAC with an estimated maximum footprint of ± 275 ha. The approximate area that each component of the SEF will occupy is summarised in Table 2 below.

Table 2: Technical details for the proposed PV facility.

SEF Component	Estimated Area	% of Total Area (± 275 ha)	% of Farm Area (636.7946 ha)
PV structures/modules	± 250 ha	90.91 %	39.26 %
Internal roads	± 18 ha	6.55 %	2.82 %
Auxiliary buildings	± 1 ha	0.36 %	0.16 %
Substation	± 1 ha	0.36 %	0.16 %

Other	± 5 ha	1.82 %	0.78 %

The following maps identify the proposed layout and power line routings.

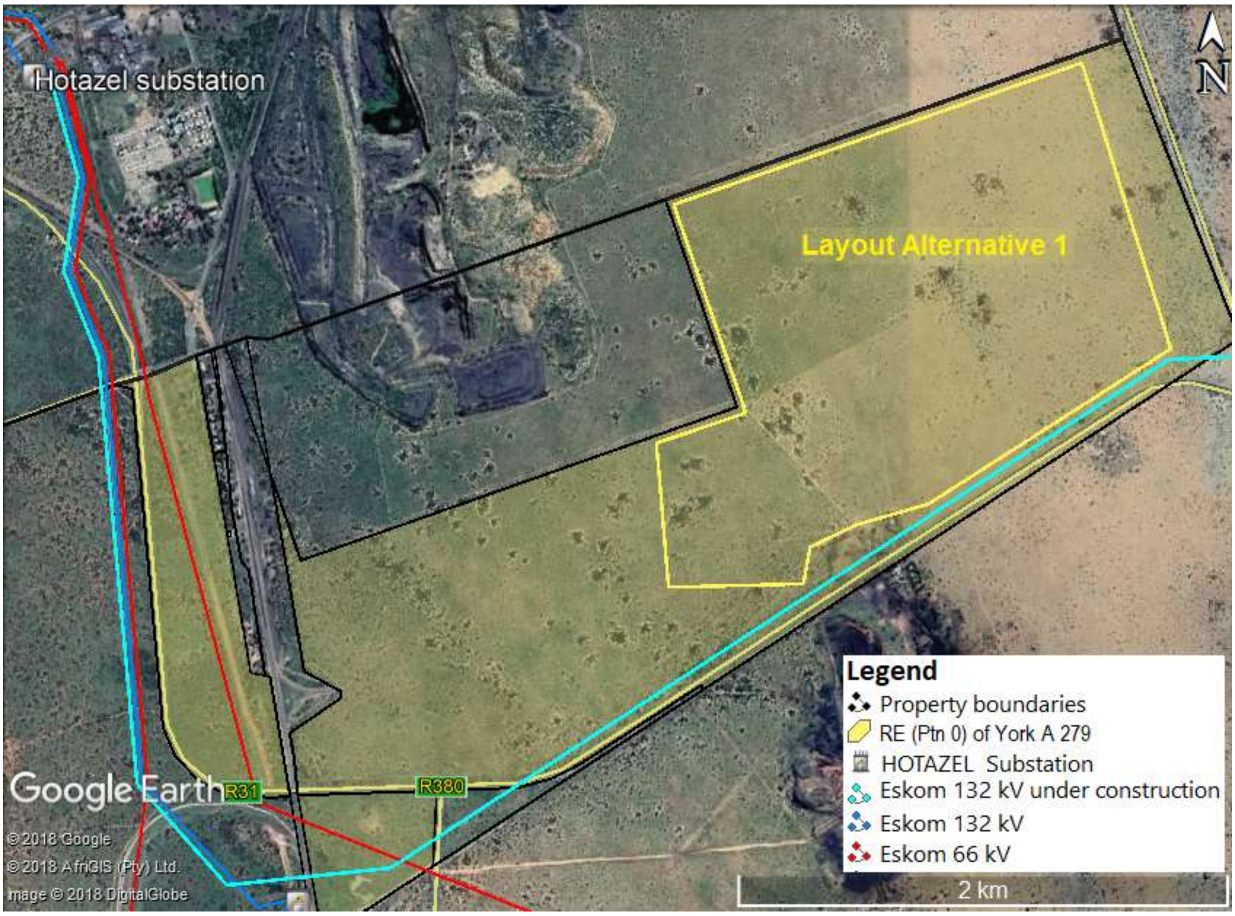

Figure 2: Preliminary PV Layout Alternative 1 locality map.

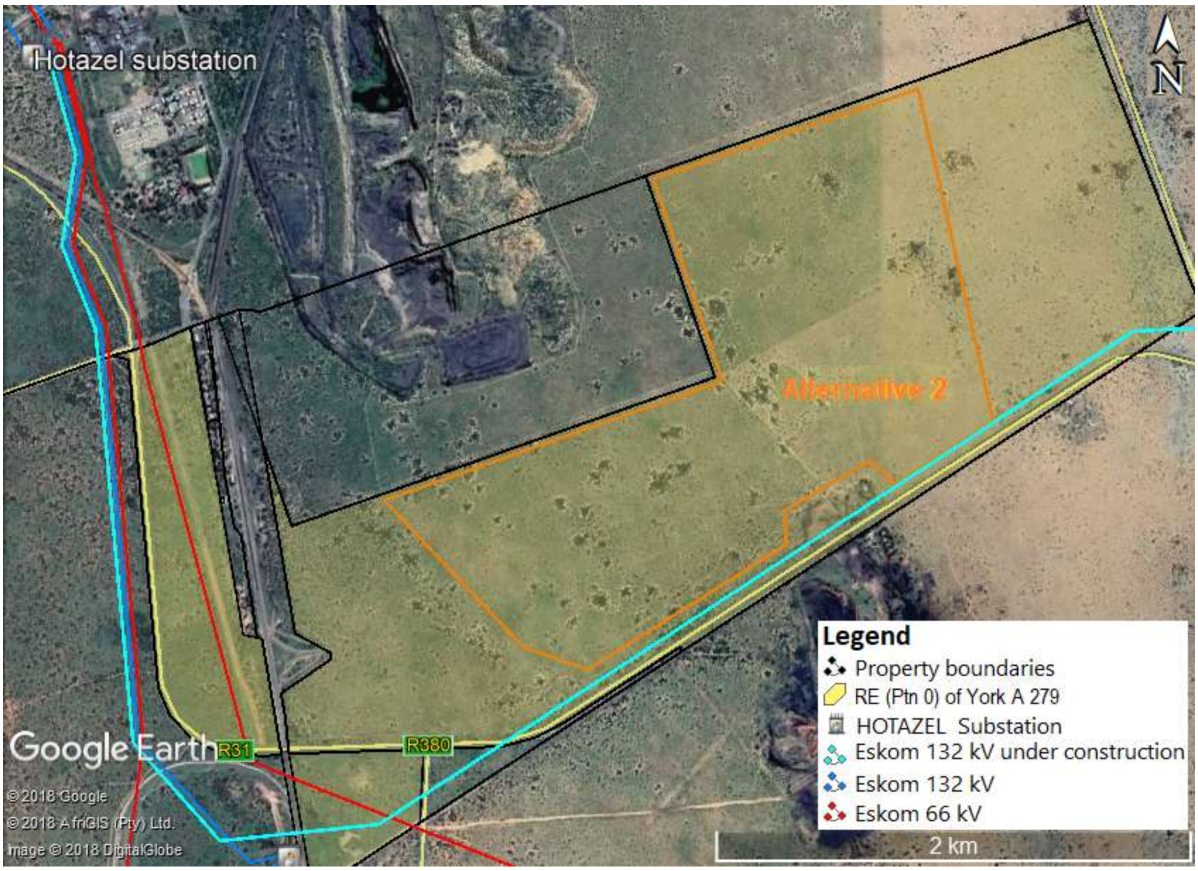

Figure 3: Preliminary PV Layout Alternative 2 locality map.

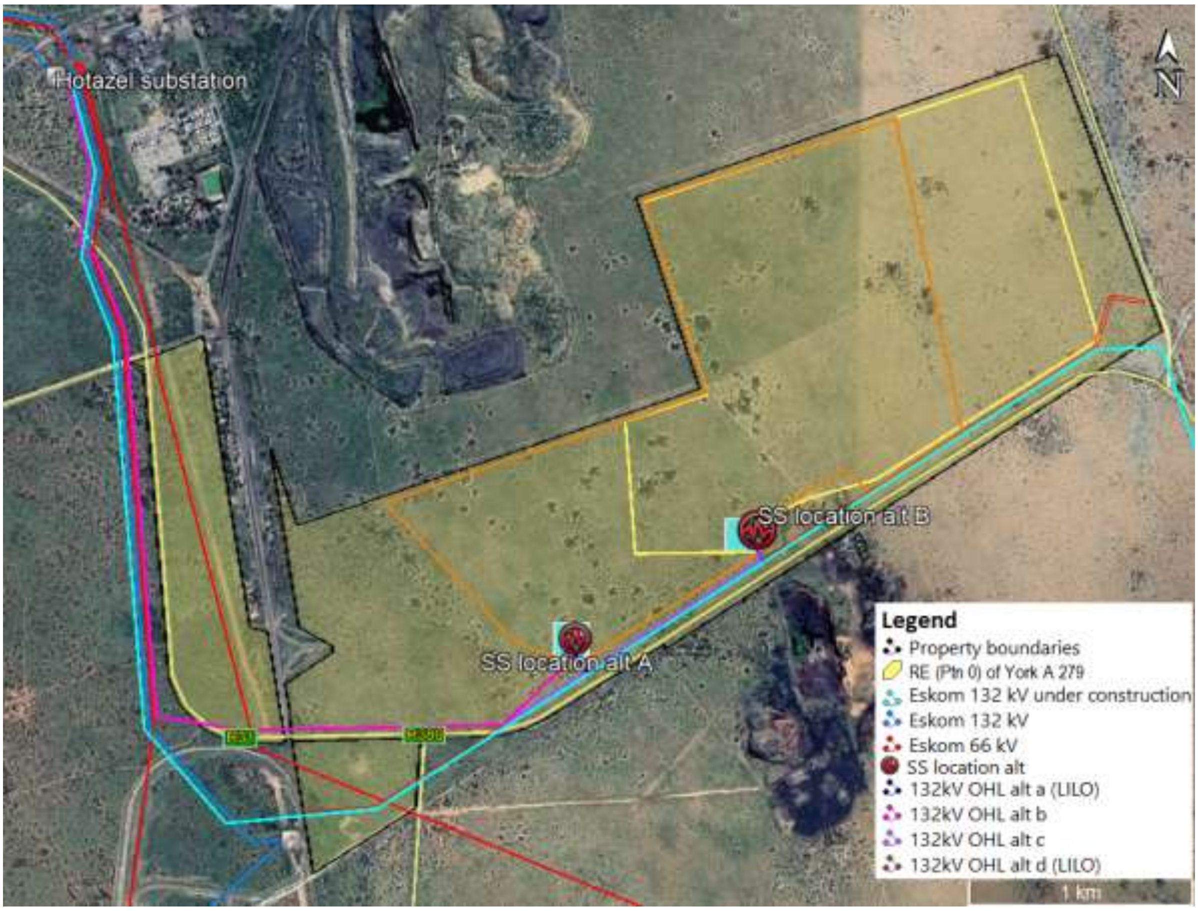

Figure 4: Substation and Power line Routing Alternatives locality map.

