ANNEXURE C8
SPECIALIST ASSESSMENTS

- Visual Impact Assessment

FINAL VISUAL IMPACT ASSESSMENT

PROPOSED PHOTOVOLTAIC SOLAR ENERGY PLANTS (PV 2 – PV 11) ON FARM HOEKPLAAS, NEAR COPPERTON, NORTHERN CAPE

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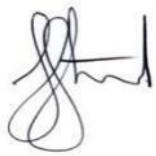

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LIST OF ACRONYMS

APHP	Association of Professional Heritage Practitioners
BLM	Bureau of Land Management (United States)
BPEO	Best Practicable Environmental Option
CALP	Collaborative for Advanced Landscape Planning
CSP	Concentrated Solar Power
CPV	Concentrated Photovoltaic
DEA	Department of Environmental Affairs
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
IEMA	Institute of Environmental Management and Assessment (United Kingdom)
IEMP	Integrated Environmental Management Plan
KOP	Key Observation Point
LRC	Lighting Research Centre
MAMSL	Metres above mean sea level
NELPAG	New England Light Pollution Advisory Group
PSDF	Provincial Spatial Development Framework
PV	Photovoltaic
ROD	Record of Decision

SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Plan
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management
ZVI	Zone of Visual Influence

GLOSSARY

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

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

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

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

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

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

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

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

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

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

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

1 EXECUTIVE SUMMARY

VRM Africa was appointed by Aurecon South Africa Pty (Ltd) to undertake a Visual Impact Assessment (VIA) for Mulilo Renewable Energy (Pty) Ltd (Mulilo). The proposed photovoltaic (PV) solar energy plants are located on a farm, near Copperton in the Northern Cape. The proposed projects would take place on the farm Hoekplaas (Remainder of Farm No. 146) *(See Figure 1).* The site lies approximately 7.8 km to the south of Copperton and borders on the Kronos substation.

The scope of the VIA covers the entire affected project area. This includes an inspection of the full site extent and a brief assessment, including the following:

- Quantifying and assessing the existing scenic resources / visual characteristics on, and around, the proposed site.
- Evaluating and classifying the landscape in terms of sensitivity to a changing land use.
- Reviewing the legal framework that may have implications for visual scenic resources.

The Northern Cape regions' most predominant features are the open plains of the Karoo scrub and the Nama Karoo. The existing landscape character has been shaped historically by the uniform nature of the flat Nama Karoo plains which are strongly associated with South African cultural heritage. Cultural modifications are typically Karoo farming and are limited to the occasional farmstead, which adds to the sense of open space. Receptor sensitivity to these landscapes would be moderate as the wide open plains add value to the vista and are a core element in the area's sense of place. The landscape has agricultural and cultural value. However, the site does not have a specific sense of place. There are no existing landscape modifications and this adds value due to the open vista and remote scenic quality.

A site landscape character assessment was undertaken from four locations to assess the scenic quality, receptor sensitivity to landscape change and receptor distance to the proposed landscape modifications. It was found that the topography is made up of flat plains with a few ridges sporadically seen within the landscape. The flat uniformity of the local landscape results in a view that merges with surrounding flat open areas. This is a completely uncluttered landscape. The landscape is of such a scale that the site barely forms a visual focus, even absorbing the clutter of the now-closed Copperton Mine and existing Copperton settlement. The overall visual impression of the locality is one of an open, flat, rural, landscape with some signs of industry, offering long expansive views *(Hansen. 2012).*

A viewshed analysis generated for the proposed PV Plants and substations would be *moderate* due to its prominence within the flat landscape and low-lying scrub nature of the existing vegetation. The viewshed generated for the transmission lines, using an offset height of approximately 15 – 20m, would be *moderate* due to the slightly undulating Karoo landscape and the diffuse nature of the pylon structures, which limited the zone of visual influence.Making use of the viewshed, two Key Observation Points (KOPs) were identified:

- R357 regional road
- Copperton Road

Receptors in the area are agricultural but, as the area is very remote, the amount of use would be very low. The adjacent landusers are also agricultural in nature, with no special areas identified, and public interest is *low* as there is an existing context of transmission lines and a substation.

Based on the VRM Matrix, Visual Management Classes were defined for each of the sites. The sites would fall into a Class IV. However, as they are agricultural, this would change to a 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.

Using the Aurecon impact criteria, a significance rating was undertaken for the following visual aspects:

- PV Plants (including all alternatives)

- Transmission Lines and Substations
- Cumulative Impacts

The proposed landscape modification is large and will generate strong levels of visual contrast. The Class III visual objectives, to retain the existing rural landscape character, will not be met and a change in the landscape character will take place to the site and the immediate surrounds. It must be noted that there are other energy-related projects proposed for the immediate surrounds which would significantly alter the surrounding landscape character. Should the project be undertaken in isolation from other PV projects, it is recommended that PV 6 and the eastern-facing sections of PV 8 and PV 11 are excluded, as they would wrap over the hill and extend the viewshed of the proposed landscape modification to the east.

Currently, Mulilo has four approved solar energy facilities in the area and there is another PV facility situated closer to Copperton, at Struisbult (Portion 1 of Farm 104), which is located within the same vicinity. Should these projects be constructed, the visual intrusion brought about by the change in landscape caused by the proposed project, would significantly be reduced. Due to the location of the site, and to the small number of potential receptors, it is recommended that, from a visual perspective, the preferred layout proceed. An Environmental Management Plan (EMP) should be implemented, and mitigation measures must be effectively undertaken relating to:

Construction Phase

- Keeping contract period to the minimum;
- Traffic control measures;
- Disposal of surplus materials;
- Location of lay-down areas; and
- Creating a 100m buffer on the R357.

Operational Phase

- Height, location, finishes of building(s);
- Use of non-reflective materials and receding colours; and
- Discussions with local people.

Closure Phase

- Removal of all PV structures, associated structures and infrastructure; and
- Rehabilitation and restoration.

2 INTRODUCTION

VRM Africa was appointed by Aurecon South Africa Pty (Ltd) to undertake a Visual Impact Assessment (VIA) for Mulilo Renewable Energy (Pty) Ltd (Mulilo). The proposed project would take place on the farm Hoekplaas (Remainder of Farm No. 146), near Copperton in the Northern Cape.

The proposed site area lies approximately 7.8 km to the south of Copperton and borders on the Kronos substation. As can be seen in the regional map below, the town of Prieska lies within the SiyaThemba Local Municipality, which is situated within the broader Pixley ka Seme District Municipality.

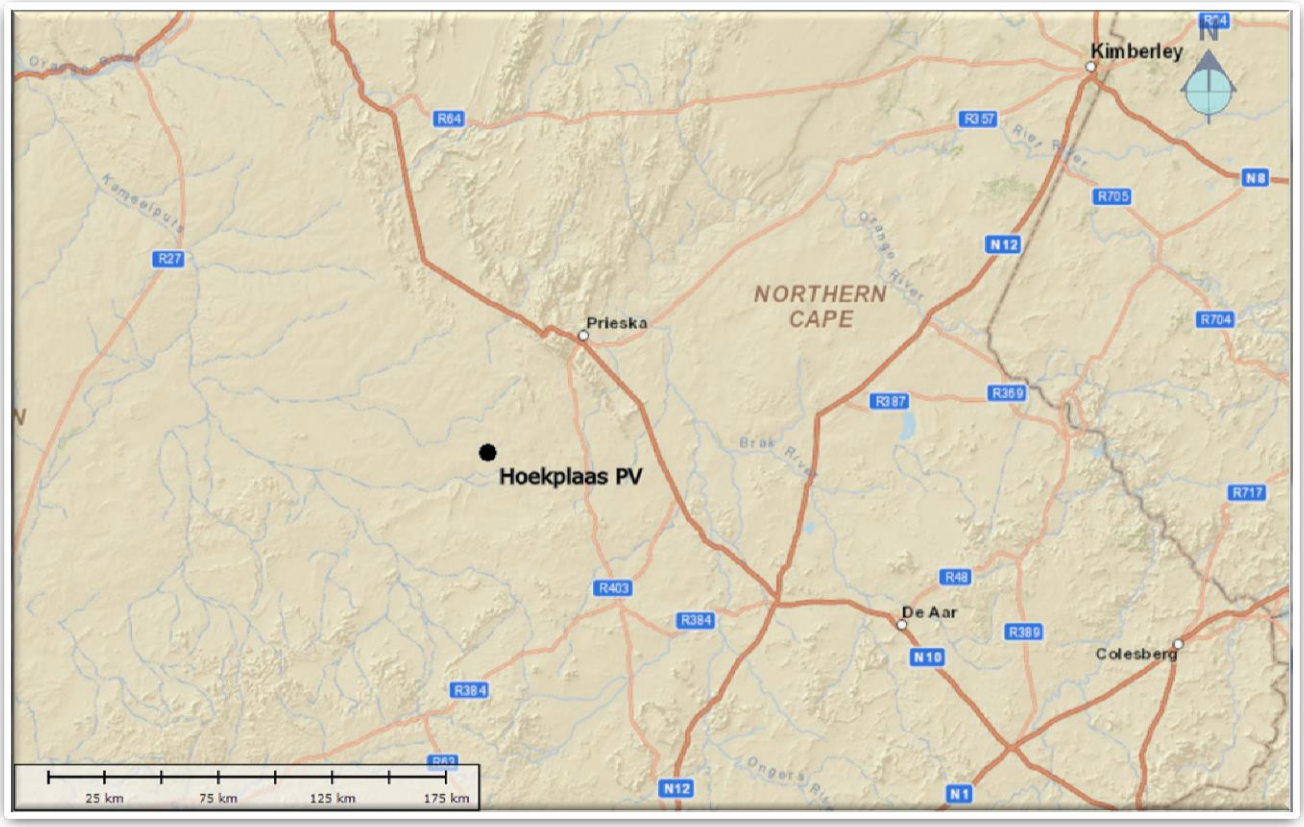


Figure 1: Regional location map

3 APPROACH TO STUDY

3.1 Terms of Reference

The scope of the study was to cover the entire affected project area. This included a site visit of the full site extent, as well as where potential impacts may occur beyond the site boundaries such as cumulative impacts.

- All available secondary data relevant to the affected project area was collated and analysed.
- Information was sourced from the following previous studies of the area:
  - Aurecon. 2013. Proposed Photovoltaic Energy Plant on Farm Hoekplaas near Copperton, Northern Cape. Draft Scoping Report. Report No. 7579/109378.
  - Karen Hansen Landscape Architect for Aurecon Environmental Services. Jan 2012. Proposed Photo-Voltaic Facilities near Copperton, Northern Cape: Hoekplaas Farm. Level 3 Visual Impact Assessment. DEA REF NR: 12/12/20/2503.
- Cumulative effects were to be considered in all impact reports.
- Specific attention was given to the following:
  - Quantify and assess existing scenic resources/visual characteristics on, and around, the proposed site.
  - Evaluate and classify the landscape in terms of sensitivity to a changing land use.
  - Determine viewsheds, view corridors and important viewpoints in order to assess the visual impacts of the proposed project.
  - Determine visual issues, including those identified in the public participation process.
  - Review the legal framework that may have implications for visual/scenic resources.
  - Assess the significance of potential visual impacts resulting from the proposed project for the construction, operational and decommissioning phases of the project.
  - Identify possible mitigation measures to reduce negative visual impacts for inclusion into the project design, including input into the Environmental Management Plan (EMP).

3.2 Summary of Visual Impact Assessment Methodology

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

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

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

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

Landscapes are sub-divided into three distance zones based on relative visibility from travel routes or observation points. Proximity to surrounding receptors is evaluated in terms of these distance buffers: foreground zone is less than 7 km, background zone is from 7 to 24 km and "seldom seen" has no receptors. Viewshed maps are generated that indicate the overall area where the project activities would be visible, and in which distance buffer zone the receptors fall *(Assessment undertaken up to this point falls within the ambit of the Baseline Study. What follows after this point comprises the Impact Assessment Study).*

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

Using the impact assessment method provided by the environmental consultant, each project activity is then assessed for its visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors to determine whether the proposed activities meet the recommended visual objectives defined, in order to protect the landscape character of the area. Recommendations are made and mitigations are provided.

Refer to Annexure 3 for a detailed description of the applied Visual Impact Assessment and Aurecon South Africa's Impact Assessment methodology.

In terms of Visual Impact Assessment best practice, the following guidelines were referred to:

- Internationally, the U.K. Institute of Environmental Management and Assessment's (IEMA) 'Guidelines for Landscape and Visual Impact Assessment'; (U.K Institute of Environmental Management and Assessment *(IEMA. 2002);*
- International Finance Corporation's (IFC) performance standards (PS) on environmental and social sustainability *(IFC. 2012);* and
- 'Guideline for Involving Visual and Aesthetic Specialists in EIA Processes' generated by South Africa's Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning *(Oberholzer, B. 2005);* 'Principles that influences (development) within a receiving environment include the following: The need to maintain the overall integrity (or intactness) of the particular landscape or townscape; the need to preserve the special character or 'sense of place' of a particular area; the need to minimize visual intrusion or obstruction of views within a particular area.' (Oberholzer.2005).