2.1 Legislative and Planning 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 organizations guidelines:

2.1.1 *John Taolo Gaetwewe District Municipality Spatial Development Framework (SDF)*

The Joe Morolong Municipality falls within the John Taolo Gaetwewe District Municipality.
With regard to tourism and solar energy, the John Taolo Gaetwewe District Municipality SDF makes the following statements regarding significance for the preparation and review of the document:

- *Regional Integration/ Cooperation (ZF Mgcawu & Republic of Botswana) with respect to Gamagara Corridor and Eco-Tourism Development Corridor;*
- ***Positioning the John Taolo District as the preferred investment area for solar energy** due to its proximity to the Solar Corridor in ZF Mgcawu District Municipality.*

No restrictions on solar energy were identified in the SDF.

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

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

- Ensure that the scale, density and nature of activities or developments are harmonious and in keeping with the sense of place and character of the area. The BPEO must also ensure that development must be located to prevent structures from being a visual intrusion (i.e. to retain open views and vistas).
- “Long term protection of important scenic resources and heritage sites.
- Minimisation of visual intrusion in scenic areas.
- Retention of wilderness or special areas intact as far as possible.
- Responsiveness to the area's uniqueness, or sense of place.” (Oberholzer, 2005)

3 BASELINE ASSESSMENT

3.1 Topography and Visibility

3.1.1 *Locality*

The proposed development site is located in the Northern Cape Province in the Joe Morolong Local Municipality (formerly known as Moshaweng Local Municipality). It is located within John Taolo Gaetsewe District Municipality (previously Kgalagadi District Municipality). The nearest large towns to the proposed project are Kuruman, which is located approximately 60km to the southeast, and Kathu located approximately 70km to the south. The small mining village of Hotazel is located approximately 5km to the northwest of the proposed site. The proposed site is accessed via the R31 District Road that connects the town of Hotazel to Kuruman.

3.1.2 *Regional Topography*

A regional Digital Elevation Model (DEM) was generated using NASA ASTER 90m DEM data (NASA, 2009). The data is generalised and used to better understand the broader terrain. Graphical representation of the terrain was also implemented with two profile lines cutting through the study area and extending beyond the area approximately 15km on either side as indicated on Figure 5 below.

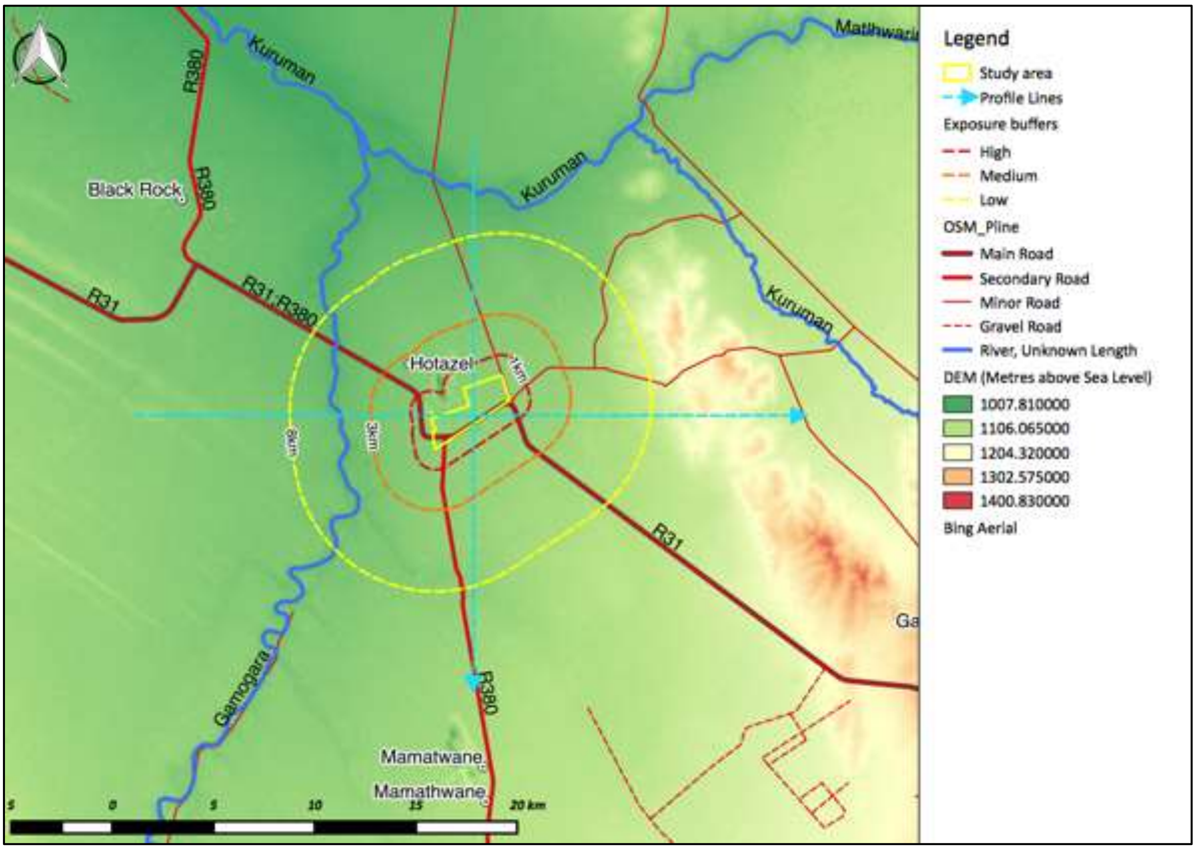

Figure 5: Regional Digital Elevation Model Map

The North to South Terrain Profile indicates the study area located within the 1070mamsl range, with flatter terrain around the study area. Over 15km to the north, the elevation drops 50m down to the Kuruman River Valley. To the south the elevation remains within a similar range, but drops slightly into a shallow depression, before continuing with a gentle increase in elevation up to a high point of 1100mamsl.

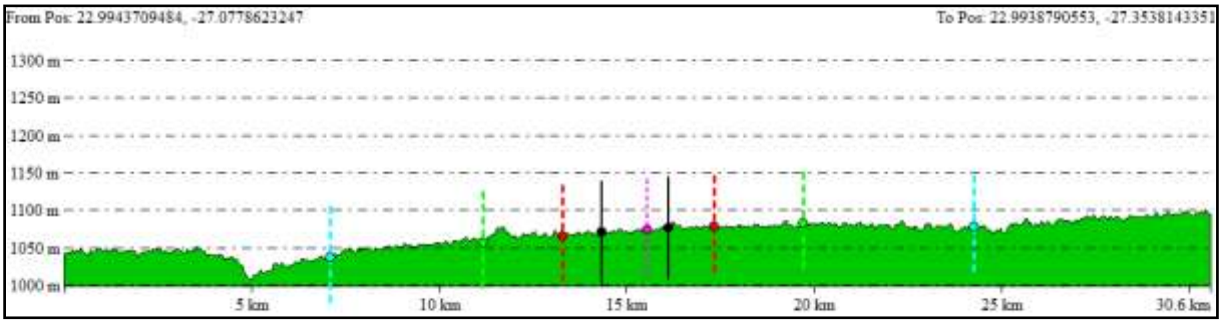

Figure 6: North to South Terrain Profile Graph

The West to East Terrain Profile places the study area within the 1070m range, with a similar terrain surrounding the study area. The drainage is to the West, dropping to a low of 1050mamsl in the Gamogara River Valley. To the east, the terrain gradually increases in elevation, with a sudden increase in elevation as the profile crosses the northern reaches of the Kuruman Hills which are approximately 100m in height. The profile of the Kuruman Hills is depicted in the photograph below which was taken from the R31 towards the east. The hills feature low in profile and rounded in nature, and do not create a dominating natural feature in the landscape.

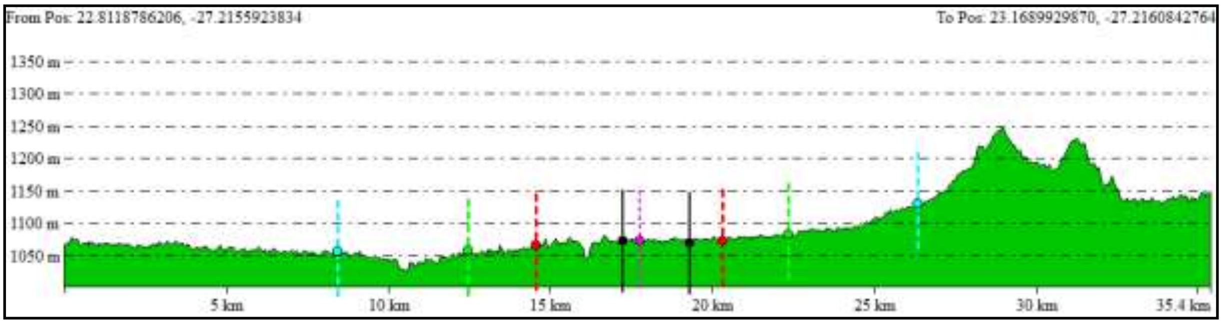

Figure 7: West to East Terrain Profile Graph (black markers indicate existing power lines)

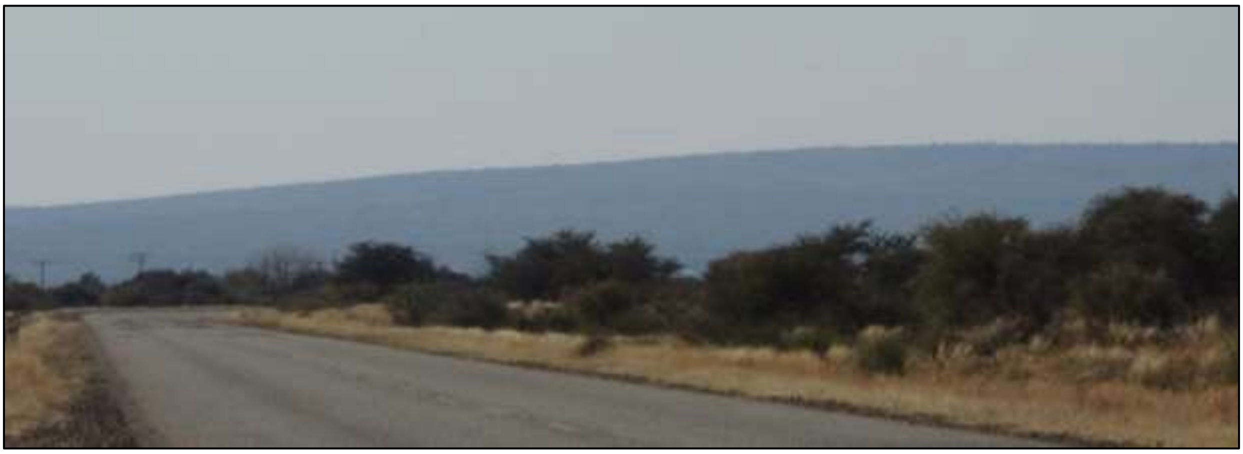

Figure 8: View east from the proposed site of the northern extents of the Kuruman Hills.

As can be seen in the Digital Elevation Model map above, the topography of the greater area surrounding the study area is relatively flat with the exception of the low hill range to the east. The main drainage of the greater region is to the north via the Gamogara River (approx. 7km west), which is a tributary of the larger Kuruman River located approximately 10km to the north. The only natural topographic feature within the greater area are the Kuruman Hills that are located approximately 15km to the southeast of the study site and rise approximately 100m above the generated terrain.

3.1.3 *Project Visibility*

The visible extent, or viewshed, is "the outer boundary defining a view catchment area, usually along crests and ridgelines" (Oberholzer, 2005). In order to define the extent of the possible influence of the proposed project, a viewshed analysis was undertaken from the proposed site at a specified height above ground level as indicated in Table 3 below, 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).

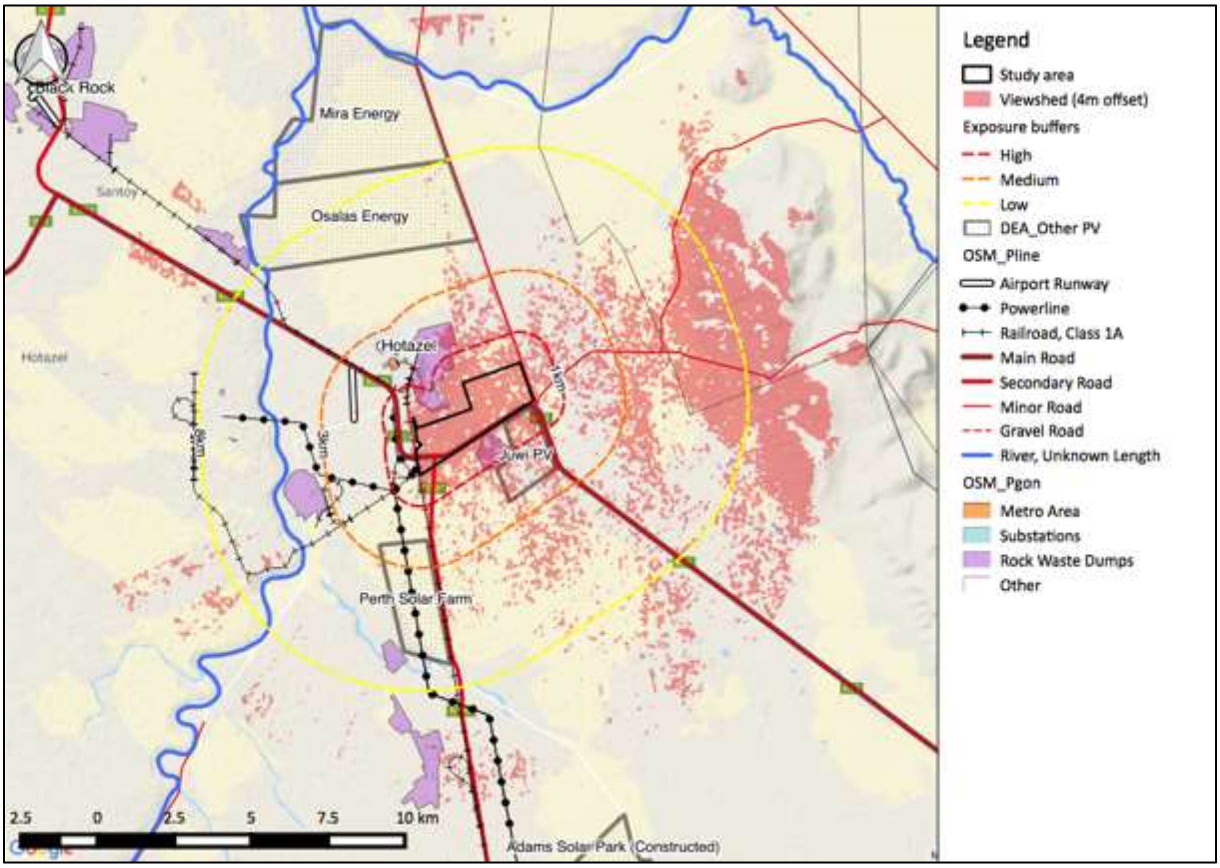

Figure 9: Approximate visibility map generated from a 4m Offset.

Table 3: Proposed Project Heights Table

Proposed Activity	Approx. Maximum Height (m)	Viewshed Extent (km)
132Kv Monopoles	25	2
PV Panels	4	12

A viewshed analysis was undertaken for the site making use of ASTER 90m Digital Elevation Model data. It is important to note that the terrain model ***excludes vegetation and structural screening***. The Offset value was set at 4m above ground to represent the approximate maximum height of the proposed PV panels.

As indicated in Figure 9 above, within the high exposure 2km buffer area visible incidence is most likely as a result of the mainly flat terrain of the study area and immediate surrounds. Due to the medium sized Bushveld vegetation that is found in the area, it is likely that a 4m high structure would be partially visible to the surrounding receptors.

Within the medium to low distance zone, visibility is mainly to the east, with some fragmented views possible from higher ground to the west. Located in this eastern area are the northern extents of the Kuruman Hills. Located 10km to the east, views from this elevated location would be subjected to atmospheric influences reducing clarity of view. This area is also remote and has very few receptors. The height of the proposed power line will be higher than the height of the surrounding bushveld vegetation, which is likely to extend the power line landscape modification. However, the small visual footprint of the monopole structure and cabling, which is located adjacent to an existing Eskom power line, is likely to reduce the extent of the zone of visual influence to that which is similar to PV project.

Although the nature of the surrounding terrain is mainly flat, the Visual Extent of the project is ***unlikely to extend beyond the foreground / middle-ground***. The contained visibility is mainly due to the Bushveld vegetation and the old Hotazel waste rock dump located to the northwest of the site, and as such the Zone of Visual Influence of total project landscape modification is likely to be ***Local*** in influence.

The High Exposure areas (2km) receptors include the R31 District Road for the proposed PV site. The small town of Hotazel is located within the Medium to High distance zone but is topographically screened by the waste rock dump located between the village and the site. Due to the close proximity of the R31 which is routed adjacent to the proposed project areas, the Visual Exposure to the R31 is rated ***High.***

3.2 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). This section of the VIA identified the main landscape features in the areas surrounding the proposed project that define the surrounding landscape character.

The following landscape dominate the character of the region:

- Mining and associated infrastructure;
- Renewable energy (proposed); and
- Other rural landuse.

3.2.1 *Mining and associated infrastructure*

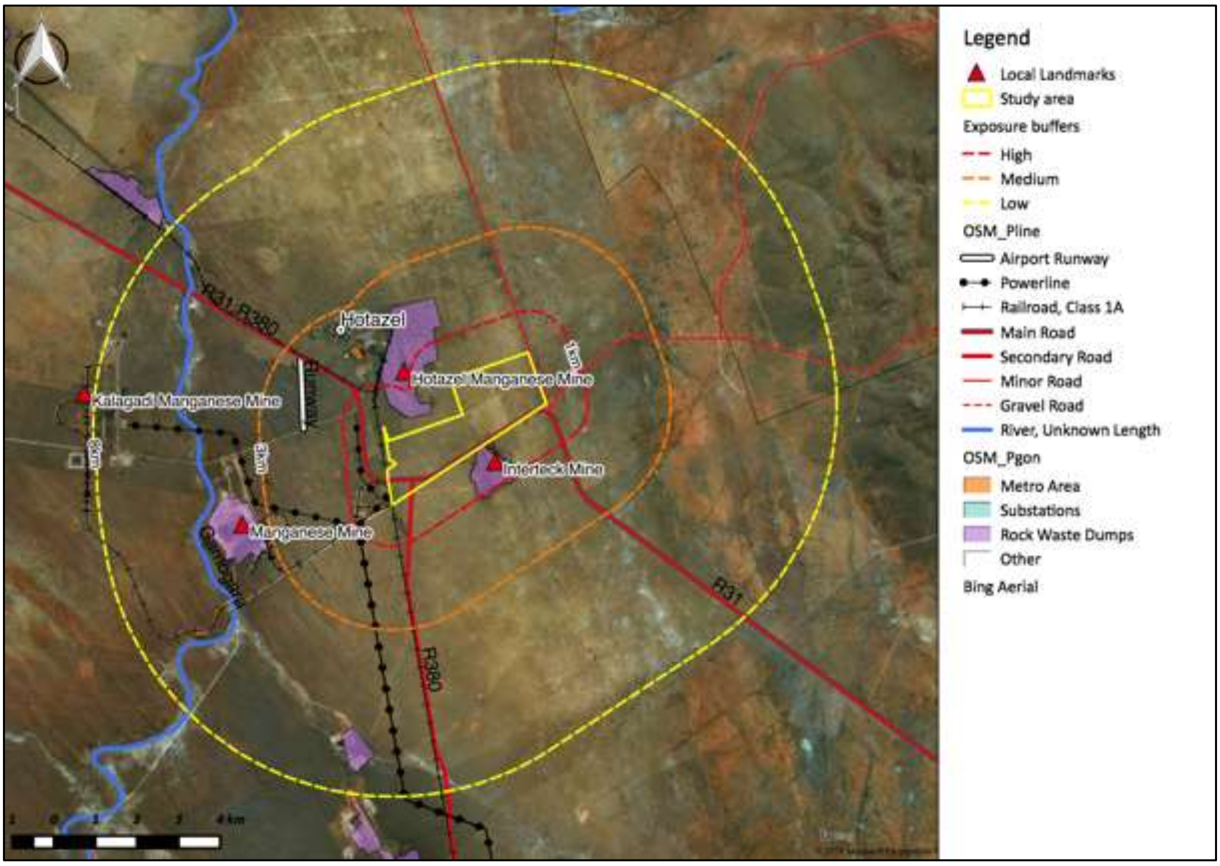

Figure 10: Key Landmarks and Infrastructure Map

A key factor influencing the regional landscape character is infrastructure that has been developed for the extraction of Manganese. As indicated by the purple areas in Figure 10 above, five large waste rock dumps are located within the vicinity of the proposed project associated with large Manganese Mines that require large structures and infrastructure. Also influencing the regional landscape is the associated electrical power and railway infrastructure required by the mines. These include two Eskom Substations (Hotazel and Umtu), multiple railway lines and multiple power lines. The Intertek Mine is an open pit type mine that is located directly south of the proposed PV study area. The mine is currently not operational. Located to the west of the power line study area is the Kalagadi Manganese Mine. As depicted in the photographs below, the mining structures and associated waste rock dumps are large in size and clearly dominate the attention of the casual observer. Due to the lower rainfalls of the area, rehabilitation of old rock dumps is limited and the dumps in the area do degrade the local landscape character.

The combination of the surrounding mining landscapes, which include large structures and waste rock dumps, in conjunction with the overhead railway structures and power lines, results in some degradation of the general landscape. This is especially experienced when the mines and infrastructures are viewed in close proximity, a strong level of visual contrast results. Due to the close proximity of the study area to the Intertek Mine site, as well as large power line infrastructure, the value of the site visual resources are reduced.

Figure 11: Photograph of the Kalagadi Manganese Mine as seen from the mine access road.

Figure 12: Photograph from the R31 south towards the Intertek Mine that is located adjacent to the south of the proposed site.

Figure 13: Photograph of the strong levels of contrast created by the combined railway line and power line infrastructure as seen from the proposed Umtu Power Line Routing.