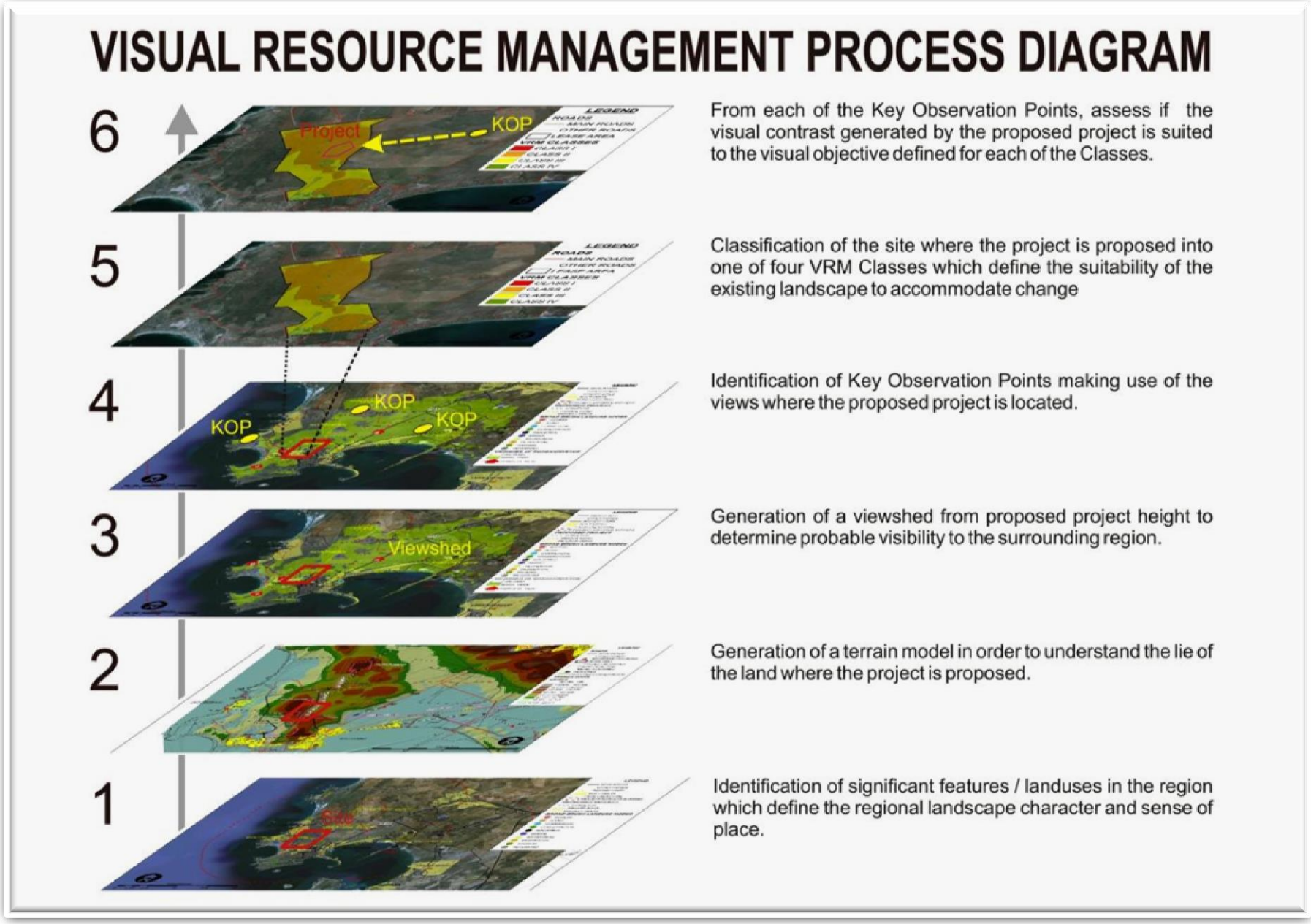


Figure 2: VRM Process Diagram

4 LIMITATIONS AND ASSUMPTIONS

- Although every effort to maintain accuracy was undertaken, as a result of the Digital Elevation Model (DEM) being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence.
- The mapping in this document was created using Bing Maps (previously *Live Search Maps*, *Windows Live Maps*, *Windows Live Local*, and *MSN Virtual Earth*) and powered by the Bing Maps for Enterprise framework.
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
    - ASTGTM_S2 3E014 and ASTGTM_S24E014 data set (ASTER GDEM is a product of METI and NASA (ASTER, Source: https://lpdaac.usgs.gov).
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure *(Lange 1994)*. The project deliverables, including electronic copies of reports, maps, data, shape files and photographs, are based on the author's professional knowledge, as well as available information. The 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.

5 LEGISLATIVE CONTEXT

5.1 Applicable Laws and policies

In order to comply with the Visual Resource Management requirements, it is necessary to clarify which planning policies govern the 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 assessed, taking the following planning policies into consideration:

- Northern Cape Provincial Spatial Development Framework (SDF) (2012)
- SiyaThemba Local Municipality Infrastructure Development Plan (IDP) (2012/13)

Northern Cape Provincial SDF

- Aesthetically prominent natural features or areas should be declared Protected Natural Environments if such declaration would promote natural scenic beauty or biodiversity. No development must be allowed in proclaimed Protected Natural Environments.
- Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts.
- The construction of energy infrastructure must be strictly regulated in terms of the spatial plans and guidelines put forward in the Provincial SDF (PSDF). They must be carefully placed to avoid visual impacts on landscapes of significant symbolic, aesthetic, cultural or historic value and should blend in with the surrounding environment to the extent possible *(C8.3.3 Energy Policy, Pg 141).*

SiyaThemba Local Municipality (LM) IDP

- The SiyaThemba LM has also identified the possible economic spin-offs from being strategically positioned just outside the demarcated area of the SKA Area. Prieska will therefore be in a position to benefit from major industrial and low activity which will not be allowed or possible within the SKA demarcated area for no or low industrial activity and communication.
- The SiyaThemba LM has identified solar energy projects as one of their major economic activities.
- The area should develop a unique tourism brand of its own and be marketed on various platforms.

5.2 Relevant standards to comply with

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

The above includes the following, amongst others:

- Inspiration: Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture, and advertising;
- Aesthetic values: Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, scenic drives, and the selection of housing locations;

- Sense of place: Many people value the "sense of place" that is associated with recognised features of their environment, including aspects of the ecosystem;
- Cultural heritage values: Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species; and
- Recreation and ecotourism: People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

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

Other Proposed and Approved Projects

According Renewables Map generated by the Department of Environmental Affairs, there are existing proposed renewable energy projects in the surrounding area. This map cannot be displayed in the document due to defined restriction. The map can be viewed or download via the following link:

http://www.csir.co.za/nationalwindsolarsea/contact_reg.php

The 10 MW PV has been approved and is to be located 4 km to the north, and close to the closed mine. There are two additional proposed 100 MW PV facility sites currently being assessed; one to the east of this site, at Hoekplaas Dam Farm, and one closer to Copperton at Struisbult (Portion 1 of Farm 104). There is an approved 190 turbine development which will occupy two sites between the R357 and the R386 to Carnarvon. A proposed 56 turbine wind energy farm is being considered on a site to the north of the Struisbult PV facility site and it would be located about 9 km to the north. There would be new transmission lines, substations and new access roads associated with all the new developments.

6 PROJECT DESCRIPTION

The objective of this section is to describe the character of the project activities and define the extent to which it will be visible to the surrounding areas.

The need and desirability of the proposed activity is based on the well-documented reasons for the desirability of renewable energy such as solar energy, which include:

- Utilising resources available to South Africa;
- Meeting nationally appropriate emission targets in line with global climate change commitments;
- Enhancing energy security by diversifying generation; and
- Creating a more sustainable economy *(Aurecon. 2013).*

Aurecon undertook an Environmental Impact Assessment (EIA) process during 2012 on behalf of Mulilo for the authorisation of a 100MW PV plant on farm Hoekplaas (Remainder of Farm No. 146) near Copperton. An Environmental Authorisation was issued by the Department of Environmental Affairs (DEA) on 21 January 2013 (this approved PV facility will hereafter be referred to as Hoekplaas PV 1). Mulilo is now investigating an additional 10 PV plants of 75 MW AC (alternating current) each on farm Hoekplaas. Alternatively, three PV plants of 225 MW AC, 290 MW AC and 500 MW AC, respectively, are proposed on the same farm *(Aurecon. 2013). See Figure 3: Proposed Alternative 1 Layout Map and Figure 4: Proposed Alternative 2 Layout Map.*

6.1 Proposed Layout Alternatives

Mulilo proposes to develop one of the following photovoltaic solar facility alternatives on this site:

- Alternative 1: 10 PV plants of 75 MW on Hoekplaas Farm (RE/146) with footprint of 2 497 Ha.
- Alternative 2: 3 PV plants of 225 MW on same farm with footprint of 2 270 Ha.

Previous EIAs have been conducted on this farm, which highlighted sensitive areas. The proposed sites are well studied, they are suitable for the proposed development, located close to existing and proposed Eskom infrastructure, and no fatal flaws have been identified. Mulilo are proposing to group similar developments together so that there is a sharing of infrastructure and a minimising of potential impacts on the environment due to the combination of infrastructure and footprints.

<u>Layout Alternative 1 (preferred)</u>
This alternative consists of the 10 proposed 75 MW AC PV plants and associated infrastructure. These layouts take cognisance of the 75 MW AC cap determined by the Department of Energy and the environmentally sensitive areas that were identified in the 2012 EIA process for Farm Hoekplaas *(Aurecon. 2013).*

Plant	Footprint	**Plant**	Footprint
PV 2	230	**PV 7**	223
PV 3	322	**PV 8**	205
PV 4	222	**PV 9**	263
PV 5	350	**PV 10**	249
PV 6	203	**PV 11**	230

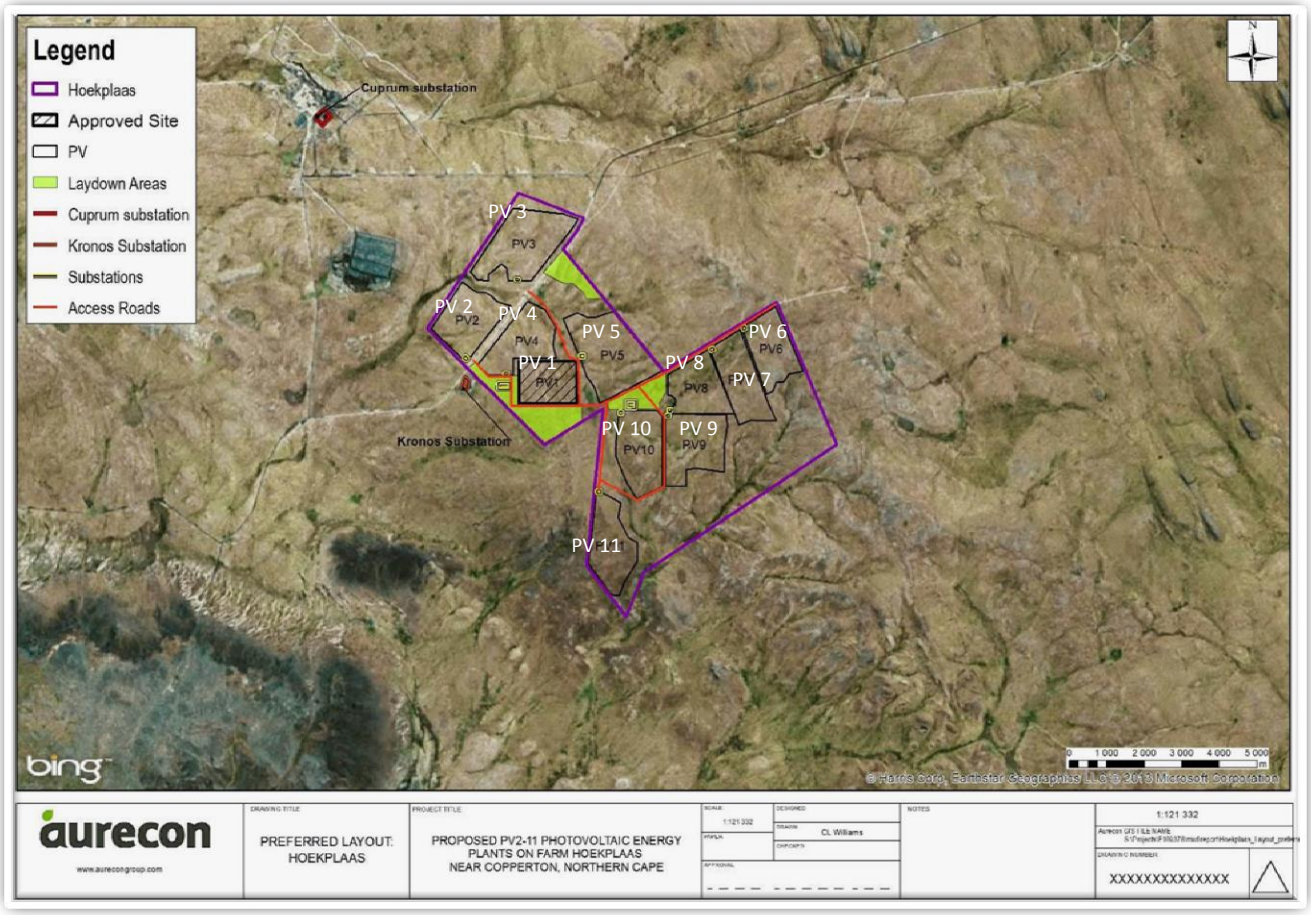


Figure 3: Proposed Alternative 1 Layout Map

Layout Alternative 2

This alternative consists of three PV plants of 225 MW AC (Alternative PV 2), 290 MW AC (Alternative PV3) and 500 MW AC (Alternative PV 4) each. The site layouts were developed by extending and combining some of the proposed 75 MW AC facilities. This alternative is thus not limited to the Department of Energy's 75 MW AC cap per project. The benefit of developing larger plants relates to the reduction of associated development and construction costs which, in turn, reduces lending rates and essentially lowers the tariff of electricity sold *(Aurecon. 2013).*

Plant	Footprint (Ha)	Capacity (MW)
PV 2	670	225
PV 3	800	290
PV 4	800	500

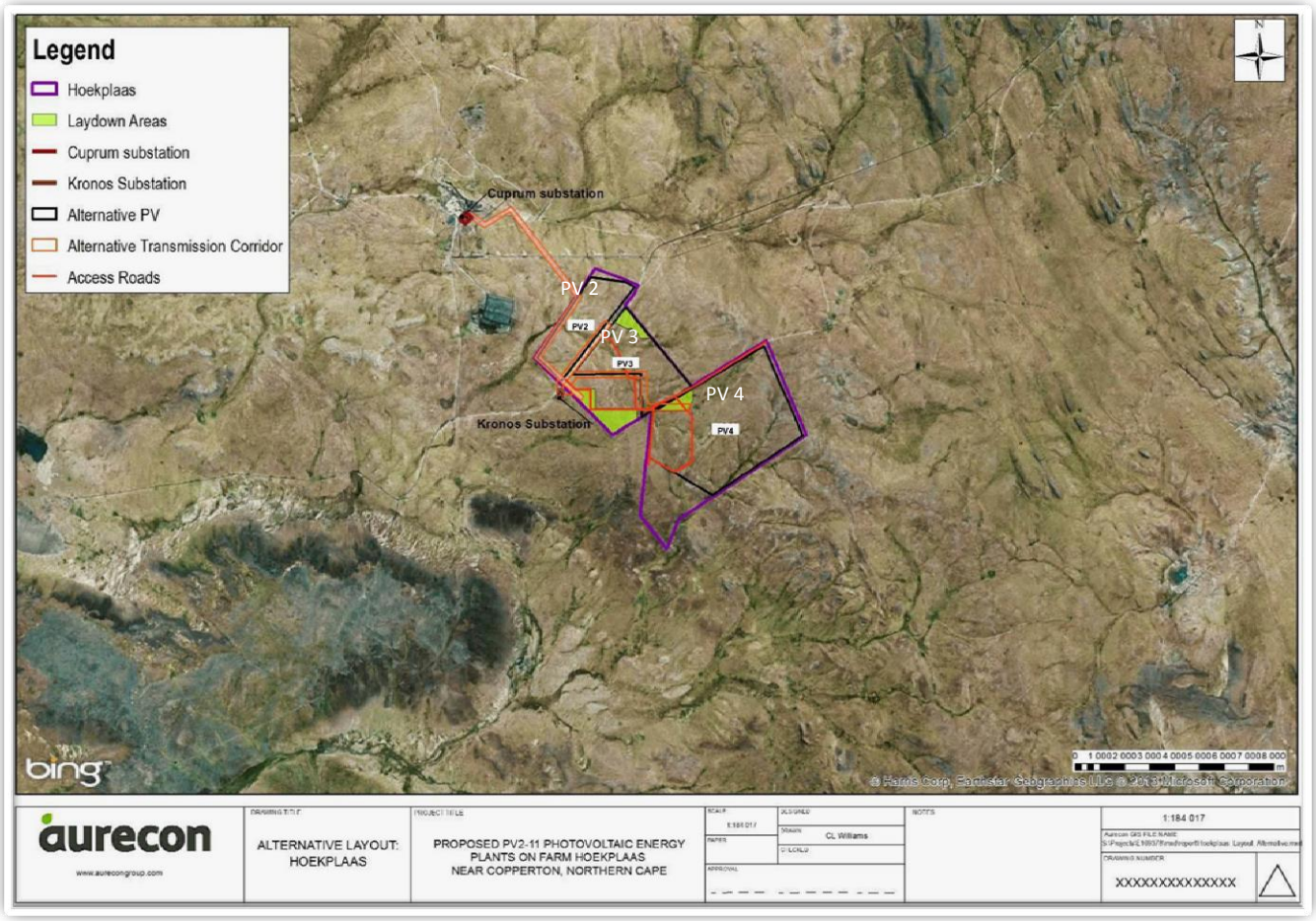


Figure 4: Proposed Alternative 2 Layout Map

No-Go Alternative

- The No-Go Alternative will be assessed as a baseline option. This alternative would include the existing rights on the property, including the approved PV facility (PV 1).