3.2.2 *Other Renewable Projects*

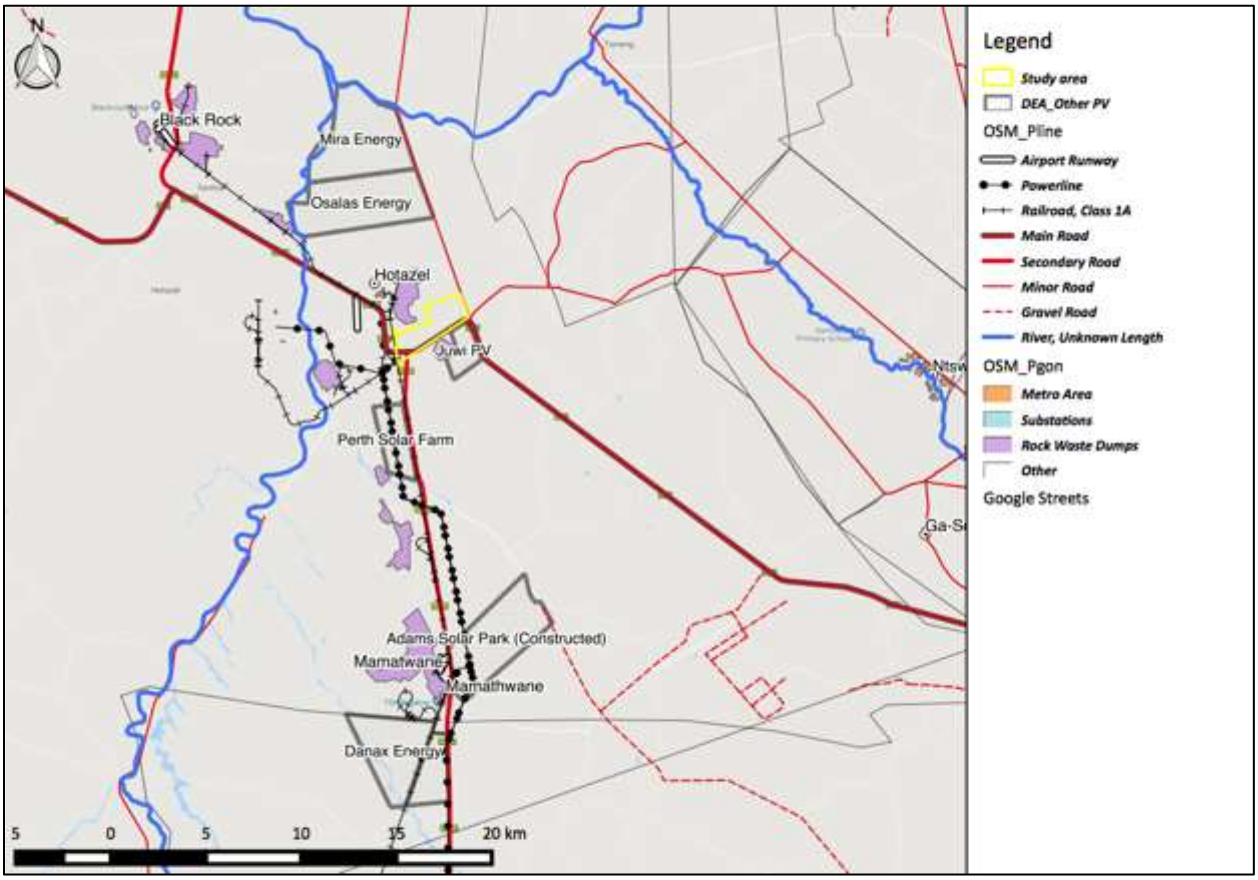

Figure 14: Map depicting the Renewable Energy mapping in relation to the approximate development area of the project.

A spatial query on the DEA Renewable Energy mapping found that there are six other projects proposed within 30 km. The two nearest developments are the Juwi PV, which is located directly to the south, and Perth Solar Farm located approximately 4 km southwest of the study area. Of the six proposed projects, Adams Solar Park appears to be the only project that has been constructed. In terms of understanding cumulative effects, intervisibility of multiple PV projects has the potential to create a massing effect that is likely to dominate the attention of the casual observer. However, due to the surrounding bushveld vegetation that tends to localise the landscapes, negative cumulative effects from intervisibility degrading the regional landscape character is likely to be limited. As can be seen in the overlap incidence in the viewshed map in Figure 9, the close proximity of the proposed PV project to the Juwi site is likely to result in intervisibility between the two projects once constructed. Opportunities of retaining the existing bushveld trees along the R31 road could reduce this visual effect.

3.2.3 *Other Rural Landuse*

Other land use identified in the area include limited residential / commercial landuse, and widespread cattle farming. The town of Hotazel was developed to house the workers of the adjacent Hotazel mining area and is located approximately four kilometres to the northwest of the PV study area. The town is small in size and does include some limited commerce. Views from the Hotazel residents towards the proposed study area are limited by the Bushveld vegetation, and by the location of the Hotazel Mine Waste Rock dumps between the town and the PV study site.

The Bushveld vegetation is well suited to cattle based agriculture. Due to the limited carrying capacity of the vegetation, farms are large in size and the farm dwellings are limited. Due to the Bushveld vegetation, views of the associated rural farmstead dwellings were limited. Also located in the area are game farms, which could offer some tourism potential. Other than possible game farming, no evidence of tourism activities were identified in the area.

Figure 15: Photograph of an isolated farmhouse, which is located on the proposed property, as seen from the R31.

3.3 Site Landscape Character

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

3.3.1 *Vegetation*

According to the South African National Biodiversity Institute (SANBI, 2012) Vegetation Map of South Africa, Lesotho and Swaziland, the vegetation biome within which the study area is located is defined as the Savanna Biome. Two main vegetation types were listed as intersecting with the study area: Gordonia Duneveld to the west, Kathu Bushveld where the PV development is proposed, and Kuruman Thornveld to the east (SANBI, 2012).

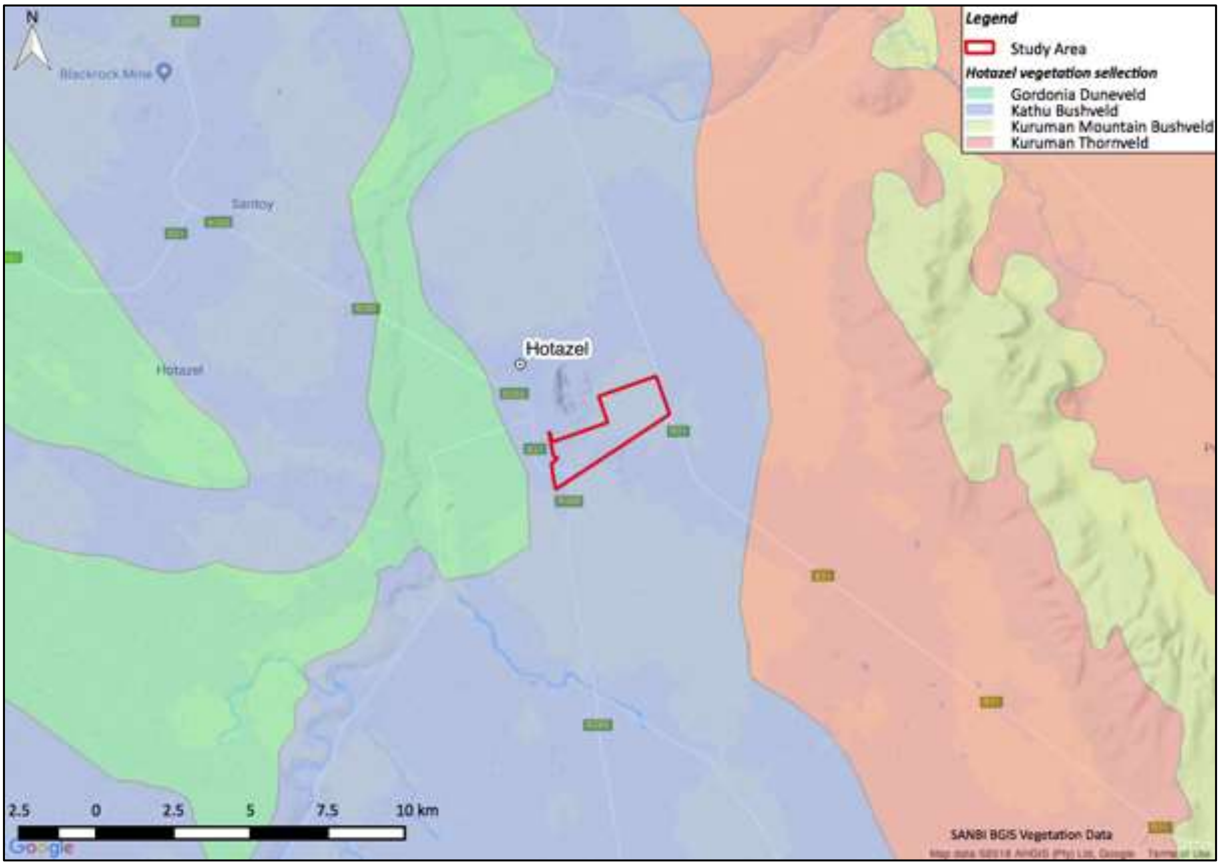

Figure 16: SANBI Vegetation Type Map (South African National Biodiversity Institute, 2012)

According to the SANBI website, "the Savanna Biome is the largest Biome in southern Africa, occupying 46% of its area, and over one-third of the area of South Africa. It is well developed over the Lowveld and Kalahari region of South Africa and is also the dominant vegetation in Botswana, Namibia and Zimbabwe". The advantage of this Biome is that it is characterized by "a grassy ground layer and a distinct upper layer of woody plants" which can assist in visual screening. The lack of rain tends to prevent the upper vegetation layer from dominating, which, coupled with fires and grazing, keeps the grass layer dominant. "The shrub-tree layer may vary from 1 to 20m in height, but in Bushveld typically varies from 3 to 7m. The shrub-tree element may come to dominate the vegetation in areas which are being overgrazed." (SANBI, 2012) In the vicinity of the study area, medium height Bushveld vegetation was identified which, in relation to the flatter terrain, could assist in reducing the zone of visual influence.

The Flora Scoping Report compiled by Simon Todd indicated that *Acacia haematoxylon* and *Acacia erioloba* are located on site which are protected tree species. The report indicates "*Acacia haematoxylon* is particularly common and approximately 2000 – 6000 individuals would potentially be lost as a result of the development" (Todd, 2018). Simon Todd indicates that the extent of habitat loss is not seen as being highly significant for this species but that DAFF should be engaged to investigate potential mechanisms to reduce or offset the negative impact. Preliminary visual recommendations are that the layout alternative that is less densely populated with these trees would be preferred. However, given the degraded nature of the surrounding landscape and the agricultural nature of the landuse, should the western section of the property be developed, the isolation of the eastern section is likely to be of low visual significance.

3.3.2 *Site Photographs and Descriptions*

In order to convey the landscape character of the proposed PV site, photographs that characterise the site landscape sense of place were taken as mapped in Figure 17 below.