6.2 Proposed Activities

Each of the proposed PV plants would consist of the following:

- **Solar energy plant:** A photovoltaic component comprising of numerous arrays of PV panels and associated PV module mountings to generate up to 75 MW AC per plant, through the photovoltaic effect.
- **Transmission lines:** 132 kV overhead transmission lines to connect each facility to the central onsite substation or an existing Eskom substation (i.e. Kronos or Cuprum).
- **Substations:** An onsite 132 kV, three bay substation per project and two central multibay 132 kV substations with a maximum of six incoming bays and two outgoing *(8.08m x 3.05m x 2.79m high).*
- **Boundary fence:** Each 75MW AC facility will have an electric fence for safety and security reasons.

The project comprises the following additional infrastructure:

- On-site buildings *(including a Connection Centre of 5.44 m x 2.5 m x 2.55 m high);*
- Guard house and Control house *(6m x 10m x 2.55m high);*
- Access road from the R357 and internal road network linking all plants; and
- Water supply and storm water infrastructure.

6.2.1 *Proposed Solar Panel Alternatives*

Three solar panel types were highlighted for the proposed plant:

- Concentrated photovoltaic (CPV) using lenses or curved mirrors to concentrate sunlight onto a small area of solar PV cells to generate electricity. This is considered to be more cost effective than conventional PV solar cells although, to be most effective, it requires solar tracking. Conventional PV solar cells do not use mirrors or lenses and generate electricity by converting solar radiation energy into a DC current (direct current) which then needs to be converted to an AC current to connect to the grid.
- Concentrated solar power (CSP) using mirror or lenses to concentrate thermal energy on a small surface area using a heat engine. Due to the large volume of water required this alternative will not be studied further.

Photograph of example of solar plant *(Source: www.hawaiirenewableenergy.org/Villamesias2)*

Example of conventional large scale type solar panels *(Source: www globalnvcorp com)*

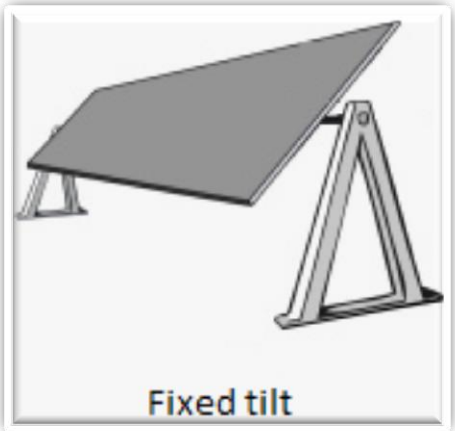
Example of CPV type solar panels *(Source: www ecofriend com)*

Figure 5: Photographs of examples of similar solar panel alternatives

There are two mounting alternatives:

- A fixed axis tracking system - the PV panels are installed at a set tilt and cannot move.
- A single axis tracking system - the panels follow the sun to ensure maximum exposure to sunlight. These have the highest efficiency level, the smallest footprint and lower development costs.

Panels would be approximately 2 m wide and 1 m long and would be arranged into modules.



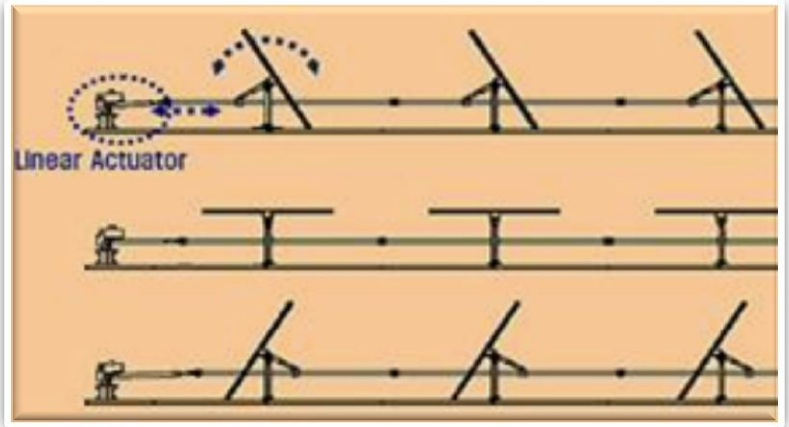


Figure 6: Examples of two mounting alternatives
(Source: Provided by Aurecon)

6.2.2 *Transmission Lines and Substation*

Each PV facility would require a substation on each site. This would then be linked via 132 kV transmission lines to:

- Routing Alternative 1 (preferred): Onsite substations would feed into one of two central onsite multibay substations before connecting to the Kronos Substation *(Aurecon. 2013).*
- Routing Alternative 2: Connect to Cuprum Substation if Kronos substation does not have sufficient capacity. A corridor of approximately 6.3 km in length (measured from farm boundary) and 180 m wide has therefore been identified for the transmission lines *(Aurecon. 2013).*

Photograph of example of mounting
(Source: Provided by Aurecon)

Example of an existing 132 kV transmission line *(Source: Aurecon. 2013)*

Substation with transformers at Sugarloaf Hill *(Source: www.grocotts.co.za)*

Figure 7: Examples of photographs of additional infrastructure

7 NATURE OF THE RECEIVING ENVIRONMENT

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

Within the national context, the property is located in the Northern Cape within the SiyaThemba Local Municipality and the Pixley ka Seme District Municipality. This is a rural area and, as such, the population density is very low. The existing landscape character has been shaped historically by the uniform nature of the Nama Karoo plains with typical semi-desert and desert climatic conditions, which adds to the sense of open space. The Nama Karoo landscape is fairly iconic and is strongly associated with South African cultural heritage. Surrounding land use is agricultural, predominantly sheep farming.

Figure 8: View of nearest town, Prieska
Seen from N10 National Road, located 63km to the north-east of the proposed site.
(Source: NJR ZA. http://commons.wikimedia.org)

Location and Routes
The R357 is a tarred road, in good condition, which connects Prieska and Van Wyksdorp. Prieska is located 63.4 km to the north-east and is situated along the N10. There is no longer a railway line servicing this area but the local airfield is situated approximately 2.5 km to the north of Copperton *(Hansen 2012).* There is also a small civilian airport at Prieska.

Figure 9: View from R357 of local sense of place

Topography
The topography is made up of flat plains, with a few ridges sporadically seen within the landscape. These ridges are therefore extremely visually prominent. The Pixley ka Seme IEMP (2007), notes that ridges and koppies should be conserved and should not be transformed or developed in any way. The

area surrounding the site is located at some 1 100 – 1 200 m above mean sea level. The area is gently undulating to flat, with a very gradual slope east to west *(Aurecon. 2013).*

Figure 10: View from R357 showing topography and Nama Karoo vegetation

Vegetation

The site falls within the Nama Karoo Biome which covers a large part of the Northern Cape Province. According to the national classification of the vegetation of South *Africa (Mucina et al. 2006 in Mucina and Rutherford, 2006)*, the vegetation found at the study site is mainly Bushmanland Basin. The 2012 specialist botanical assessment *(McDonald, 2012)* noted a well-defined and extensive seasonal drainage area or watercourse located on the adjacent farm (Klipgats Pan, Portion 4 of Farm 117), which crosses the northern section of Farm Hoekplaas *(Aurecon. 2013).*

Bushmanland Basin vegetation occurs on slightly irregular plains with dwarf shrubland, dominated by a mixture of low, sturdy and spiny shrubs and grasses. The bushes and scrub are low in height with few trees, except for those in the settlement of Copperton and some at sporadic farmhouses. Grasses occur along the roads. The grass is dry in winter and turns a yellow-brown hue with grey colours being added by the shrubs *(Hansen. 2012).*

Agriculture

The dominant surrounding landuse is agricultural, mostly with the purpose of grazing. The surrounding farms are widely dispersed and sparsely inhabited and there are no farmsteads found within 5km of the site. In the surrounding area there are pastures, mainly for sheep, goats and cattle.

Mining and Alkantpan

The nearest settlement to the site is Copperton, at a distance of 13.4 km, which was originally established for the workers of Copperton Mine, which commenced in 1972 and closed in 1991 when the majority of the houses were demolished. Copperton was sold to a private owner after the closing of the mine. The town is currently on a long-term lease by the Request Trust *(SiyaThemba Municipality IDP).* Although there are some trees and shrubs present, the sense of place is one of a derelict, small settlement. The resident population is in the order of 70 people. The remaining built structures include the mineshaft, an adjacent concrete shed and large concrete storage tanks, as well as unused lighting pylons.

At Alkantpan, 5 or 6km to the west of Copperton, there is a government owned ammunition test ground facility which is long established. It is used nationally and internationally and is likely to continue for the foreseeable future. It does not have a residential component *(Hansen. 2012).*

Figure 11: View of existing mining infrastructure of Copperton Mine

Transmission Lines and Substation

The Cuprum Substation was built to serve Copperton Mine and still operates together with Kronos substation, which lies several kilometres to the south. There are existing powerlines that run through the area.

Figure 12: View of existing Cuprum substation

Other Land Uses

A large number of wind and solar energy facilities are being proposed for the Copperton area, all in various stages of applying for environmental authorisation. Currently, Mulilo has four approved solar energy facilities in the area, of which one includes the 100 MW PV 1 plant on Farm Hoekplaas. The proposed site falls within the general astronomy advantage area and is located approximately 12 km north of the nearest SKA station *(Aurecon. 2013).* However, this falls outside of the zone of visual influence for visual impact and will not be assessed.

Landscape Value

The existing landscape character has been shaped historically by the uniform nature of the flat Nama Karoo plains, which is strongly associated with South African cultural heritage. Cultural modifications are typically Karoo farming and are limited to the occasional farmstead, which adds to the sense of open space. Receptor sensitivity to these landscapes would be moderate, as the wide open plains add value to the vista and are a core element in the area's sense of place.The landscape has agricultural and cultural value. However, the site does not have a specific sense of place. There are no landscape modifications and this adds value due to the open vista and remote scenic quality.

The flat uniformity of the local landscape results in a merging view with surrounding flat open areas. This is a completely uncluttered landscape. The landscape is of such a scale that the site barely forms a visual focus, even absorbing the clutter of the mine and of the Copperton settlement. The overall visual impression of the locality is one of an open, flat, rural, landscape with some industry, offering long expansive views *(Hansen. 2012).*

8 PROJECT VISIBILITY

8.1 Project Visibility and Exposure

Making use of the ASTGTM survey data, a terrain model was generated for the area around the proposed project. A viewshed was generated from each of the project sites, making use of the height values as metres above point ground level as indicated in the table below:

Photovoltaic panels and mountings	± 4.5 m
Transmission lines	± 15 – 20 m
Substations	± 15 – 20 m
Boundary fence	± 2 m

Due to the nature of the flat, horizontal landscape, any tall structures, such as existing powerlines, are visible for many kilometres. The potential therefore exists that the proposed PV plants and associated infrastructure could be visible from many kilometres away. The viewshed is assessed using an offset height of approximately 4.5 m for all the sites, and an offset height of 15 m for the transmission lines.

8.1.1 *Viewshed: All sites*

As indicated in Figures 20 - 22, the viewshed generated by a landscape modification on each of the sites would be *moderate to high* due to the predominantly flat landscape and the low height of the existing vegetation.

8.1.2 *Viewshed: Site PV transmission lines*

As indicated in Figure 22, the viewshed generated from a landscape modification with an offset height of approximately 15 – 20 m would be *high* due to the flat Karoo landscape and low height of the vegetation.

9 SITE LANDSCAPE CHARACTER

The proposed projects would take place on the farm Hoekplaas (Remainder of Farm No. 146), near Copperton in the Northern Cape *(see Figure 15 in the Annexure 1: Colour Plates).* The site lies approximately 7.8 km to the south of Copperton and borders on the Kronos substation. The farm is approximately 5014ha in size and is split into two portions by the R357.

The proposed site was selected based on the following criteria:

- Solar radiation based on historic satellite data;
- Grid connectivity and close proximity to strong grid access points;
- Availability of flat, level and open land;
- Land use in terms of population numbers and non-arable/ low potential agricultural land; and
- Potential sensitive receptors and features, such as fauna, flora, heritage, visual and other technical aspects such as the SKA *(Aurecon. 2013).*

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

The scenic quality is determined using seven key factors:

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

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

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

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

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

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

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

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

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

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)
* If adjacent areas are **Class III** or lower, assign **Class III**.
If higher, assign **Class IV.**

The landscape character of the sites were assessed from photographs taken from 6 survey points as can be seen in the Site Map in Figure 15. The photographs can be seen in Figures 16 - 19 in Annexure 1: Colour Plates. The following locations, which are associated with the various proposed project activities, were surveyed during the field study to determine scenic quality, receptor sensitivity to landscape change and distance from nearest receptors:

- Photo site 1: West of PV 1;
- Photo site 3: PV 7 survey track;
- Photo site 4: South of PV 11; and
- Photo site 5: North-west of Copperton.