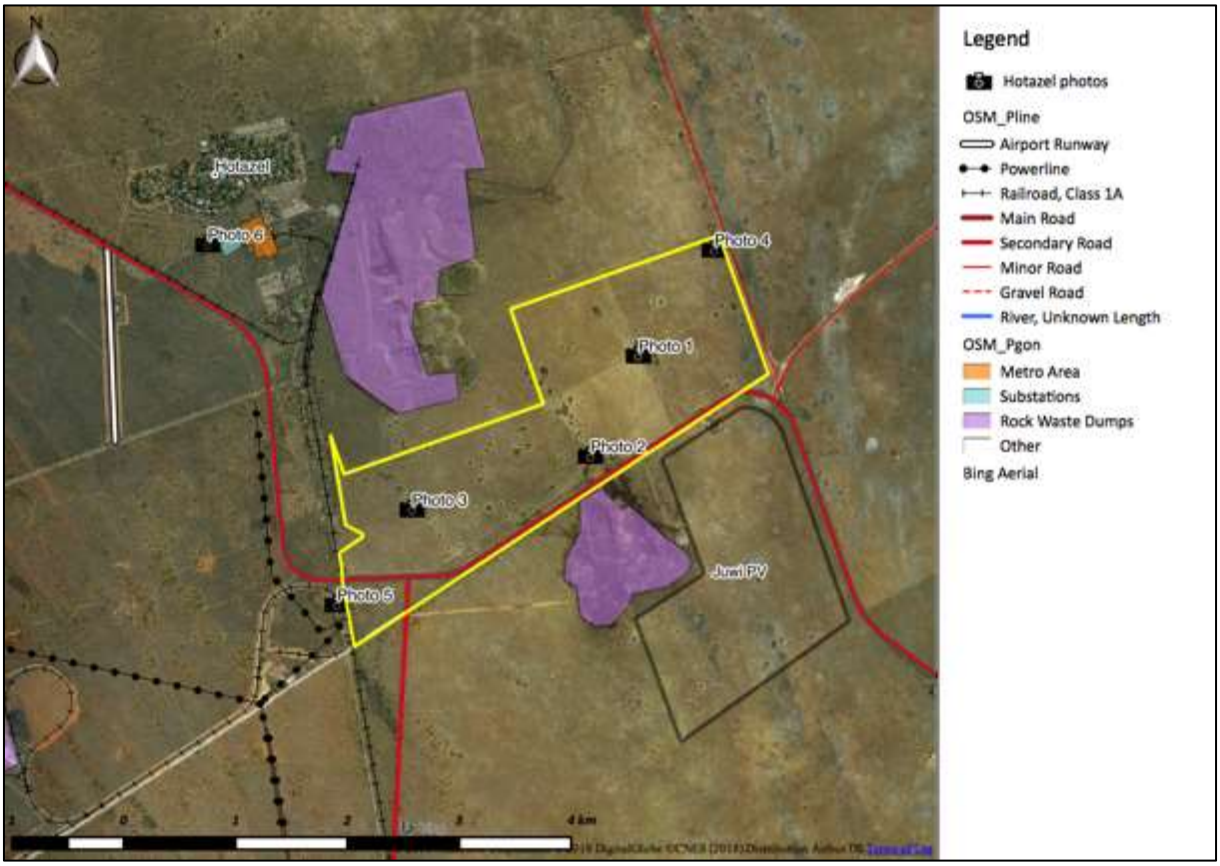

Figure 17: Proposed site photograph locality map.

Figure 18: View north from **Photo 1** of the grasslands and scattered bushveld trees with the old Hotazel Mine Waste Rock Dumps visible in the background.

Figure 19: View north from **Photo 2** of farm roads and more dense Kathu Bushveld trees.


Figure 20: View north from **Photo 3** of the higher bushveld vegetation.


Figure 21: View west from **Photo 4** of a similar bushveld vegetation.

Figure 22: View north from **Photo 5** of the existing power line and railway line infrastructure along which the proposed power line would be routed.

Figure 23: View west from **Photo 6** of the existing Hotazel Substation to which the proposed power line would be routed.

3.3.3 *Scenic Quality and Receptor Sensitivity Ratings*

The single landscape type defined as Rural Kathu Bushveld, was subjected to an analysis of its intrinsic value as a visual resource by quantifying Scenic Quality and Receptor Sensitivity to landscape change of the property. This can be viewed in Annexure 2.

The ***Scenic Quality*** scores are totalled and assigned an A (High scenic quality), B (Moderate scenic quality) or C (Low scenic quality) category based on the following split: *A= scenic* *quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11* (USDI., 2004). If applicable, the Cultural Modification can be assigned a negative value if the landscape is significantly degraded by human-made modifications. ***Receptor Sensitivity*** levels are a measure of public concern for scenic quality. Receptor sensitivity to landscape change is determined by rating the key factors relating to the perception of landscape change in terms of Low to High.

Table 4: Scenic Quality Rating Table

Aspect	Rating	Motivation
Landform	1	Generally flat terrain that has few or no interesting landscape features.
Vegetation	2	Some variety of vegetation, but only one or two major types.
Water	0	No presence of water was apparent on the site
Colour	2	Subtle colour variation created by the grey-green vegetation and the browns of the veld grasses.
Scarcity	2	Interesting within its setting but fairly common within the region.
Adjacent scenery	1	The dominance of the adjacent power lines, as well as the clear views of Intertek Mine and Hotazel Mine waste rock dumps located to south and west, reduce the scenic value of the adjacent scenery.
Cultural Modif.	2	Cultural modifications on site are limited to farm tracks and a single disused structure, which maintains the existing rural agricultural sense of place.

Table 5: Receptor Sensitivity Rating Table

Aspect	Rating	Motivation
Type user	Low	Due to the close proximity of the proposed site to the adjacent mines where waste rock dumps are visible, the local farming community are unlikely to be sensitive to landscape change.
Amount use	Medium	The site is located adjacent to the R31 District Road, but due to the remote locality of the site, traffic is limited and the site is partially screened due to the bushveld vegetation.
Public interest	Low	Given the strong mining landscape context of the site and the domination of mining within the local economy, it is likely that public interest in maintaining visual quality is low.
Adjacent land users	Low	Adjacent users are limited to mining activities and isolated farmers who are likely to have a low sensitivity to landscape change due to the mining activities located in close proximity to the site.
Special zoning	Medium	The property is currently zoned rural agricultura which restricts development to agricultural purposes. Acacia vegetation on the site is also protected.

3.3.4 *Site Visual Resources*

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

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

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

Table 6: Scenic Quality and Receptor Sensitivity Summary Table

Visual Resources	Scenic Quality A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11									Receptor Sensitivity H = High; M = Medium; L = Low						VRM	
NAME	**Landform**	**Vegetation**	**Water**	**Colour**	**Scarcity**	**Adjacent Landscape**	**Cultural Modifications**	**Sum**	**Rating**	**Type of Users**	**Amount of Use**	**Public Interest**	**Adjacent Land Uses**	**Special Areas**	**Rating**	**Visual Inventory Class**	**Visual Resource Management Class**
Kathu Bushveld	1	2	0	2	2	1	2	11	**C**	L	M	L	L	M	**M**	**IV**	**III**

Class I & II

Class I is typically assigned when legislation restricts development in certain areas (Class I), or when the Scenic Quality and Receptor Sensitivity is very high (Class II). 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. As no significant scenic resources were identified within the area, Class I and Class II Visual Objectives were not assigned.

Class III

Due to the zoning of the property as Agriculture, and the current land use being related to agriculture, the Visual Inventory Class IV was amended to a Visual Resource Management Class III. 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. However, careful consideration of the protected trees located on the property needs to be implemented.

Class IV

The Class IV objective is to provide for management activities that require major modifications of the existing character of the landscape. Due to the zoning of the property as Agriculture, and the current farming land uses of the surrounding areas, very high levels of visual intrusion could be degrading to the surrounding landscape character. As such, no Class IV areas were defined.

4 PRELIMINARY FINDINGS

Landscape Context

As can be seen in the Digital Elevation Model map above, the topography of the greater area surrounding the study area is relatively flat with the exception of the low hill range to the east. The main drainage of the greater region is to the north via the Gamogara River (approx. 7km west), which is a tributary of the larger Kuruman River located approximately 10km to the north. The only natural topographic feature within the greater area is the Kuruman Hills that are located approximately 15km to the southeast of the study site and rise approximately 100m above the generated terrain. Due to the distance between the site and the hill feature, landscape change on the site is thus highly unlikely to influence the Kuruman Hills sense of place.

A key factor also influencing the landscape character of the site is the close proximity to mining landscapes. These include four large Manganese Mines that require large structures and generate large waste rock dumps. Also influencing the regional landscape is the associated electrical power and railway infrastructure required by the mines. These include two Eskom Substations (Hotazel and Umtu), multiple railway lines and multiple power lines. A new 132kV Eskom power line currently under construction on the property routed adjacent to the R31 road. The combination of the surrounding mining landscapes, which include large structures and waste rock dumps, in conjunction with the overhead railway structures and power lines, results in some degradation of the general landscape and increased the Visual Absorption Capacity of the landscape. This is especially experienced when the mines and infrastructures are viewed in close proximity as strong levels of visual contrast result. Due to the close proximity of the study area to the Intertek Mine site, as well as large existing power line infrastructure, the value of the area visual resources are reduced.

Project Visibility and Exposure

Due to the Bushveld vegetation and surrounding mining landscapes, the Zone of Visual Influence of a 6m PV type landscape modification is likely to be ***Local*** in influence. Background views could also be extended to rural farmsteads, however due to the remoteness of the location and Bushveld vegetation, this is unlikely. Due to the close proximity of the proposed project area to the R31 located adjacent the site, the Visual Exposure to the proposed project is rated as ***High***.

Site Scenic Quality

One broad-brush landscape was identified during the site visit and is listed and mapped below:

- Kathu Bushveld.

Based on the VRM rating criteria, the overall scenic quality of the site is rated as ***Medium to Low.*** This was mainly due to the close proximity of the study area to the adjacent Intertek Mine, which degrades the local visual resources. The botanical specialist has identified that *Acacia haematoxylon* and *Acacia erioloba* are located on site. Although protected tree species, the flora scoping report findings indicate that the habitat loss “is not seen as being highly significant for this species” (Todd, 2018). As these are protected trees, and do add to the local Bushveld sense of pace, the layout should be designed so as to minimise the impact on these trees.

Receptor Sensitivity

Based on the VRM rating criteria, the main Receptor that would be exposed to the site is the R31 Road users located adjacent to the site. Due to the relatively remote location of the site, and the close proximity to existing mining landscapes, receptor sensitivity is rated as ***Medium to Low.*** Other than game farming, no tourism activities were identified during the site visit.

5 IMPACT ASSESSMENT

5.1 Nature of the visual impact

5.1.1 *PV and Road Infrastructure*

The Nature of the Visual Impact of both the PV alternatives is rated ***Negative***. The proposed PV landscape has the potential to generate strong levels of colour, form, texture and line contrast to the existing rural landscape. The following visual impacts could take place during the lifetime of the ***proposed PV*** project:

Construction Phase:

- Loss of site landscape character due to the removal of vegetation and the construction of the PV structures and associated infrastructure.
- Wind-blown dust due to the removal of large areas of vegetation.
- Possible soil erosion from temporary roads crossing drainage lines.
- Windblown litter from the laydown and construction sites.

Operation Phase:

- Massing effect in the landscape from a large-scale modification.
- On-going soil erosion.
- On-going windblown dust.

Decommissioning Phase:

- Movement of vehicles and associated dust.
- Wind-blown dust from the disturbance of cover vegetation / gravel.

Cumulative Effects:

- A long term change in landuse setting a precedent for other similar types of solar energy projects.
- Change to local sense of place from cumulative inter-visibility of multiple PV projects.

Reversibility

Due to the limited necessity for major earthworks in the construction of the PV project, impacts associated with the proposed PV project are defined as ***Reversible***. The existing agricultural landscape could be re-established to some degree with the removal of all the panels. It is likely that natural Bushveld vegetation would re-establish over time.

Confidence

The impact ratings were defined as ***Sure*** as sufficient information was provided regarding the nature of the landscape modification in relation to the main key observation points.

5.1.2 *Power Line Infrastructure*

The Nature of the Visual Impact of the proposed power line routings is rated Negative, as all these landscape modifications will require the removal of vegetation, or have the potential to be visually discordant with the surrounding rural landscape to some degree. Although the power lines do follow an existing Eskom power line routing, the multi-lines will create a visual massing effect which will degrade the local landscape character.