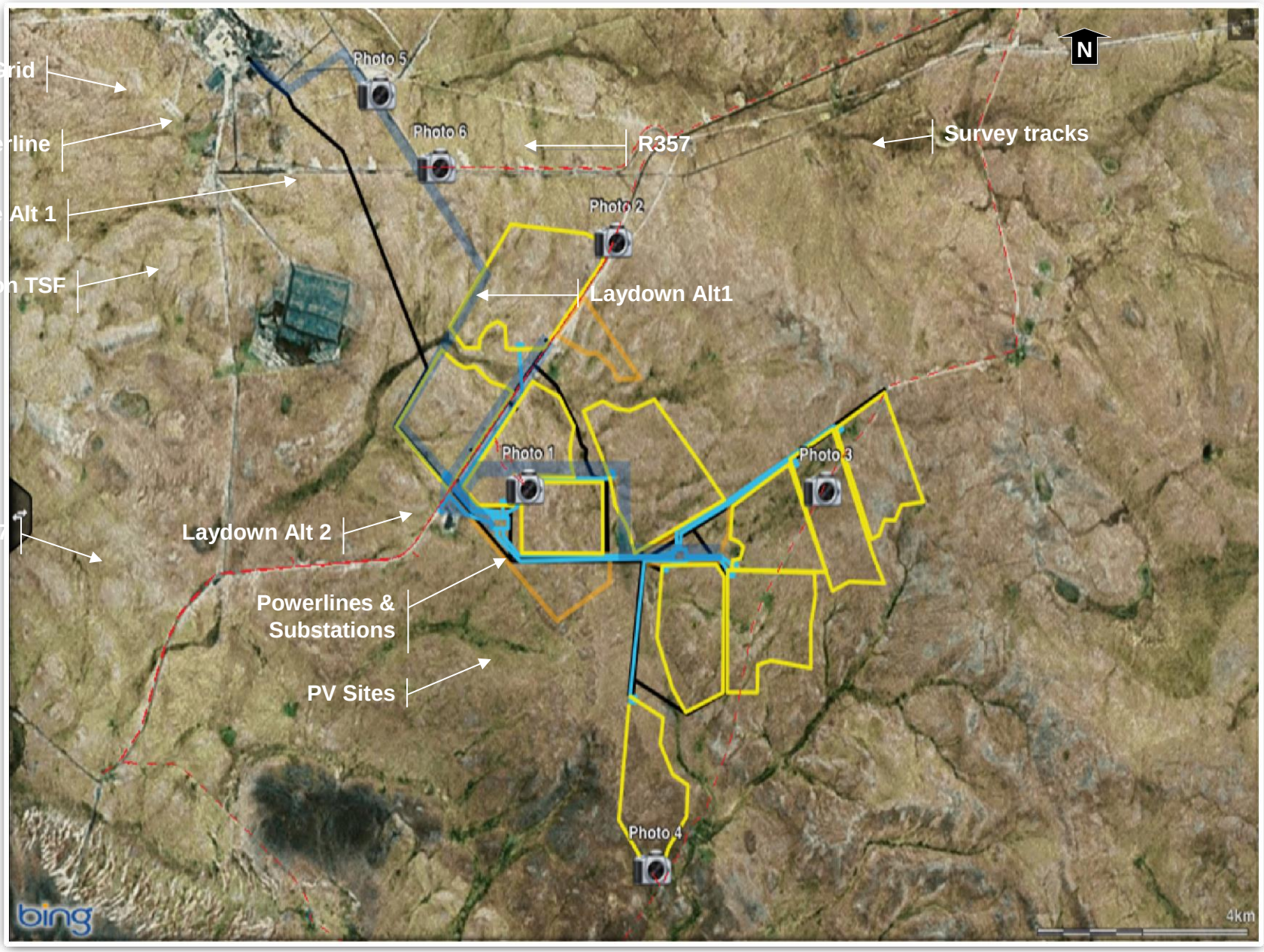


Figure 13: Site layout plan and photo point locality map

Table 1: Site Landscape Character Summary Table

Survey Points				
Name	Hoekplaas Photo point 1	Hoekplaas Photo point 3	Hoekplaas Photo site 4	Hoekplaas Photo point 5
Feature	PV 1	PV 7	PV 11	Transmission Lines
VAC	Low	Low	Low	High
Viewshed	High	Moderate	Low	High

Scenic Quality				
Land form	1	1	1	1
Vegetation	1	1	1	1
Water	0	0	0	0
Colour	2	1	1	2
Adjacent scenery	2	2	2	1
Scarcity	1	1	2	1
Cultural modifications	0	0	0	-2
Score	7	6	7	4
Category	C	C	C	C

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

Sensitivity				
Type of user	L	L	L	L
Amount of use	L	L	L	L
Public interest	L	L	L	L
Adjacent land users	L	L	L	L
Special areas	L	L	L	L
Score	L	L	L	L

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

Distance zone	FG	SS	SS	FG

(FG = Foreground, BG = Background, SS = Seldom Seen)

VRM Class	IV (III)	IV (III)	IV (III)	IV (III)

<u>*Site Landscape Character: PV 2, 3, 4 & 5 (Refer to Figure 16 in Annexure 1: Colour Plates)*</u>

The sites of PV 6 - 10 lie in the north and east of the proposed footprint area and would be in the foreground zone of potential receptors. The R357 runs adjacent to all of these sites. The landscape character of these sites can be seen from photo point 1 in Figure 12. The existing landuse is agricultural. However, there are existing transmission lines, a substation and a regional road running through them. The viewshed is *moderate* as the area is prominent, with very low-level vegetation. The Visual Absorption Capacity (VAC) of the area is *low* due to the flat Karoo landscape and low scrub so that any landscape modification would be prominent. The landscape has a *low* scenic quality as it is level and horizontal without any slope, even and smooth without any bumps or hollows and consistent in line and form, even-textured with no features or water visible. Cultural modifications including transmission lines create some vertical lines against the horizon line.

Receptors in the area would be agricultural but, as the area is very remote, the amount of use would be very low. The adjacent landusers are also agricultural in nature, with no special areas identified, and public interest is *low* as there is an existing context of transmission lines and a substation.

The sites would fall into a Class IV. However, as the sites are agricultural, the class category would therefore change to a 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.

Site Landscape Character: PV 6, 7, 8, 9 & 10 (Refer to Figure 17 in Annexure 1: Colour Plates)
The sites of PV 2 – 5 lie in the east of the R357 and the proposed footprint area, and would fall into the seldom-seen zone of potential receptors. The sites lie adjacent and to the north of the previously identified 'No-Go' zone. The landscape character of these sites can be seen from photo point 3 in Figure 13. The existing landuse is agriculture in nature. The viewshed is *moderate* and contained. The VAC of the area is *low* due to the flat Karoo landscape and low scrub, so that any landscape modification would be prominent. The landscape has a *low* scenic quality as it is level and horizontal without any slope; even and smooth without any bumps or hollows, and consistent in line and form; even-textured with no features or water visible and no cultural modifications.

Receptors in the area would be agricultural but, as the areas are very remote, the amount of use would be *very low*. The adjacent land users are also agricultural and mining in nature, with no special areas identified, and public interest is *low* as there is an existing context of mining and transmission lines, with no tourism in the area. The sites would fall into a Class IV. However, as the sites are agricultural, the class category would therefore change to a Class III.

Site Landscape Character: PV 11 (Refer to Figure 18 in Annexure 1: Colour Plates)
The site of PV 11 lies to the south of the proposed footprint area, adjacent to the previously identified 'No-Go' zone. The site falls into the seldom-seen zone of potential receptors. The landscape character for these sites can be seen from photo point 3 in Figure 13. The existing landuse is agricultural. The viewshed is *low* and open to the south-east. The VAC of the area is *low* due to the flat Karoo landscape and low scrub, so that any landscape modification would be prominent. The landscape has a low scenic quality as it is level and horizontal, without any slope, even and smooth without any bumps or hollows, consistent in line and form, even-textured with no features or water visible, and there are no cultural modifications.

Receptors in the area would be agricultural but, as the area is very remote, the amount of use would be very low. The adjacent land users have a *low* rating as they are remote, with no tourism in the area, and they are also agricultural in nature. There are no special areas identified and public interest is *low* due to the remoteness of the area. The sites would fall into a Class IV. However, as the sites are agricultural, the class category would therefore change to a Class III.

Site Landscape Character: PV Transmission lines (Refer to Figure 22 in Annexure 1: Colour Plates)
The proposed transmission lines would run from the proposed sites to the local substation. The site falls into the foreground view of potential receptors. The existing landuse is agricultural. The viewshed is *moderate* due to the flat Karoo landscape. The VAC of the area is *high* due to the context of existing transmission lines. The landscape has a low scenic quality as it is level and horizontal without any slope, even and smooth without any bumps or hollows, consistent in line and form, even-textured with no features or water visible and with an existing context of transmission lines and substation.

Receptors in the area would be agricultural and mining but, as the area is very remote, the amount of use would be very low. The adjacent land users have a *low* rating as they are remote, with no tourism in the area, and are also agricultural in nature. There are no special areas and public interest is *low*. The sites would fall into a Class IV. However, as the sites are agricultural, the class category would therefore change to a Class III.

10 KEY OBSERVATION POINTS

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

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

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

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

- R357 Regional Road; and
- Copperton Road

11 CONTRAST RATING FROM KEY OBSERVATION POINTS

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

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

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

KOP 1: R357 Westbound

The view from the R357 can be seen in Figure 19 in Annexure 1: Colour Plates. The area is remote, with a contained viewshed and an existing context of landscape modifications in the area such as transmission lines and mining. The construction phase would have a *moderate to strong* degree of contrast and be classified as a Class III area, except for the form which will be weak. The operational phase would have a *strong* degree of contrast and also be a Class III area, except for the form which will be weak. The closure phase would have no contrast and would meet the Class III visual objectives.

Table 2: Contrast Rating Table R357 westbound

Visual Objective: Class III			
Landscape Modifications	**Construction**	**Operation**	**Closure**
Line	Moderate to Strong	Strong	None
Colour	Moderate to Strong	Strong	None
Texture	Moderate to Strong	Strong	None
Form	Weak	Weak	None
Predicted contrast	Moderate to Strong	Strong	None
Visual Obj. Met?	No	No	Yes

Key: Y = Yes, N = No, Y (M) = Yes with mitigation, x = Not visible

KOP 2: Copperton Road

The view from Copperton Road can be seen in Figure 20 in Annexure 1: Colour Plates. The area is remote, with a contained viewshed and an existing context of landscape modifications in the area such as transmission lines and mining. The construction phase would have a *moderate to strong* degree of contrast and be classified as a Class III area, except for the form which will be weak. The operational phase would have a *strong* degree of contrast and also be a Class III area, except for the form which will be weak. The closure phase would have no contrast and would meet the Class III visual objectives.

Table 3: Contrast Rating Table: Copperton Road

Visual Objective			
Landscape Modifications	**Construction**	**Operation**	**Closure**
Line	Moderate to Strong	Strong	None
Colour	Moderate to Strong	Strong	None
Texture	Moderate to Strong	Strong	None
Form	Weak	Weak	None
Predicted contrast	Moderate to Strong	Strong	None
Visual Obj. Met?	Yes	Yes	Yes

Key: Y = Yes, N = No, Y (M) = Yes with mitigation, x = Not visible

12 CUMULATIVE ASSESSMENT

Visual Impacts	Mitigation	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Confidence	Reversibility
The proposed project setting a precedent for other similar renewable energy projects in the area resulting in possible landuse conflicts related to rapid and large scale landscape change	Without mitigation	Local	Low	Long term	MODERATE	Possible	Moderate	Reversible
	With mitigation				LOW			

The visual impact of this proposed development must also be assessed in the context of the other renewable energy projects within the Copperton area that are in various stages of approval. Copperton has become a centre of interest for alternative energy developments.

The 10 MW PV has been approved and is to be located 4 km to the north, and close to the closed mine. There are two additional proposed 100 MW PV facility sites currently being assessed; one to the east of this site, at Hoekplaas Dam Farm, and one closer to Copperton at Struisbult (Portion 1 of Farm 104). The Hoekplaas PV site is on the opposite side of the R357, about 3 km away, due east and inter-visible with Klipgats Pan PV site (remainder of Farm 146). The Struisbult farm PV facility would be situated approximately 1 km to the south-east of Copperton and between 8 and 9 km from Klipgats Pan and Hoekplaas.

There is an approved 190 turbine development which will occupy two sites between the R357 and the R386 to Carnarvon. The smaller of the two sites is about 2 km away to the south, and the larger lies about 6 km to the south-east. The proponent for this development is Mainstream Renewable Energy.

A proposed 56 turbine wind energy farm is being considered on a site to the north of the Struisbult PV facility site and it would be located about 9 km to the north. The proponent for this development is Plan 8 Infinite Energy.

There would be new transmission lines, substations and new access roads associated with all the new developments. It is uncertain whether these construction periods will run concurrently or not, with a consequential increased impact on local roads *(Hansen. 2012).*

Given the prevalence for wind and solar energy projects in the area, some of which have already been awarded environmental authorisation, it is likely that the area will undergo a change to the current landscape character. As the area is strongly associated with the existing Copperton Mine tailings storage facility (TSF), the Kronos substation and numerous Eskom powerlines (refer to Copperton TSF and substation viewshed map below), and is not associated with any landscape-based tourism, the suitability of using the site as a node for energy development increases. The main risk with the area as an energy node relates to the post closure phase in the instance where the energy projects are not properly de-constructed and rehabilitated. This scenario would result in significant landscape degradation. As the PV and wind energy projects utilise a recyclable resource, it is unlikely that this scenario would take place.

The map below represents the viewshed of the existing TSF and the approved Hoekplaas PV 1 visibility. The bulk of the proposed project takes place in a shallow bowl and is contained, with the exception of PV 6 and PV 11. Should the project be undertaken in isolation from other PV projects, it is recommended that PV 6, the southern section of PV 8 and PV 11 are excluded, as they would wrap over the hill and extend the viewshed of the proposed landscape modification to the east.

Mitigations would include setting up a planning committee which includes renewable developers, I&AP's and Local Authority which is tasked with addressing the issue of possible landuse conflicts related to rapid and large scale landscape change around Copperton.

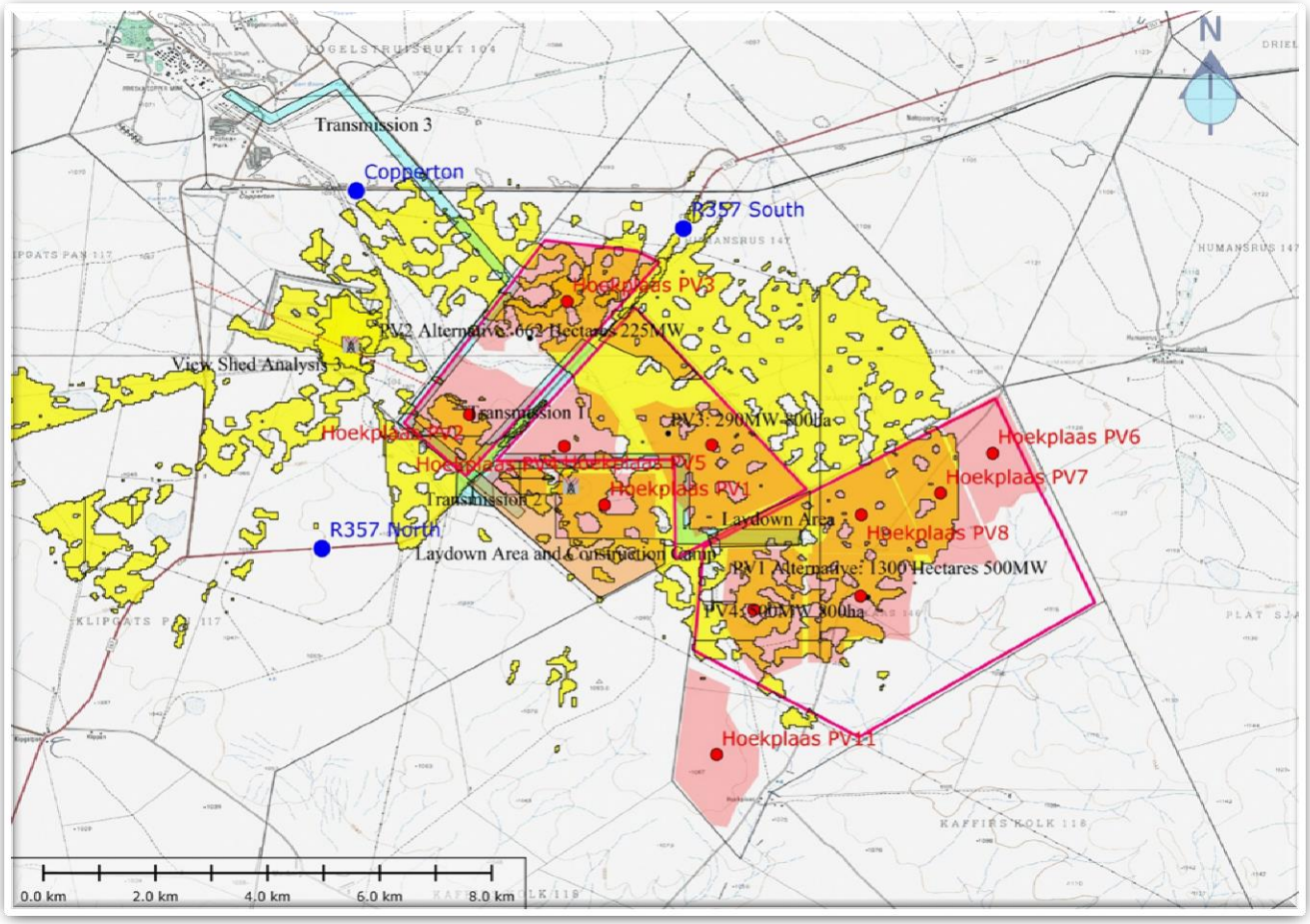


Figure 14: Existing TSF and DEA authorised PV viewshed overlaid onto Project Alternatives Map

13 MITIGATION MEASURES

13.1 Construction phase:

Potential Impacts: dust caused by materials haulage to and from the site, site development works.

- Access roads are to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads.
- Surface material should be scraped off, conserved and used for rehabilitation. The remainder could be used for site development, and any surplus should be disposed of in a manner that appears natural.
- Lay-down area(s) should preferably be located outside of direct view of the R357 and should be screened with shade cloth.
- Site offices and structures should be limited to single storey and they should be sited carefully to reduce visual intrusion. Colours should reflect hues of the surrounding vegetation and/or the ground. Roofs should be grey and non-reflective. Doors and window frame colour should reference either the roof or wall colours.
- Litter is to be regarded as a serious offence and no contaminants to be allowed to enter the environment by any means. An EMP would be drawn up and must be adhered to.
- Road construction and management must take run-off into consideration in order to prevent soil erosion.
- The top 50-100 mm of naturally occurring substrate should be separated and then spread over finished levels.
- The developer will be required to ensure that the footprint areas of all impact sites utilised in construction but not in operation, are rehabilitated and restored as near as natural vegetation state as possible.
- It is recommended that pylons are constructed from wooden poles.
- The fencing should be grey in colour and located as close as possible around the PV site. If possible, natural water ways and drainage lines indicated as sensitive should not be fenced in.
- All PV footprints (excluding the electrical fences) should maintain a 100 m buffer from the R357.
- Should the project be undertaken in isolation from other PV projects, it is recommended that PV 11 site are excluded, as they would wrap over to the south and be visual seperated from the rest of the proposed PV sites.
- Due to the remoteness of the location where there are very few receptors, no preference of PV technology type or structure type is defined, and best performance criteria should be utilised to define the optimum PV technology and structure type.

13.2 Operational phase

Potential Impacts: Lights at night and movement of maintenance vehicles.The visual impact of lighting will be significant because it can cause a project to have a far greater zone of visual influence at night than the structures have during the day.

- All lighting is to be kept to a minimum within the requirements of safety and efficiency.
- Where such lighting is deemed necessary, low-level lighting, which is shielded to reduce light spillage and pollution, should be used.
- No naked light sources are to be directly visible from a distance. Only reflected light should be visible from outside the site.
- Any necessary aircraft warning lights are to be installed as per the relevant authority requirements.
- External lighting must use down-lighters shielded in such a way as to minimise light spillage and pollution beyond the extent of the area that needs to be lit.

- Security and perimeter lighting must also be shielded so that no light falls outside the area needing to be lit. Excessively tall light poles are to be avoided.

13.3 Closure phase

Potential Impacts: Removal of all PV structures, associated structures and fencing. Ripping of all internal roads and rehabilitation to natural state.

- All PV structures, associated structures and fencing should be removed and recycled.
- Internal roads should be ripped and then rehabilitated.
- All impacted footprint areas should be rehabilitated and restored to indigenous, endemic vegetation.

13.4 No Development Option

The No-Go Option would retain the status quo which would include the development of PV 1 which has already been approved. Given that the landscape context of this development will change the sense of place, and the limited landscape value that the property holds for the surrounding areas, the landscape status quo could be changed without a significant visual impact to the surrounding areas. It is therefore recommended that Alternative 1 with mitigation can be implemented.

13.5 Impact Assessment Summary Table: Alternative 1

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
CONSTRUCTION PHASE : ALT 1											
1	Hauling and delivery of PV parts	Regional	Constr	Medium	Definite	Negative	Sure	Reversible	Medium	Good traffic management and keeping local people informed	
				Low							LOW
2	Hauling and delivery of construction materials	Regional	Constr	Medium	Definite	Negative	Sure	Reversible	Medium	Good traffic management and keeping local people informed	
				Low							LOW
3	Location of access road	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	Upgrade road junctions as required and rehabilitate after works	
				Low							LOW
4	Visual disturbance of construction site and laydown area	Local	Constr	Medium	Definite	Negative	Certain	Reversible	Moderate	Screen site, operate within Construction Industry Management Guidelines	
				Low							LOW
5	Movement of construction vehicles with lights	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	No night and weekend working	
				Low							LOW
6	Construction of trenches for cables	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	Return ground to original state	
		Local		Low							LOW
7	Construction of PV facilities and buildings	Local	Constr	High	Definite	Negative	Certain	Reversible	High	Use of local materials so that buildings blend in (best practice). 100m buffer along the R357 road for PV. Exclusion of areas outside of the Copperton TSF viewshed ***if project is undertaken in isolation.***	
				Medium High							MEDIUM HIGH
8	Construction of transmission lines	Local	Constr	Medium	Definite	Negative	Certain	Irreversible	Moderate	Wooden structures if possible.	
											MEDIUM
9	Completion of site works and fencing	Local	Constr	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Grey colour fencing. Good site management avoidance of litter etc	
				Low							LOW

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
CLOSURE PHASE : ALT 1											
1	Maintenance visits using existing road access	Local	Long term	Medium	Definite	Neutral	Certain	Reversible	Moderate	Good management practices and dust control, dust control	
				Low							LOW
2	Visual impact of installation during lifetime	Local	Long term	High	Definite	Neutral	Certain	Reversible	High	Local consultations, mitigation measures, EMP	
				Medium High							MODERATE HIGH
3	Site buildings and perimeter fence	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Carry out repairs promptly and keep tidy	
											MODERATE
4	Impact of transmission line from site to adjacent Eskom line	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	None	
											MODERATE

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
CLOSURE PHASE : ALT 1											
1	Removal of existing road access	Local	Long term	Medium	Definite	Neutral	Certain	Reversible	Moderate	Ripping of roads and rehabilitation, restoration	
			Short term	Low							LOW
2	Removal of PV structures	Regional	Long term	High	Definite	Neutral	Certain	Reversible	Moderate High	Removal, rehabilitation and restoration and EMP	
			Short term	Low							LOW
3	Removal of site buildings and perimeter fence	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Ripping of roads and rehabilitation, restoration and EMP	
			Short term	Low							LOW
4	Removal of transmission line from site to adjacent Eskom line	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Ripping of roads and rehabilitation, restoration and EMP	
			Short term	Low							LOW

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

13.6 Impact Assessment Summary Table: Alternative 2

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
CONSTRUCTION PHASE : ALT 2											
1	Hauling and delivery of PV parts	Regional	Constr	Medium	Definite	Negative	Sure	Reversible	Medium	Good traffic management and keeping local people informed	
				Low							LOW
2	Hauling and delivery of construction materials	Regional	Constr	Medium	Definite	Negative	Sure	Reversible	Medium	Good traffic management and keeping local people informed	
				Low							LOW
3	Location of access road	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	Upgrade road junctions as required and rehabilitate after works	
				Low							LOW
4	Visual disturbance of construction site and laydown area	Local	Constr	Medium	Definite	Negative	Certain	Reversible	Moderate	Screen site, operate within Construction Industry Management Guidelines	
				Low							LOW
5	Movement of construction vehicles with lights	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	No night and weekend working	
				Low							LOW
6	Construction of trenches for cables	Local	Constr	Medium	Definite	Negative	Sure	Reversible	Moderate	Return ground to original state	
		Local		Low							LOW
7	Construction of PV facilities and buildings	Local	Constr	High	Definite	Negative	Certain	Reversible	High	Use of local materials so that buildings blend in (best practice). 100m buffer along the R357 road for PV. Exclusion of areas outside of the Copperton TSF viewshed ***if project is undertaken in isolation.***	
											HIGH
8	Construction of transmission lines	Local	Constr	Medium	Definite	Negative	Certain	Reversible	Moderate	Wooden structures if possible.	
											MEDIUM
9	Completion of site works and fencing	Local	Constr	Medium	Definite	Negative	Certain	Reversible	Moderate	Grey colour fencing. Good site management avoidance of litter etc	
				Low							LOW

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
OPERATIONAL PHASE : ALT 2											
1	Maintenance visits using existing road access	Local	Long term	Low	Definite	Neutral	Certain	Reversible	Moderate	Good management practices and dust control	
											LOW
2	Visual impact of installation during lifetime	Local	Long term	High	Definite	Neutral	Certain	Reversible	High	Local consultations, mitigation measures, EMP, impact may reduce with habitation	
											HIGH
3	Site buildings and perimeter fence	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Carry out repairs promptly and keep tidy	
											MODERATE
4	Impact of transmission line from site to adjacent Eskom line	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	None	
											MODERATE

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

	Nature of the impact	Extent	Duration	Magnitude	Probability	Status	Confidence	Reversibility	Significance	Mitigation Measures	Significance after mitigation
CLOSURE PHASE : ALT 2											
1	Removal of existing road access	Local	Long term	Medium	Definite	Neutral	Certain	Reversible	Moderate	Ripping of roads and rehabilitation, restoration	
			Short term	Low							LOW
2	Removal of PV structures	Local	Long term	High	Definite	Neutral	Certain	Reversible	High	Ripping of roads and rehabilitation, restoration and EMP	
			Short term	Low							LOW
3	Removal of site buildings and perimeter fence	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Removal, rehabilitation and restoration and EMP	
			Short term	Low							LOW
4	Removal of transmission line from site to adjacent Eskom line	Local	Long term	Medium	Definite	Negative	Certain	Reversible	Moderate	Ripping of roads and rehabilitation, restoration and EMP	
			Short term	Low							LOW

Note: Blank mitigation cells retain the rating for 'without mitigation' rating

14 CONCLUSION

The proposed landscape modification is large and will generate strong levels of visual contrast. The Class III visual objectives to retain the existing rural landscape character will not be met and a change in the landscape character will take place to the site and to the immediate surrounds. It must be noted that there are other energy-related projects proposed for the immediate surrounds which would significantly alter the surrounding landscape character. Should the project be undertaken in isolation from other PV projects, it is recommended that PV 11 site is excluded, as the site would wrap over to the south and extend the viewshed of the proposed landscape modification to the south-east.

Currently, Mulilo has four approved solar energy facilities in the area and there is another PV facility situated closer to Copperton, at Struisbult (portion 1 of Farm 104), which is located in the same vicinity. Should these projects be constructed, the visual intrusion caused by the change in landscape brought about by this proposed project, would be significantly reduced. Due to the location of the site, and to the small number of potential receptors, it is recommended that, from a visual perspective, the preferred layout proceed.

Transmission routing Alternative 1 would be the preferred option as it connects to the existing Kronos substation on the adjacent site. Due to the remoteness of the location where there are very few receptors, no preference of PV technology type or structure type is defined, and best performance criteria should be utilised to define the optimum PV technology and structure type. An EMP should be implemented, and mitigation measures must be effectively undertaken relating to:

Construction Phase

- Keeping contract period to the minimum;
- Traffic control measures;
- Disposal of surplus materials;
- Location of lay-down areas;
- 100m buffer on the R357 for the PV; and
- Exclusion of PV 11 site ***if the project are undertaken in isolation.***

Operational Phase

- Height, location, finishes of building(s) recommendations to be implemented;
- Use of non-reflective materials and receding colours; and
- Discussions with local people.

Closure Phase

- Removal of all PV structures, associated structures and infrastructure; and
- Rehabilitation and restoration.