The following visual impacts could take place during the lifetime of the proposed ***transmission line***:

Construction Phase

- Loss of site landscape character due to the removal of vegetation and the construction of the power line structures and access road.
- Possible soil erosion from temporary roads crossing drainage lines.
- Possible windblown litter from the lay-down and construction sites.

Operation Phase

- On-going soil erosion.
- On-going windblown dust.
- Sunlight glint off cables and structures.

Decommissioning Phase

- Movement of vehicles and associated dust.
- Windblown dust from the disturbance of cover vegetation/gravel.

Cumulative Effects

- Massing effects from numerous power lines converging on the substations.
- Cluttering effects from add-hoc routings that are not aligned with existing Eskom power line corridors.

Reversibility

Due to the small footprint of the structure, all the alternatives were defined as ***Reversible***. The monopoles can be removed, and existing Bushveld vegetation would grow back, but only after a long period of time. Rehabilitation and restoration would be required.

Confidence

Confidence for the PV grid connection was rated ***Sure*** as sufficient information was provided regarding the nature of the proposed landscape modification.

5.2 Impact Assessment Rating Criteria

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

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

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

5.3 PV Impact Assessment

Table 7: PV Option 1 Impact Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with
PV Sites and Structures	Cons.	W/Out	-ve	Local	Short	Med	P	Med	
		With	-ve	Local	Short	Low	P		Low
	Ops.	W/Out	-ve	Local	Long	Med	P	Med	
		With	-ve	Local	Long	Low	P		Low
	Close	W/Out	-ve	Local	Short	Med	P	Med	
		With	-ve	Local	Short	Low	P		Low
	Cuml. Risk	W/Out	-ve	Local	Long	Med	P	Med	
		With	-ve	Local	Long	Med	P		Med

Table 8: PV Option 2 Impact Table (Preferred layout)

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with
PV Sites and Structures	Cons.	W/Out	-ve	Local	Short	High	P	Med	
		With	-ve	Local	Short	Med	P		Low
	Ops.	W/Out	-ve	Local	Long	High	P	Med to High	
		With	-ve	Local	Long	Med	P		Med
	Close	W/Out	-ve	Local	Short	Med	P	Med	
		With	-ve	Local	Short	Low	P		Low
	Cuml. Risk	W/Out	-ve	Local	Long	Med	P	Med to Low	
		With	-ve	Local	Long	Med	P		Low

Due to the partial overlap of the two proposed sites, and the location of the sites adjacent to each other with similar landscape character, the visual impact ratings for the two options are very similar. There is a marginal visual preference for PV Option 1 as this portion of the site has less *Acacia* tree species which are defined as protected species.

For Option 1, the Pre-mitigation Visual Significance was rated ***Medium*** as the local sense of place is degraded to some degree by the adjacent mine and is likely to become further degraded by possible expansion. Existing trees along the R31 would offer partial screening, and the existing Eskom power line located along the R31 does increase the visual absorption capacity of the locality to some degree. Further moderation of the impact is due to the contained project zone of visual influence. This is due to the surrounding Bushveld vegetation that is fairly prolific in the area and the relatively flat terrain that restricts clear views as seen from local receptors. The Post-mitigation ***Visual Significance*** was rated ***Low***. The retention of a natural vegetation buffer along the R31, would effectively screen the high exposure views as seen from the R31 road receptors. Due to the location of this layout directly opposite the R31 from the proposed Juwi PV development, the intervisibility of Alternative 1 is likely to be strongly experienced by the R31 Road receptors. However, as the existing landscape character is not significant (degraded by views of mining landscapes), this intervisibility is rated as Medium Negative. As the Eskom power line would require the removal of trees adjacent to the road, mitigation in terms of retaining the trees along the verge, is limited and the rating remains Medium Negative.

For Option 2, the Pre-mitigation Visual Significance is rated ***Medium*** for construction phase, but ***Medium to High*** for Operational Phase. This is due to the long-term loss of the site sense of place due to the removal of the *Acacia* trees. As with Option 1, moderation of the visual impact does take place due to the degraded surrounding mining areas, as well as the contained visual envelope of the proposed PV landscape modification. However, with mitigation that includes retaining the surrounding Bushveld vegetation, the impacts are likely to be ***Medium*** during Optional Phase. Due to the location of this layout further to the west, there is less direct intervisibility due to the staggered nature of the PV locality with respect to the R31 Road receptors. The existing trees located on the south-western extent of the property will screen visibility, resulting in Medium to Low Negative cumulative impacts (without mitigation). With mitigation which would require retaining the some of the trees to the southwest of the layout (Grid reference I4 in Figure 24 below), would reduce the potential for intervisibility, resulting in Low Negative Cumulative impacts.

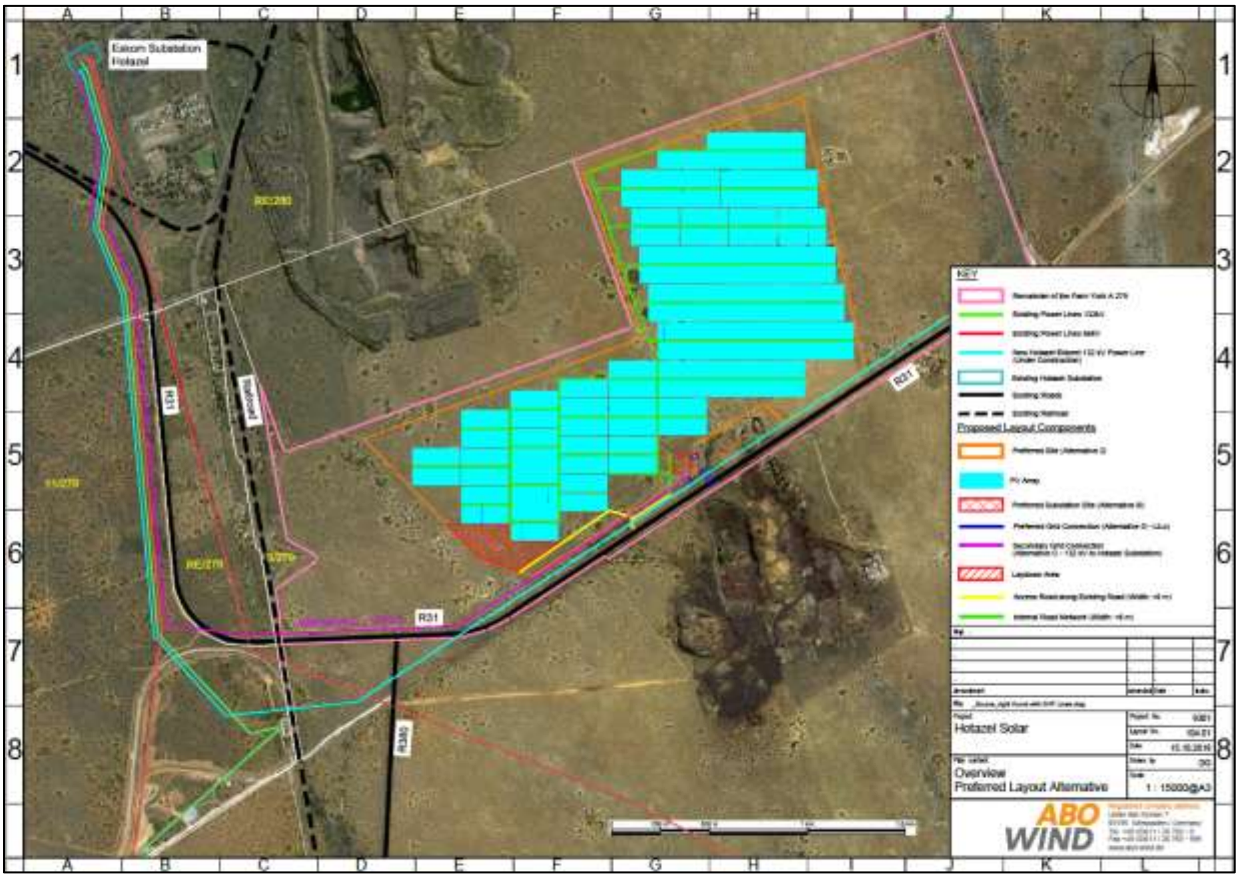

Figure 24: Proposed preferred layout plan.

The following mitigations are recommended per phase:

<u>PV Site and Structure Construction</u>

- Bushveld trees that do not create shade or fire risk, between the proposed PV site and the R31 Road, should be retained for visual intervisibility screening.
- The laydown area should not be sited directly adjacent to the R31 Road.
- Topsoil from the footprints of the road and structures should be dealt with in accordance with EMP.
- The buildings and battery storage facility should be painted a grey-brown colour.
- Fencing 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.
- Signage on the R31 should be moderated.
- Lights at night have the potential to significantly increase the visual exposure of the proposed project, therefore it is recommended that mitigations be implemented to reduce light spillage (refer to appendix for general guidelines).

<u>PV Site and Structure Operation</u>

- Control of lights at night to allow only local disturbance to the current dark sky night landscape (refer to appendix for general guidelines).

- Light spillage management to ensure that security lighting at night is not visually intrusive. Lighting for security should be downward and inward facing and not include overhead security lighting options.
- Continued erosion control and management of dust.

PV Site and Structures Closure

- All structures should be removed and where possible, recycled.
- Building structures should be broken down (including foundations).
- The rubble should be managed according to NEMWA and deposited at a registered landfill if it cannot be recycled or reused.
- All compacted areas should be rehabilitated according to a rehabilitation specialist.
- Monitoring for soil erosion should be undertaken on a routine basis.

Cumulative Effects

The negative cumulative effects of the project are mainly related to the change in local sense of place in a currently rural landscape. There are also other PV projects proposed in the vicinity that will result in some inter-visibility. In these instances along the R31 road, the change to the rural sense of place in the landscape can be visually dominating. However, the R31 has moderate to low levels of scenic quality, and none of the visual resources are utilised for eco-tourism activities where landuse conflict can occur.

The Hotazel area is an established mining area with four large mining landscapes. These landscapes include waste rock dumps, mine headgear as well as large structures. Within the proposed project zone of visual influence, the landscape character is mainly dominated by Bushveld vegetation and the two adjacent mining sites. Due to the Bushveld trees surrounding the proposed PV development sites in the area, inter-visibility potential is significantly reduced. Retaining a buffer along the road for the existing Bushveld trees will assist in breaking up clear views of the PV panels, and further growth within this buffer zone would further reduce visibility and inter-visibility with other PV projects proposed in the vicinity. PV. From a cumulative visual impact perspective, Layout 2 is visually preferred. As indicated above, this is due to the location of this layout further to the west, there is less direct intervisibility due to the staggered nature of the PV locality with respect to the R31 Road receptors. The existing trees located on the south-western extent of the property will screen visibility, and with mitigation and retaining some of the trees along the R31, the potential for intervisibility would be further reduced.