15 REFERENCES

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4. Bureau of Land Management, U.S. Department of Interior. 2004. Visual Resource Management Manual 8400.
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16 ANNEXURE 1: COLOUR PLATES

View North

View East

View South

View West

Figure 15: Views from photo point 1

View North

View East

View South

View West

Figure 16: Views from photo point 3

View North

View East

View South

View West

Figure 17: Views from photo point 4

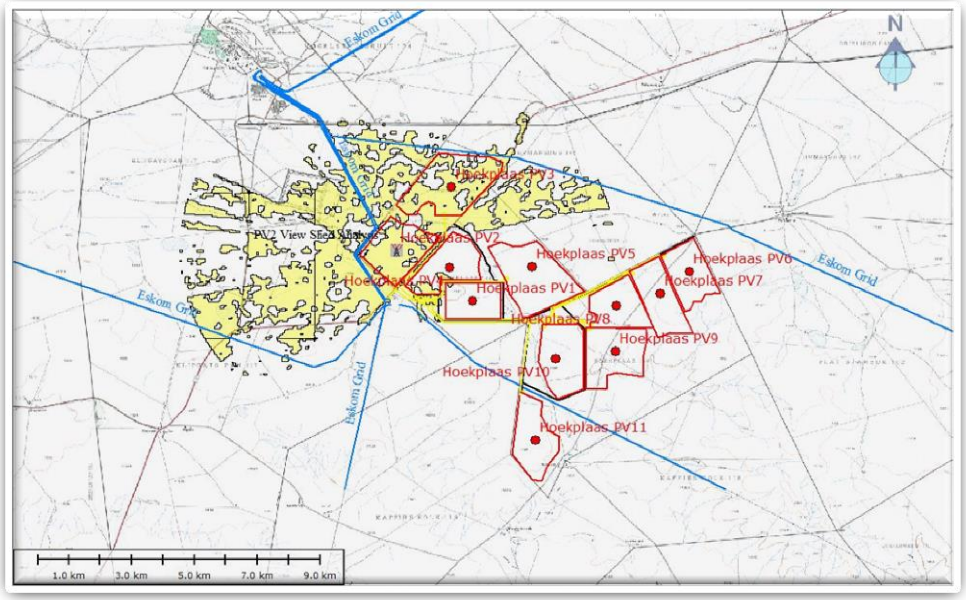
View North

View East

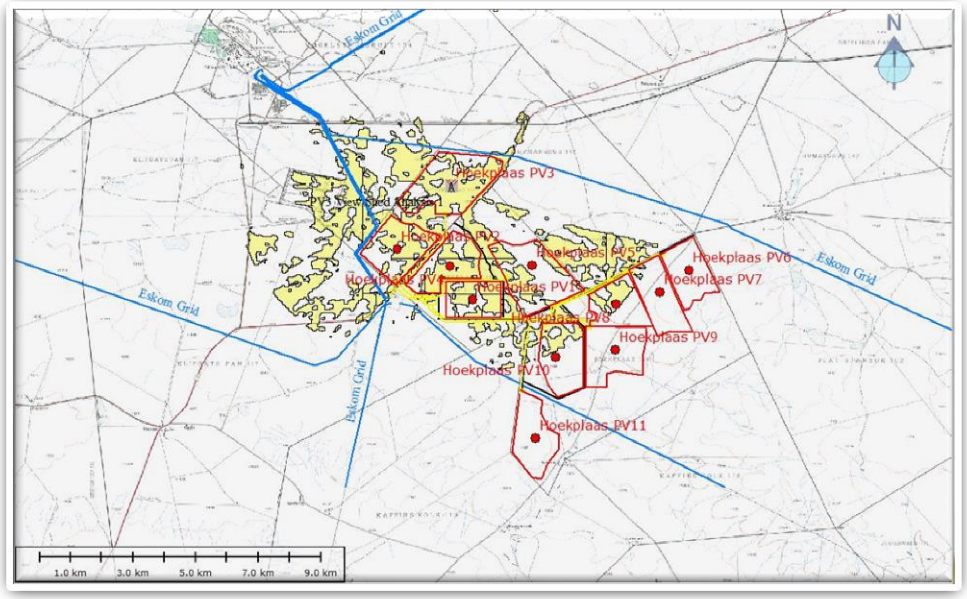
View South

View West

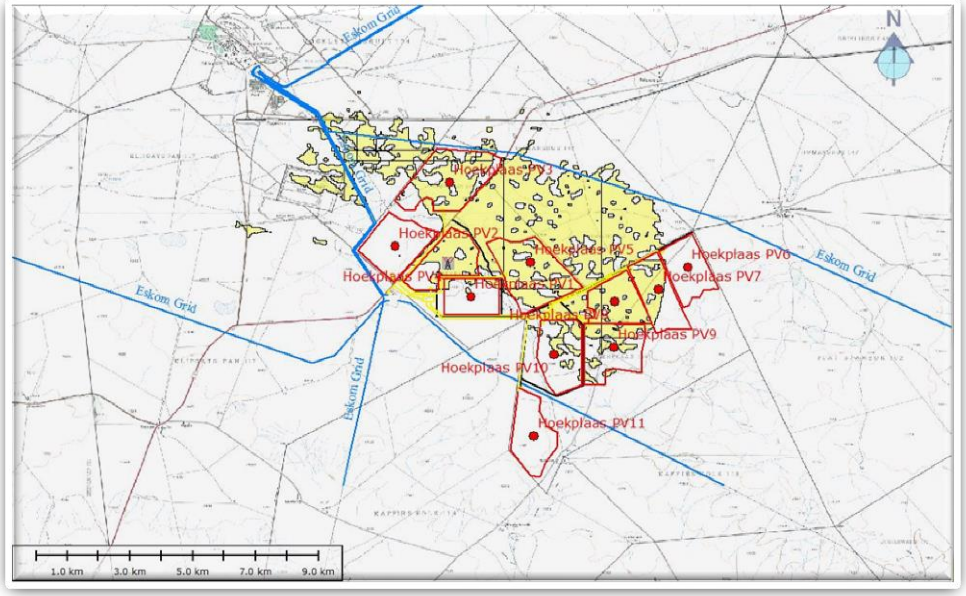
Figure 18: Views from photo point 5



Viewshed: PV 2



Viewshed: PV 3



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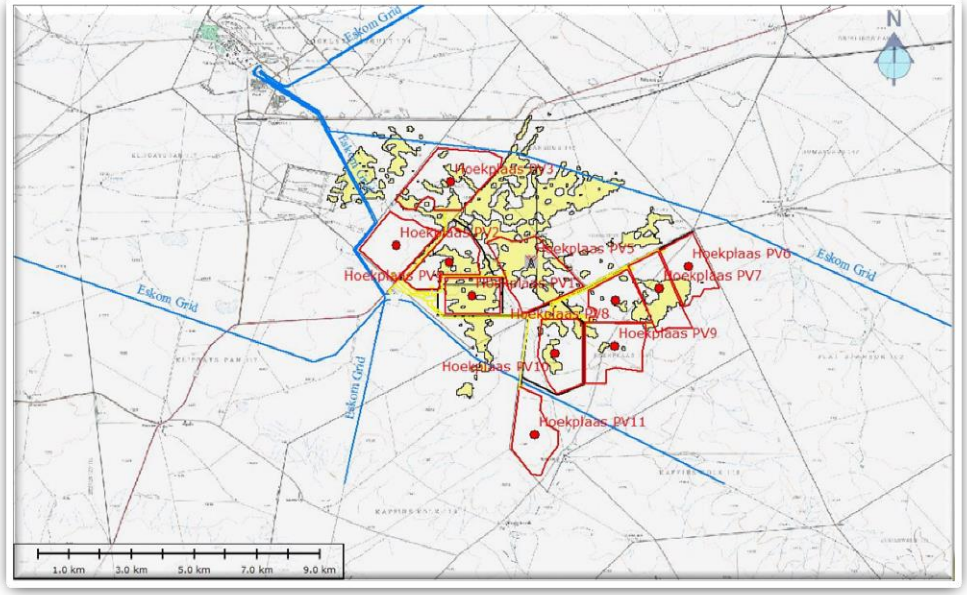
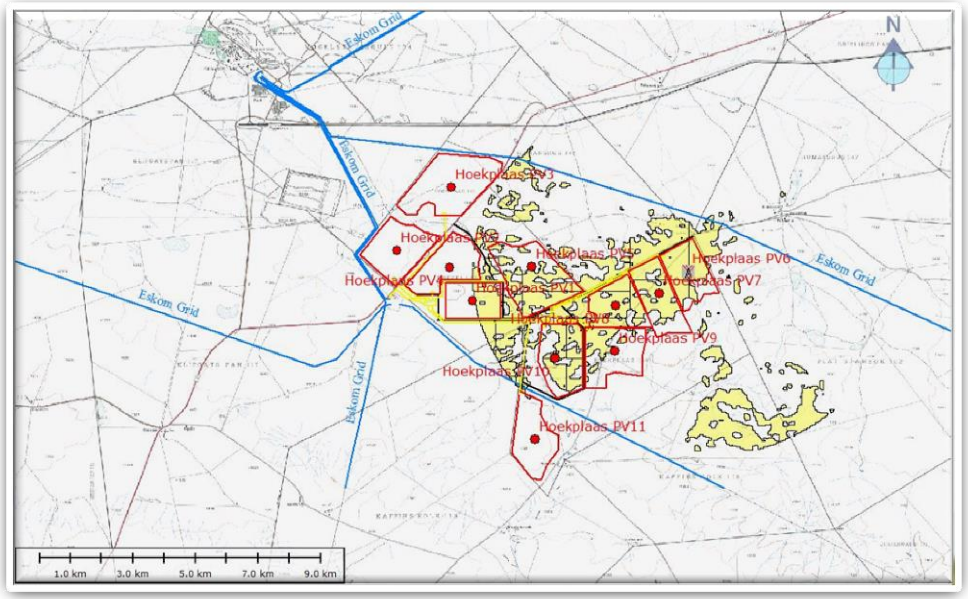
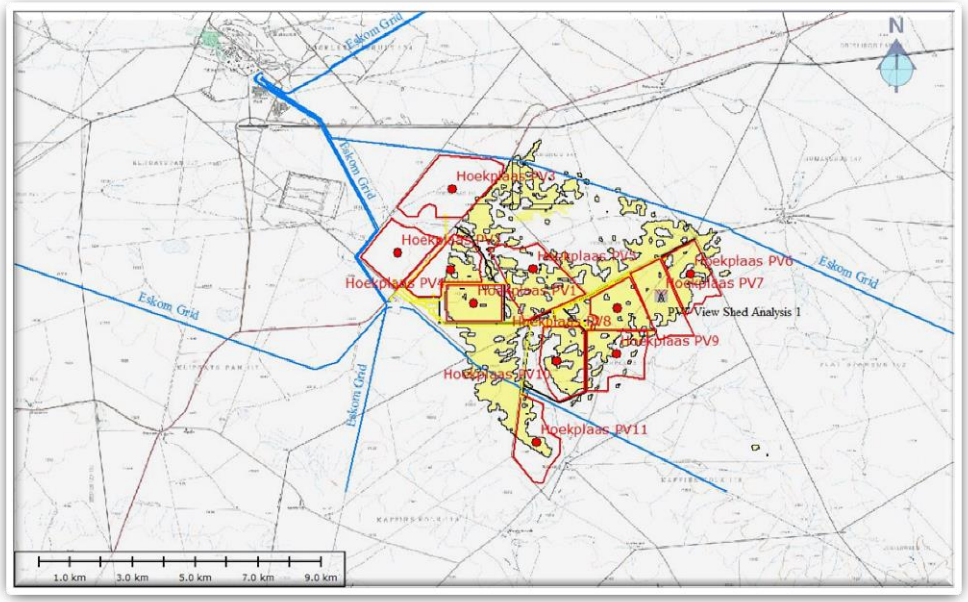