5.4 Preferred PV Alternative Selfbuild Grid Connection and Substation

Table 9: Alternative A Selfbuild Grid Connection and Substation Impact Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with
Alt A Grid Connection and Substation	Cons.	W/Out	-ve	Local	Short	L	P	L	
		With	-ve	Local	Short	L	P		VL
	Ops.	W/Out	-ve	Local	Long	L	P	L	
		With	-ve	Local	Long	L	P		VL
	Close	W/Out	-ve	Local	Short	L	P	L	
		With	-ve	Local	Short	VL	P		VL
	Cuml.	W/Out	-ve	Reg.	Long	H	P	M	
		With	-ve	Local	Short	L	P		L

Table 10: Alternative B Selfbuild Grid Connection and Substation Impact Table

Impact Activity	Phase	Mitigation	Nature	Extent	Duration	Severity	Probability	Significance without	Significance with
Alt B Grid Connection and Substation	Cons.	W/Out	-ve	Local	Short	VL	P	VL	
		With	-ve	Local	Short	VL	P		VL
	Ops.	W/Out	-ve	Local	Long	L	P	VL	
		With	-ve	Local	Long	VL	P		VL
	Close	W/Out	-ve	Local	Short	L	P	VL	
		With	-ve	Local	Short	VL	P		VL
	Cuml.	W/Out	-ve	Reg.	Long	H	P	M	
		With	-ve	Local	Short	L	P		L

Without mitigation, the Visual Significance for all phases was rated ***Low*** for ***Alternative A***. The proposed power line mainly follows existing distribution power line / telecommunication lines as well as existing farm access routes. The ZVI for the monopoles is also expected to be localised due to the higher visual absorption capacity created by the existing Eskom power line infrastructure, as well as the surrounding medium sized Bushveld trees that will partially visually screen the proposed On-site substation. With erosion control the visual significance can be reduced to ***Very Low***.

Due to the location of the site substation away from the R31 road, there is a slight visual preference for ***Alternative B*** with Visual Significance rated as ***Very Low*** for all phases. Although the power line routing is slightly longer, the majority of the routing follows the existing Eskom powerline corridor. This preference is marginal as the trees adjacent the R31 would also provide partial visual screening for Substation Alternative A. Ultimately, from a visual perspective, the preferred option is a direct LILO to the existing Eskom power line. This would alleviate the multiple lines converging into the Hotazel Substation, and reduce the visual massing effects from the multi-lines. This option should be considered first, and only excluded if deemed to be not feasible from an Eskom connectivity perspective.

Pre-construction Phase Mitigation

- Integration planning with Eskom if required.

- Planning for reduced light intrusion (without compromising security)

Construction Phase Mitigation

- Soil erosion management to be implemented where required.
- Strict litter control.

Operation Phase Mitigation

- On-going erosion control monitoring by the ECO.

Closure Phase Mitigation

- Removal of all structures and recycling of the structure and cables.
- Removal of any foundations and filling of holes created and shaped to appear natural.
- Rehabilitation and restoration of the footprint and track according to a rehabilitation specialist recommendations.

6 CONCLUSION

As the visual significance of the proposed PV facility is unlikely to result in significant degradation of the surrounding visual resources, the conclusion of this visual impact assessment is that the PV project is authorised with mitigation. Due to the partial overlap of the two proposed sites, and the location of the sites adjacent to each other with similar landscape character, the visual impact ratings for the two options are very similar. However, there is a marginal visual preference for PV Option 2. Although this portion of the site has more *Acacia* tree species, the more westerly location reduces the potential for intervisibility with the Juwi PV plant proposed to the south of this site.

Based on the VRM rating criteria, the overall scenic quality of the site is rated as ***Medium to Low.*** This was mainly due to the close proximity of the study area to the adjacent Intertek Mine, which degrades the local visual resources. Adding value to the scenic quality is the Bushveld vegetation. The botanical specialist has identified that *Acacia haematoxylon* and *Acacia erioloba* are located on site. Although protected tree species, the flora scoping report findings indicate that the habitat loss “is not seen as being highly significant for this species” (Todd, 2018). As these are protected trees, and do add to the local Bushveld sense of pace, the layout should be designed so as to minimise the impact on these trees. However, due to the relatively remote location of the site and the close proximity to existing mining landscapes, receptor sensitivity is rated as ***Medium to Low.***

There are also other PV projects proposed in the vicinity (south of the R31 Road) that will result in some inter-visibility. In these instances along the R31 road, the change to the rural sense of place in the landscape can be dominated by the PV landscape. However, the R31 has moderate to low levels of scenic quality due to the old mine site also located within the receptor viewshed, and none of the visual resources are utilised for eco-tourism activities where landuse conflict can occur. Due to the Bushveld trees surrounding the proposed PV development sites in the area, inter-visibility potential is locally contained. Retaining a buffer along the road for the existing Bushveld trees will assist in breaking up clear views of the PV panels, and further tree growth within this buffer zone would further reduce visibility and inter-visibility with other PV projects proposed in the vicinity. From a cumulative visual impact perspective, PV Option 2 is visually preferred. This is due to the location of this layout further to the west, there is less direct intervisibility due to the staggered nature of the PV locality with respect to the views from the R31 Road receptors. The existing trees located on the south-western extent of the property will continue to screen visibility, and with mitigation and retaining some of the trees along the R31, the potential for intervisibility would be further reduced. Due to the rural setting, lights at night also need to be designed to reduce light spillage.

Due to the advantages of reducing multi-lines, the direct LILO option is the visually preferred, with a slight visual preference for Selfbuild Grid Alternative A due to the shorter length. However, as the routes follow an existing Eskom Power Line routing through a landscape that does include mining landscape modifications, the impact of the proposed routings is moderated and negative cumulative visual effects are likely to be of low significance. Selfbuild Substation Alternative B is also partially visually screened by existing bushveld vegetation adjacent to the road, closer to the existing farmhouse structure and opposite to the truck wash area, all which influence the sense of place and increase the visual absorption capacity, thus reducing the visual intrusion of these landscape modifications.

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8 ANNEXURE 1: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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

The specialist appointed in terms of the Regulations

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

General declaration:

- I act as the independent specialist in this application
  I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

SILVER SOLUTIONS TRADING AS VRM AFRICA

8.1 Curriculum Vitae

Curriculum Vitae (CV)

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

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

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

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

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

11. **Continued Professional Development:**
    - Integrating Sustainability with Environment Assessment in South Africa (IAIAsa Conference, 1 day)
    - Achieving the full potential of SIA (Mexico, IAIA Conference, 2 days 2011)

- Researching and Assessing Heritage Resources Course (University of Cape Town, 5 days, 2009)

12. Countries of Work Experience:

- South Africa, Mozambique, Malawi, Lesotho, Kenya and Namibia

13. Relevant Experience:

Stephen gained six years of experience in the field of Geographic Information Systems mapping and spatial analysis working as a consultant for the KwaZulu-Natal Department of Health and then with an Environmental Impact Assessment company based in the Western Cape. In 2004 he set up the company Visual Resource Management Africa which specializes in visual resource management and visual impact assessments in Africa. The company makes use of the well documented Visual Resource Management methodology developed by the Bureau of Land Management (USA) for assessing the suitability of landscape modifications. In association with ILASA qualified landscape architect Liesel Stokes, he has assessed of over 100 major landscape modifications through-out southern and eastern Africa. The business has been operating for eight years and has successfully established and retained a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

14. Languages:

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

15. Projects:

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

YEAR	NAME	DESCRIPTION	LOCATION
2018	Mogara PV	Solar Energy	Northern Cape (SA)
2018	Gaetsewe PV	Solar Energy	Northern Cape (SA)
2017	Kalungwishi Hydroelectric (2) and power line	Hydroelectric	Zambia
2017	Mossel Bay UISP (Kwanoqaba)	Settlement	Western Cape (SA)
2017	Pavua Dam and HEP	Hydroelectric	Mozambique (SA)
2017	Penhill UISP Settlement (Cape Town)	Settlement	Western Cape (SA)
2016	Kokerboom WEF * 3	Wind Energy	Northern Cape (SA)
2016	Hotazel PV	Solar Energy	Northern Cape (SA)
2016	Eskom Sekgame Bulkop Power Line	Infrastructrue	Northern Cape (SA)
2016	Ngonye Hydroelectric	Hydroelectric	Zambia
2016	Levensdal Infill	Settlement	Western Cape (SA)
2016	Arandis CSP	Solar Energy	Namibia
2016	Bonnievale PV	Solar Energy	Western Cape (SA)
2015	Noblesfontein 2 & 3 WEF (Scoping)	Wind Energy	Eastern Cape (SA)
2015	Ephraim Sun SEF	Solar Energy	Nothern Cape (SA)
2015	Dyasonsklip and Sirius Grid TX	Solar Energy	Nothern Cape (SA)
2015	Dyasonsklip PV	Solar Energy	Nothern Cape (SA)
2015	Zeerust PV and transmission line	Solar Energy	North West (SA)

2015	Bloemsmond SEF	Solar Energy	Nothern Cape (SA)
2015	Juwi Copperton PV	Solar Energy	Nothern Cape (SA)
2015	Humansrus Capital 14 PV	Solar Energy	Nothern Cape (SA)
2015	Humansrus Capital 13 PV	Solar Energy	Nothern Cape (SA)
2015	Spitzkop East WEF (Scoping)	Solar Energy	Western Cape (SA)
2015	Lofdal Rare Earth Mine and Infrastructure	Mining	Namibia
2015	AEP Kathu PV	Solar Energy	Nothern Cape (SA)
2014	AEP Mogobe SEF	Solar Energy	Nothern Cape (SA)
2014	Bonnievale SEF	Solar Energy	Western Cape (SA)
2014	AEP Legoko SEF	Solar Energy	Northern Cape (SA)
2014	Postmasburg PV	Solar Energy	Northern Cape (SA)
2014	Joram Solar	Solar Energy	Northern Cape (SA)
2014	RERE PV Postmasberg	Solar Energy	Northern Cape (SA)
2014	RERE CPV Upington	Solar Energy	Northern Cape (SA)
2014	Rio Tinto RUL Desalinisation Plant	Industrial	Namibia
2014	NamPower PV * 3	Solar Energy	Namibia
2014	Pemba Oil and Gas Port Expansion	Industrial	Mozambique
2014	Brightsource CSP Upington	Solar Energy	Northern Cape (SA)
2014	Witsand WEF (Scoping)	Wind Energy	Western Cape (SA)
2014	Kangnas WEF	Wind Energy	Western Cape (SA)
2013	Cape Winelands DM Regional Landfill	Industrial	Western Cape (SA)
2013	Drennan PV Solar Park	Solar Energy	Eastern Cape (SA)
2013	Eastern Cape Mari-culture	Mari-culture	Eastern Cape (SA)
2013	Eskom Pantom Pass Substation	Substation /Tx lines	Western Cape (SA)
2013	Frankfort Paper Mill	Plant	Free State (SA)
2013	Gibson Bay Wind Farm Transmission lines	Tranmission lines	Eastern Cape (SA)
2013	Houhoek Eskom Substation	Substation /Tx lines	Western Cape (SA)
2013	Mulilo PV Solar Energy Sites (x4)	Solar Energy	Northern Cape (SA)
2013	Namies Wind Farm	Wind Energy	Northern Cape (SA)
2013	Rossing Z20 Pit and WRD	Mining	Namibia
2013	SAPPI Boiler Upgrade	Plant	Mpumalanga (SA)
2013	Tumela WRD	Mine	North West (SA)
2013	Weskusfleur Substation (Koeburg)	Substation /Tx lines	Western Cape (SA)
2013	Yzermyn coal mine	Mining	Mpumalanga (SA)
2012	Afrisam	Mining	Western Cape (SA)
2012	Bitterfontein	Solar Energy	Northern Cape (SA)
2012	Kangnas PV	Solar Energy	Northern Cape (SA)
2012	Kangnas Wind	Solar Energy	Northern Cape (SA)
2012	Kathu CSP Tower	Solar Energy	Northern Cape (SA)
2012	Kobong Hydro	Hydro & Powerline	Lesotho
2012	Letseng Diamond Mine Upgrade	Mining	Lesotho

2012	Lunsklip Windfarm	Wind Energy	Western Cape (SA)
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 (SA)
2012	Sasol Upington CSP Tower	Solar Power	Northern Cape (SA)
2011	Beaufort West PV Solar Power Station	Solar Energy	Western Cape (SA)
2011	Beaufort West Wind Farm	Wind Energy	Western Cape (SA)
2011	De Bakke Cell Phone Mast	Structure	Western Cape (SA)
2011	ERF 7288 PV	Solar Energy	Western Cape (SA)
2011	Gecko Industrial park	Industrial	Namibia
2011	Green View Estates	Residential	Western Cape (SA)
2011	Hoodia Solar	Solar Energy	Western Cape (SA)
2011	Kalahari Solar Power Project	Solar Energy	Northern Cape (SA)
2011	Khanyisa Power Station	Power Station	Western Cape (SA)
2011	Olvyn Kolk PV	Solar Energy	Northern Cape (SA)
2011	Otjikoto Gold Mine	Mining	Namibia
2011	PPC Rheebieck West Upgrade	Industrial	Western Cape (SA)
2011	George Southern Arterial	Road	Western Cape (SA)
2010	Bannerman Etango Uranium Mine	Mining	Namibia
2010	Bantamsklip Transmission	Transmission	Eastern Cape (SA)
2010	Beaufort West Urban Edge	Mapping	Western Cape (SA)
2010	Bon Accord Nickel Mine	Mining	Mapumalanga (SA)
2010	Etosha National Park Infrastructure	Housing	Namibia
2010	Herolds Bay N2 Development Baseline	Residential	Western Cape (SA)
2010	MET Housing Etosha	Residential	Namibia
2010	MET Housing Etosha Amended MCDM	Residential	Namibia
2010	MTN Lattice Hub Tower	Structure	Western Cape (SA)
2010	N2 Herolds Bay Residental	Residential	Western Cape (SA)
2010	Onifin(Pty) Ltd Hartenbos Quarry Extension	Mining	Western Cape (SA)
2010	Still Bay East	GIS Mapping	Western Cape (SA)
2010	Vale Moatize Coal Mine and Railway	Mining / Rail	Mozambique
2010	Vodacom Mast	Structure	Western Cape (SA)
2010	Wadrif Dam	Dam	Western Cape (SA)
2009	Asazani Zinyoka UISP Housing	Residential Infill	Western Cape (SA)
2009	Eden Telecommunication Tower	Structure	Western Cape (SA)
2009	George SDF Landscape Characterisation	GIS Mapping	Western Cape (SA)
2009	George SDF Visual Resource Management	GIS Mapping	Western Cape (SA)
2009	George Western Bypass	Road	Western Cape (SA)
2009	Knysna Affordable Housing Heidevallei	Residential Infill	Western Cape (SA)
2009	Knysna Affordable Housing Hornlee Project	Residential Infill	Western Cape (SA)
2009	Rossing Uranium Mine Phase 2	Mining	Namibia

2009	Sun Ray Wind Farm	Wind Energy	Western Cape (SA)
2008	Bantamsklip Transmission Lines Scoping	Transmission	Western Cape (SA)
2008	Erf 251 Damage Assessment	Residential	Western Cape (SA)
2008	Erongo Uranium Rush SEA	GIS Mapping	Namibia
2008	Evander South Gold Mine Preliminary VIA	Mining	Mpumalanga (SA)
2008	George SDF Open Spaces System	GIS Mapping	Western Cape (SA)
2008	Hartenbos River Park	Residential	Western Cape (SA)
2008	Kaaimans Project	Residential	Western Cape (SA)
2008	Lagoon Garden Estate	Residential	Western Cape (SA)
2008	Moquini Beach Hotel	Resort	Western Cape (SA)
2008	NamPower Coal fired Power Station	Power Station	Namibia
2008	Oasis Development	Residential	Western Cape (SA)
2008	RUL Sulpher Handling Facility Walvis Bay	Mining	Namibia
2008	Stonehouse Development	Residential	Western Cape (SA)
2008	Walvis Bay Power Station	Structure	Namibia
2007	Calitzdorp Retirement Village	Residential	Western Cape (SA)
2007	Calitzdorp Visualisation	Visualisation	Western Cape (SA)
2007	Camdeboo Estate	Residential	Western Cape (SA)
2007	Destiny Africa	Residential	Western Cape (SA)
2007	Droogfontein Farm 245	Residential	Western Cape (SA)
2007	Floating Liquified Natural Gas Facility	Structure tanker	Western Cape (SA)
2007	George SDF Municipality Densification	GIS Mapping	Western Cape (SA)
2007	Kloofsig Development	Residential	Western Cape (SA)
2007	OCGT Power Plant Extension	Structure Power Plant	Western Cape (SA)
2007	Oudtshoorn Municipality SDF	GIS Mapping	Western Cape (SA)
2007	Oudtshoorn Shopping Complex	Structure	Western Cape (SA)
2007	Pezula Infill (Noetzie)	Residential	Western Cape (SA)
2007	Pierpoint Nature Reserve	Residential	Western Cape (SA)
2007	Pinnacle Point Golf Estate	Golf/Residential	Western Cape (SA)
2007	Rheebok Development Erf 252 Apeal	Residential	Western Cape (SA)
2007	Rossing Uranium Mine Phase 1	Mining	Namibia
2007	Ryst Kuil/Riet Kuil Uranium Mine	Mining	Western Cape (SA)
2007	Sedgefield Water Works	Structure	Western Cape (SA)
2007	Sulpher Handling Station Walvis Bay Port	Industrial	Namibia
2007	Trekkopje Uranium Mine	Mining	Namibia
2007	Weldon Kaya	Residential	Western Cape (SA)
2006	Farm Dwarsweg 260	Residential	Western Cape (SA)
2006	Fynboskruin Extention	Residential	Western Cape (SA)
2006	Hanglip Golf and Residential Estate	Residential	Western Cape (SA)
2006	Hansmoeskraal	Slopes Analysis	Western Cape (SA)
2006	Hartenbos Landgoed Phase 2	Residential	Western Cape (SA)

2006	Hersham Security Village	Residential	Western Cape (SA)
2006	Ladywood Farm 437	Residential	Western Cape (SA)
2006	Le Grand Golf and Residential Estate	Residential	Western Cape (SA)
2006	Paradise Coast	Residential	Western Cape (SA)
2006	Paradyskloof Residential Estate	Residential	Western Cape (SA)
2006	Riverhill Residential Estate	Residential	Western Cape (SA)
2006	Wolwe Eiland Access Route	Road	Western Cape (SA)
2005	Harmony Gold Mine	Mining	Mpumalanga (SA)
2005	Knysna River Reserve	Residential	Western Cape (SA)
2005	Lagoon Bay Lifestyle Estate	Residential	Western Cape (SA)
2005	Outeniquabosch Safari Park	Residential	Western Cape (SA)
2005	Proposed Hotel Farm Gansevallei	Resort	Western Cape (SA)
2005	Uitzicht Development	Residential	Western Cape (SA)
2005	West Dunes	Residential	Western Cape (SA)
2005	Wilderness Erf 2278	Residential	Western Cape (SA)
2005	Wolwe Eiland Eco & Nature Estate	Residential	Western Cape (SA)
2005	Zebra Clay Mine	Mining	Western Cape (SA)
2004	Gansevallei Hotel	Residential	Western Cape (SA)
2004	Lakes Eco and Golf Estate	Residential	Western Cape (SA)
2004	Trekkopje Desalination Plant	Structure Plant	Namibia (SA)
1995	Greater Durban Informal Housing Analysis	Photogrametry	KwaZulu-Natal (SA)

9 ANNEXURE 2: VRM CHECK SHEETS

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 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.

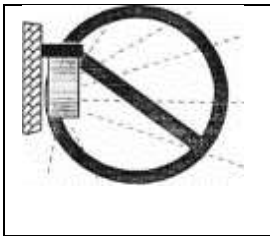
Light Trespass Poor outdoor lighting shines onto neighbours’ properties and into bedroom windows, reducing privacy, hindering sleep, and giving the area an unattractive, trashy look.

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.

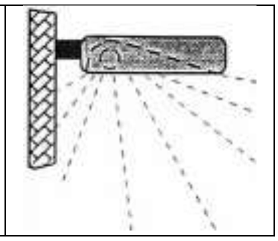
Good and Bad Light Fixtures

Typical “Wall Pack”



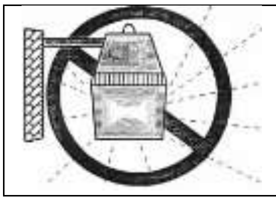
BAD
Waste light goes up and sideways

Typical “Shoe Box” (forward throw)



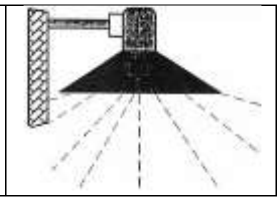
GOOD
Directs all light down

Typical “Yard Light”



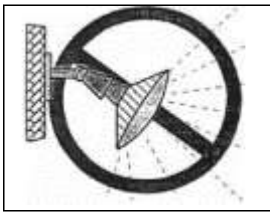
BAD
Waste light goes up and sideways

Opaque Reflector (lamp inside)



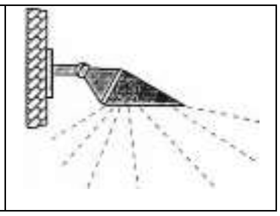
GOOD
Directs all light down

Area Flood Light



BAD
Waste light goes up and sideways

Area Flood Light with Hood



GOOD
Directs all light down

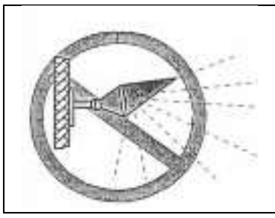
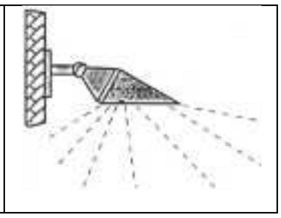
How do I switch to good lighting?
Provide only enough light for the task at hand; don’t over-light, and don’t spill light off your property. Specifying enough light for a job is sometimes hard to do on paper. Remember that a full Moon can make an area quite bright. Some lighting systems illuminate areas 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.

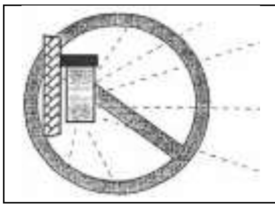
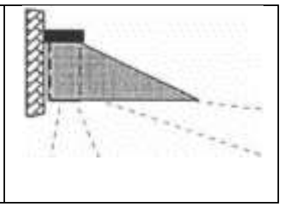
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may 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.

What You Can Do To Modify Existing Fixtures

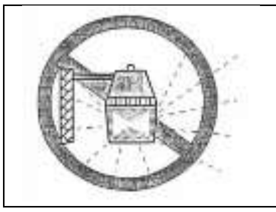
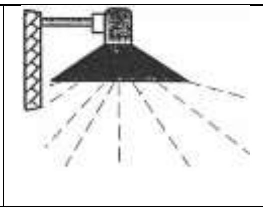
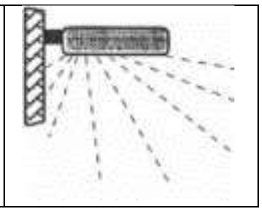
Change this . . .	to this (aim downward)
	

Floodlight:

Change this . . .	to this (aim downward)
	

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!

Wall Pack

Change this . . .	to this	or this
		
Yard Light	Opaque Reflecter	Show Box

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