Viewshed: PV 5

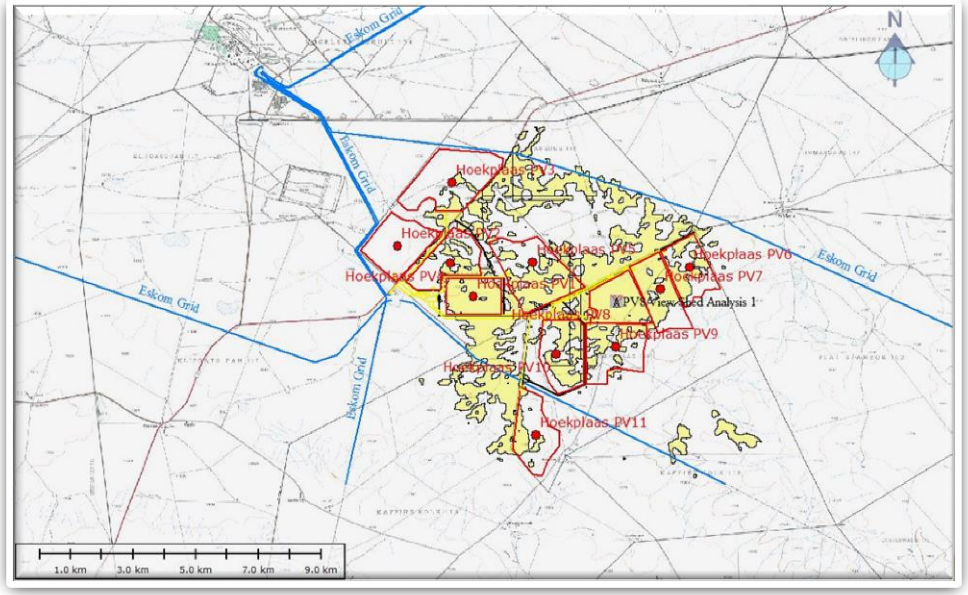
Figure 19: Viewsheds for PV 2 – PV 5



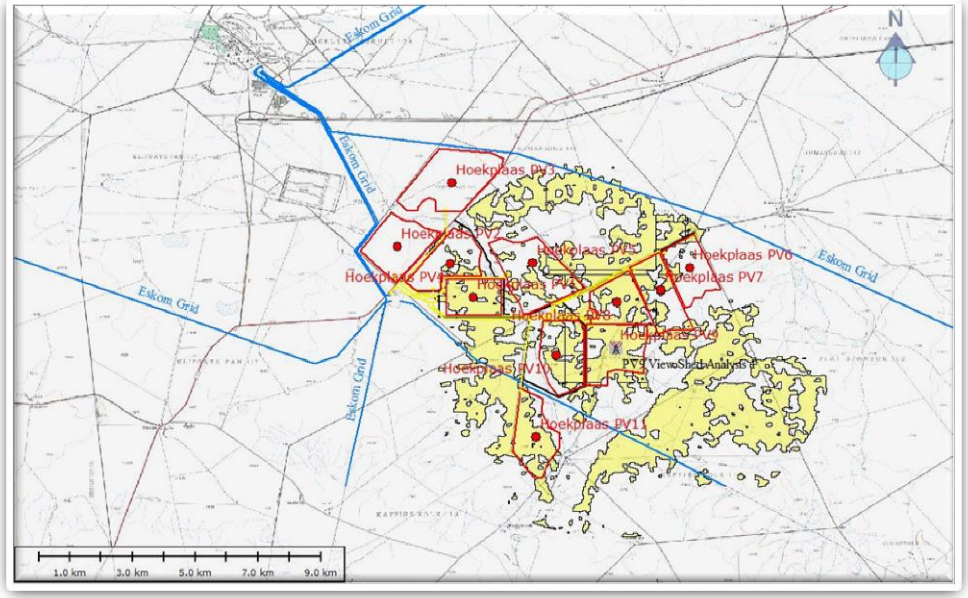
Viewshed: PV 6



Viewshed: PV 7

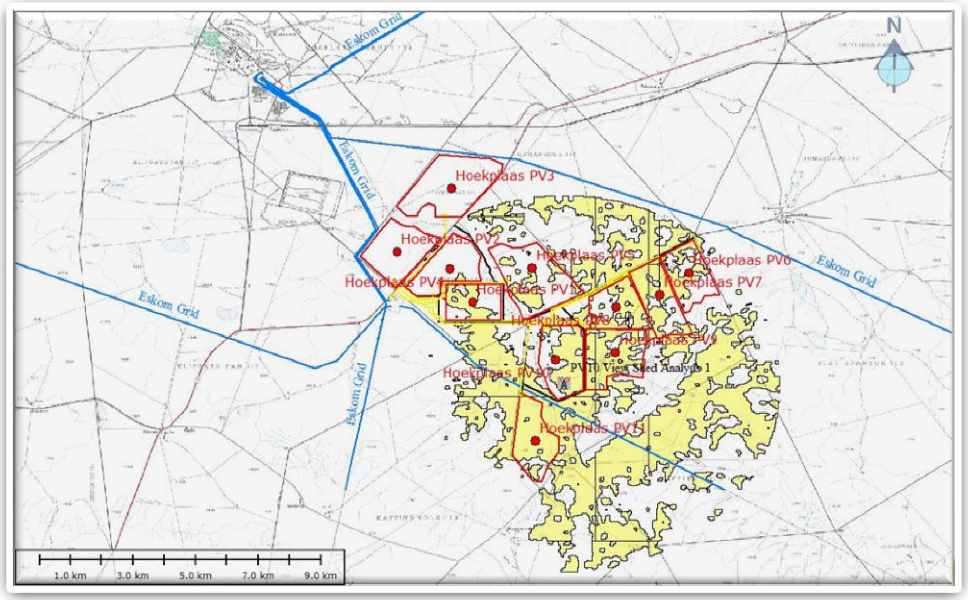


Viewshed: PV 8

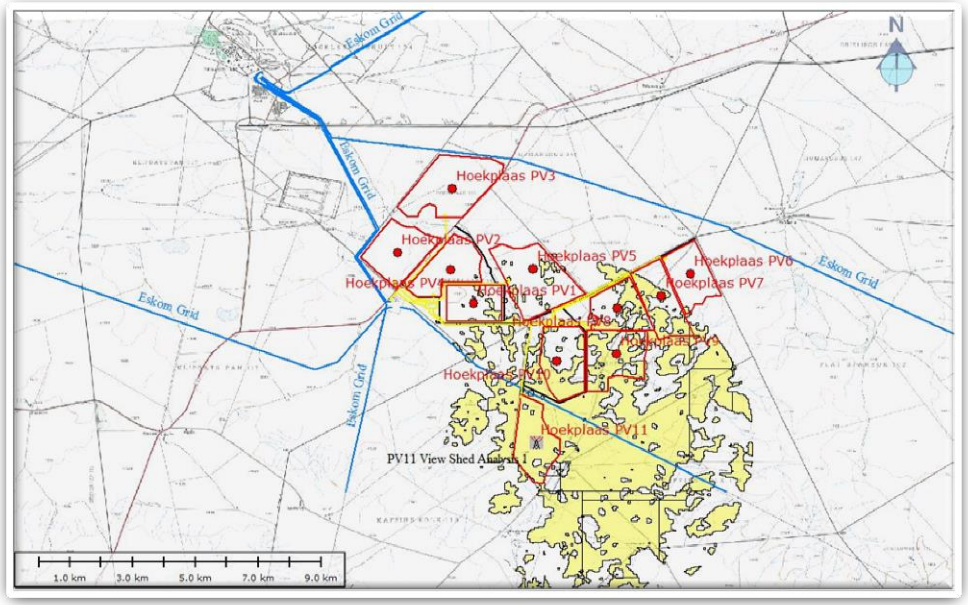


Viewshed: PV 9

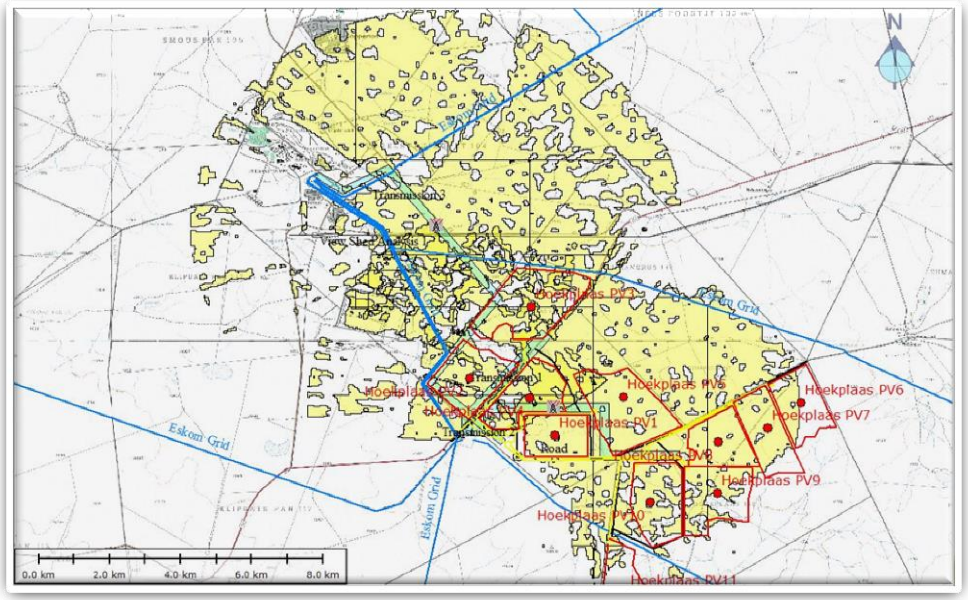
Figure 20: Viewsheds for PV 6 – PV 9



Viewshed: PV 10



Viewshed: PV 11

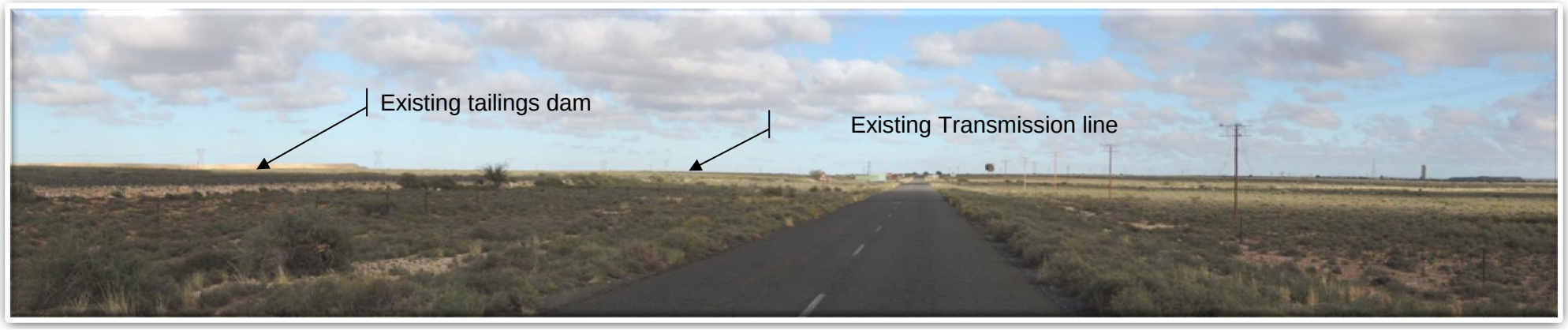


Viewshed: PV Transmission lines (offset of 15 m)

Figure 21: Viewsheds for PV 10 – PV 11 and transmission lines

View south from R357 as seen from photo point 2 where the proposed panels would be visible on either side of the road

Figure 22: Receptor view: R357 westbound



View west from Copperton towards proposed transmission lines as seen from photo point 6

Figure 23: Receptor view: Copperton Road

17 ANNEXURE 2: SPECIALIST DECLARATION OF INDEPENDENCE

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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

The specialist appointed in terms of the Regulations

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

General declaration:

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

Signature of the specialist:

SILVER SOLUTIONS TRADING AS VRM AFRICA

Name of company (if applicable):

23 JANUARY 2013

Date:

17.1 Curriculum Vitae

Curriculum Vitae (CV)

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

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

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

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

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

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

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

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

a large client base throughout Southern Africa which include amongst other, Rio Tinto (Pty) Ltd, Bannerman (Pty) Ltd, Anglo Coal (Pty) Ltd, Eskom (Pty) Ltd, NamPower and Vale (Pty) Ltd, Ariva (Pty) Ltd, Harmony Gold (Pty) Ltd, Mellium Challenge Account (USA), Pretoria Portland Cement (Pty) Ltd

14. Languages:

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

15. Projects:

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

YEAR	NAME	DESCRIPTION	CLIENT	LOCATION
2012	AfrisamSaldanha	Mine	AfriSAM	Saldana
2012	Ncondezi Power Station	Plant	Ncondezi Coal	Mozambique
2012	MET Housing Etosha Amended MCDM	Residential	Millennium Challenge	Namibia
2012	Kangnas Wind	Energy	Mainstream Renewable Power SA	N Cape
2012	Kangnas PV	Energy	Mainstream Renewable Power SA	N Cape
2012	Rossing Z20 Infrastructure Corridor	Infrastructure	Rio Tinto	Namibia
2012	MET Housing Etosha	Housing	MET	Namibia
2012	Qwale Mineral Sands	Mine	Base Resources	Kenya
2012	Houhoek Substation	Transmission	Eskom	Western Cape
2012	Bannerman Etango Mine Phase 2	Mining	Bannerman	Namibia
2012	Letseng Diamond Transmission Line Upgrade	Powerline	Gem Diaminds	Lesotho
2012	Letseng Diamond Mine Projet Kholo	Mine	Gem Diamonds	Lesotho
2012	Drennan PV	PV		Eastern Cape
2012	George Social Infrastructure	Analysis	George Municipal Area	George
2012	LunsklipWindfarm	Windfarm	Bergwind	Stilbaai
2012	Hoodia Solar	PV expansion		Beaufort West
2012	Bitterfontein	Energy	WEPTEAM	N Cape
2012	Bitterfontein slopes	Slopes Analysis	WEPTEAM	N Cape
2012	Knysna Affordable Housing	Residential	Knysna Municipality	Knysna
2012	KAH Hornlee Project	Residential	Knysna Municipality	Knysna
2012	Kobong Hydro	Dam / Powerline	Lesotho Highlands Water	Lesotho
2012	Otjikoto Gold Mine	Mining	ASEC	Namibia
2012	Mozambique Gas Engine Power Plant	Plant	Sasol	Mozambique
2012	SAPPI Boiler Upgrade	Plant	SAPPI	Mpumalanga
2012	Upington CSP	solar Power	Sasol	Northern Cape
2012	Rossing Z20 Mine	Mining	Rio Tinto	Namibia
2012	Eastern Cape Mari-culture	Mari-culture	Department of Agriculture, forestry and Fisheries	Western Cape
2011	Vodacom Mast	Structure	Vodacom	Reichterbosch
2011	Weldon Kaya	Residential	Private	Plettenberg Bay
2011	Hornlee	Housing	ABSA	Knysna
2011	Erongo Uranium Rush SEA	SEA	SAIEA	Namibia
2011	Damkoppie	Residential	Private	Western Cape
2011	Moquini Hotel	Structure	Costa Zeerva Developments	Western Cape
2011	Bon Accord Nickel Mine	Mine	African Nickel	Barbeton
2011	Rossing Uranium Mine Phase 2	Mining	Rio Tinto	Namibia
2011	Rossing South Board Meeting	Mining	Rio Tinto	Namibia
2011	Floating Liquified Natural Gas Facility	Structure	PetroSA	Mossel Bay
2011	Khanyisa Power Station	Power Station	Anglo Coal	Western Cape
2011	PPC Rheebieck West Upgrade	Industrial	PPC	Western Cape
2011	Vale Moatize Railway 1	Mining_rail	VALE	Mozambique

2011	Vale Moatize Coal Mine	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 2	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 3	Mining_rail	VALE	Mozambique
2011	Vale Moatize Railway 4	Mining_rail	VALE	Mozambique
2011	OlvynKolk PV	Solar Power		Northern Cape
2011	Beaufort West Urban Edge	Mapping	Willem de Kock Planners	Beaufort West
2011	ERF 7288 PV	PV		Beaufort West
2011	Erf 7288 Beaufort West	Slopes		Beaufort West
2011	N2 Herolds Bay Residental	Residential	MMS Developers	Herolds Bay
2011	Southern Arterial	Road	George Municipality	George
2011	De Bakke Cell Phone Mast	Mast	Vodacom	Western Cape
2011	Ruitesbosch	Mast	Vodacom	Western Cape
2011	Wadrif Dam	Dam	Plett Municipality	Western Cape
2011	George Western Bypass	Road	George Municipal Area	George
2011	Gecko Namibia	Industrial	Vision Industrial Park	
2011	Hartenbos Quarry Extension	Mining	Onifin(Pty) Ltd	Mossel Bay
2011	Wadrif Dam	Dam	Plettenberg Municipality	Beaufort West
2011	Kathu CSP	Solar Power		Northern Cape
2011	Sasolburg CSP	Solar Power		Free State
2010	George Open Spaces System	George SDF	George Municipal Area	George
2010	Sedgefield Water Works	Structure	Knysna Municipality	Sedgefield
2010	George Visual Resource Management	George SDF	George Municipal Area	George
2010	George Municipality SDF	George SDF	George Municipal Area	George
2010	Green View Estates	Residential		Mossel Bay
2010	WolweEiland Access Route	Road	Theo Ciliers	Victoria Bay
2010	AsazaniZinyoka UISP Housing	Residential	Mossel Bay Municipality	Mossel Bay
2010	MTN Lattice Hub Tower	Structure	MTN	George
2010	Destiny Africa	Residential	KDFM	George
2010	Farm Dwarsweg 260	Residential	HoogkwatierLandgoed	Great Brak
2010	Bantamsklip GIS Mapping	Mapping	Eskom	Western Cape
2010	Bantamsklip Transmission Revision	Transmission	Eskom	Eastern Cape
2010	Le Grand Golf and Residential Estate	Residenti	Private	George
2010	Ladywood Farm 437	Residential	Private	Plettenberg Bay
2010	Pezula Infill (Noetzie)	Residential	Pezula Golf Estate	Knysna
2010	Stonehouse Development	Residential	Private	Plettenberg Bay
2009	Eden Telecommunication Tower	Tower	Africon Engineering	George
2009	Walvis Bay Power Station	Structure	NamPower	Namibia.
2009	OCGT Power Plant Extension	Power Plant	Eskom	Mossel Bay
2009	Rossing Uranium Mine Phase 1	Mining	Rio Tinto	Namibia
2009	RUL Sulpher Handling Facility	Mining	Rio Tinto	Walvis Bay
2009	Boggomsbaai	Slopes	Private	Boggomsbaai
2009	Still Bay East	Mapping	DelPlan	SA, WC
2009	Bannerman Etango Uranium Mine	Mining	Bannerman	Namibia
2009	George Municipality Densification	George SDF	George Municipal Area	George
2009	Oudtshoorn Municipality SDF	Mapping	Oudtshoorn Municipality	Oudtshoorn
2009	Harmony Gold Mine	Mining	Harmony	Mpumalanga.
2009	RystKuil/RietKuil Uranium Mine	Mining	Turgis	Beaufort West
2009	Trekkopje Uranium Mine	Mining	Trekkopje Uranium Mine	Namibia
2009	Calitzdorp Retirement Village	Residential	Pretorius Family Trust	Calitzdorp
2009	Wilderness Erf 2278	Residential	Albert Hanekom	Wilderness
2009	WolweEiland Eco & Nature Estate	Residential	Theo Ciliers	Victoria Bay
2009	Zebra Clay Mine	Mining	Private	Zebra
2009	Fancourt Visualisation Modelling	Visualisation	Fancourt Golf Estate	George
2009	Erf 251 Damage Assessment	Residential	Private	Great Brak
2009	Lagoon Bay Lifestyle Estate	Residential	Lagoon Bay Estate	Glentana
2009	Lagoon Garden Estate	Residential	Dreamveldt	Great Brak
2009	Moquini Beach Hotel	Resort	Kostas Zervas	Mossel Bay
2009	Knysna River Reserve	Residential	Private	Knysna
2009	Paradyskloof Residential Estate	Residential	Private	Stellenbosch
2008	Trekkopje Desalination Plant	Structure	Trekkopje Uranium Mine	Namibia
2008	HartenbosLandgoed Phase 2	Residential	Willem van Rensburg	Hartenbos

2008	Hartenbos River Park	Residential	Adlequelle	Hartenbos
2008	Hersham Security Village	Residential	Private	Great Brak
2008	Kaaimans Project	Residential	Fritz Fenter	Wilderness
2008	Kloofsig Development	Residential	Muller Murray Trust	Vleesbaai
2008	Rheebok Development Erf 252 Apeal	Residential	Farm Searles	Great Brak
2008	Riverhill Residential Estate	Residential	Theo Cilliers	Wilderness
2008	Camdeboo Estate	Resort	Private	GraaffReinet
2008	Oasis Development	Residential	Private	Plettenberg Bay
2008	Outeniquabosch Safari Park	Residential	Private	Mossel Bay
2008	George Airport Radar Tower	Tower	ACSA	George
2008	Lakes Eco and Golf Estate	Residential	Private	Sedgefield
2008	Pinnacle Point Golf Estate	Residential	Private	Mossel Bay
2008	Paradise Coast	Residential	Private	Mossel Bay
2008	FynboskruinExtention	Residential	Ballabarn Three	Sedgefield
2008	Gansevallei	Residential	Pieter Badenhorst	Plettenberg Bay
2008	Hanglip Golf and Residential Estate	Residential	Pieter Badenhorst	Plettenberg Bay
2008	Proposed Hotel Farm Gansevallei	Resort	Wendy Floyd Planners	Plettenberg Bay
2008	Uitzicht Development	Residential	Private	Knysna
2008	Hansmoeskraal	Slopes Analysis	Private	George
2008	Kruisfontein Infill	Mapping	SetPlan George	Knysna
2008	Mount View Tourist Destination	Mapping	SetPlan	Western Cape
2008	Welgevonden	Visualisation	SetPlan George	De Rust
2008	Pierpoint Nature Reserve	Residential	Private	Knysna
2008	West Dunes	Residential	Private	Knysna
1998	Greater Durban Informal Housing Analysis	GIS	Durban Municipality	Durban

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

Yours faithfully,

_____
Stephen Stead, Director

18 ANNEXURE 3: METHODOLOGY

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

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

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

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

Landscape Significance

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

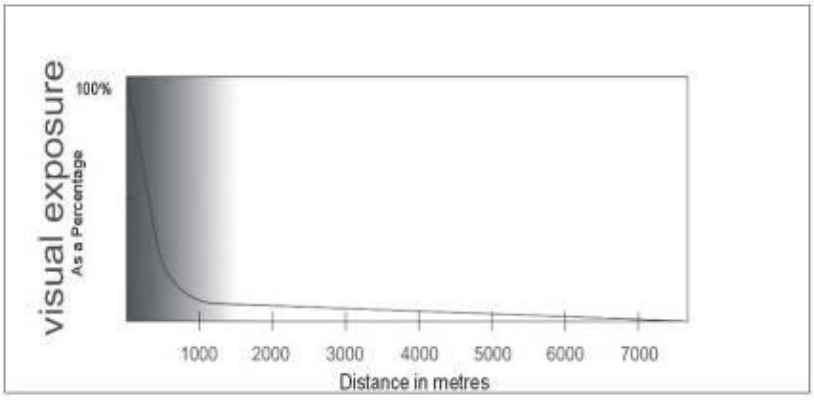
Viewshed Analysis

A viewshed is 'the outer boundary defining a view catchment area, usually along crests and ridgelines' *(Oberholzer, B., 2005)*. This reflects the area within which, or the extent to which, the landscape modification is likely to be seen. It is important to assess the extent to which the proposed landscape modifications are visible in the surrounding landscape, as a point of departure for defining the shared landscape context, and to identify the receptors making use of the common views. Viewshed analyses are not absolute indicators of the level of significance, but an indication of potential visibility *(Centre for Advanced Spatial Analysis, 2002)*. Once the sites and heights of the proposed activities have been finalised, the viewshed analysis will be undertaken.

Receptor Exposure

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

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



18.1 Distance Zones

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

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

18.2 Scenic Quality

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

1. **Landform:** Topography becomes more interesting as it gets steeper, or more massive, or more severely or universally sculptured.
2. **Vegetation:** Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Also consider smaller-scale vegetation features which add striking and intriguing detail elements to the land.
3. **Water:** That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration.

4. **Colour:** Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast and harmony.
5. **Scarcity:** This factor provides an opportunity to give added importance to one, or all, of the scenic features that appear to be relatively unique or rare within one physiographic region.
6. **Adjacent Land Use:** Degree to which scenery, outside the scenery unit being rated, enhances the overall impression of the scenery within the rating unit. The distance at which adjacent scenery will start to influence scenery within the rating unit ranges, depending upon the characteristics of the topography, the vegetative cover, and other such factors.
7. **Cultural Modifications:** Cultural modifications in the landform, water, and vegetation, and addition of structures, should be considered, and may detract from the scenery in the form of a negative intrusion, or complement or improve the scenic quality of a unit.

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

Scenic Quality Rating Questionnaire

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

	wildlife or wildflower viewing etc.		
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.

18.3 Receptor Sensitivity

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

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

Receptor Sensitivity Rating Criteria

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

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

Sensitivity Level Rating Questionnaire

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

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

Key Observation Points (KOPs)

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

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

18.4 VRM Classes

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

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

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

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

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

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

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

5. The **Class I** objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. **Class I** is assigned to those areas where a ***specialist decision*** has been made to maintain a natural landscape.
6. The **Class II** objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.
7. 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.
8. The **Class IV** objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

18.5 Photo Montages and 3D Visualisation

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

- Access to Information;
- Accuracy;
- Legitimacy;

- Representativeness;
- Visual Clarity; and
- Interest.

The Code of Ethical Conduct states that the presenter should:

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

18.6 Contrast Rating Stage

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

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

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

18.7 VRM Terminology

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

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

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

18.8 Aurecon Impact Assessment Methodology

A standardised and internationally recognised methodology *(Government of SA, 2004)* has been applied to assess the significance of the potential environmental impacts of Rössing Uranium's project, outlined as follows:

For each impact, the EXTENT (spatial scale), MAGNITUDE (size or degree scale) and DURATION (time scale) will be described. These criteria are used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the SEIA Report will represent the full range of plausible and pragmatic measures but does not necessarily imply that they should or will all be implemented. The decision as to which combination of alternatives and mitigation measures to apply for will lie with RU as the proponent, and their acceptance and approval ultimately with MET: DEA and MME. The SEIA Report will explicitly describe RU's commitments in this regard. The tables on the following pages show the scales used to assess these variables and define each of the rating categories.

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**National**	Within Namibia
	Regional	Within the Erongo Region
	Local	On site or within 100 m of the impact site
Magnitude of impact (at the indicated spatial scale)	**High**	Social and/or natural functions and/ or processes are *severely* altered
	Medium	Social and/or natural functions and/ or processes are *notably* altered
	Low	Social and/or natural functions and/ or processes are *slightly* altered
	Very Low	Social and/or natural functions and/ or processes are *negligibly* altered
	Zero	Social and/or natural functions and/ or processes remain *unaltered*
Duration of impact	**Short term**	Up to 3 years
	Medium Term	4 to 10 years after construction
	Long Term	More than 10 years after construction

Table 4: Assessment criteria for the evaluation of impacts

The SIGNIFICANCE of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in the following table, developed by Ninham Shand in 1995 as a means of minimising subjectivity in such evaluations, i.e. to allow for standardisation in the determination of significance.

SIGNIFICANCE RATINGS	LEVEL OF CRITERIA REQUIRED
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and duration except regional and long term

Neutral	• Zero magnitude with any combination of extent and duration

Table 5: Definition of significance ratings

Once the significance of an impact has been determined, the PROBABILITY of this impact occurring as well as the CONFIDENCE in the assessment of the impact would be determined using the rating systems outlined in the following two tables. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring.

PROBABILITY RATINGS	CRITERIA
Definite	Estimated greater than 95% chance of the impact occurring.
Probable	Estimated 5 to 95% chance of the impact occurring.
Unlikely	Estimated less than 5% chance of the impact occurring.

Table 6: Definition of probability ratings

CONFIDENCE RATINGS	CRITERIA
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 7: Definition of confidence ratings

Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in the following table.

REVERSIBILITY RATINGS	CRITERIA
Irreversible	***THE ACTIVITY WILL LEAD TO AN IMPACT THAT IS PERMANENT.***
Reversible	***THE IMPACT IS REVERSIBLE, WITHIN A PERIOD OF 10 YEARS.***

Table 8: Definition of reversibility ratings

19 ANNEXURE 4: GENERAL MITIGATIONS

19.1 Lights at Night

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/).*

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 sky glow — the "light pollution" that washes out our view of the stars.

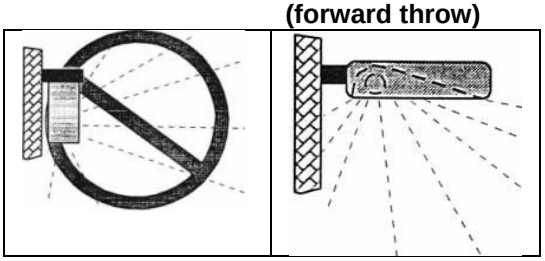
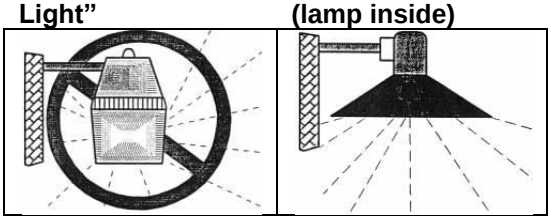
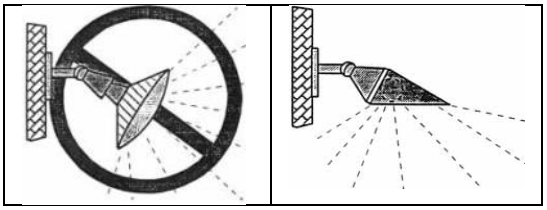
Glare Here's the basic rule of thumb: If you can see the bright bulb from a distance, it's a bad light. With a good light, you see lit ground instead of the dazzling bulb. "Glare" is light that beams directly from a bulb into your eye. It hampers the vision of pedestrians, cyclists, and drivers.

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

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

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

Good and Bad Light Fixtures

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

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

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

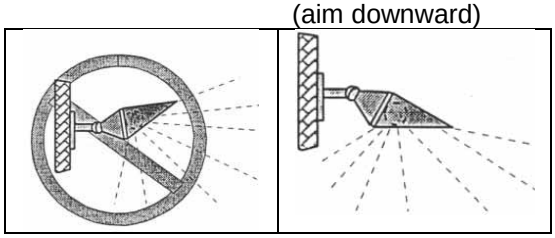
2. Install fixtures carefully to maximize their effectiveness on the targeted area and minimize their impact elsewhere. Proper aiming of fixtures is crucial. Most are aimed too high. Try to install them at night, when you can see where all the rays actually go. Properly aimed and shielded lights may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

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

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

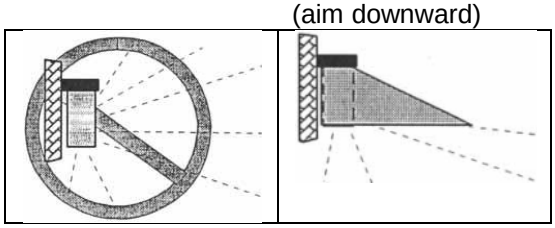
What You Can Do To Modify Existing Fixtures

Change this . . . to this (aim downward)



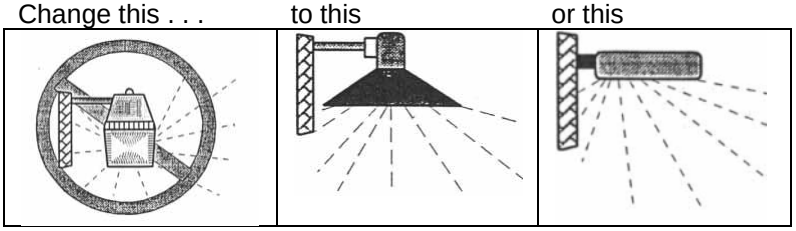
Floodlight:

Change this . . . to this (aim downward)



Wall Pack

Change this . . . to this or this



Yard Light Opaque Reflecter Show Box

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