PROPOSED PHOTO-VOLTAIC FACILITIES NEAR COPPERTON, NORTHERN CAPE: STRUISBULT FARM

DEA REF NR: 12/12/20/2099

Level 3 Visual Impact Assessment

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On behalf of
Mulilo Renewable Energy (Pty) Ltd, Cape Town

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VIA: PROPOSED PHOTO-VOLTAIC FACILITIES NEAR COPPERTON: STRUISBULT FARM

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FIGURES

Abbreviations used in the Report:
Asl : above sea level
PVF: Photo Voltaic Facility
WEF: Wind Energy Facility
Glossary:
Farmstead refers to a habitation, rather than the whole farm.

References
Guideline for Involving Visual and Aesthetic Specialists in EIA Processes. Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning. June 2005

Guidelines for Landscape and Visual Impact Assessment. 2nd Edition, Landscape Institute, Spon Press, UK, 2002
Proposed Photovoltaic Energy Plant on Struisbult Farm near Copperton, Northern Cape, Draft Scoping Report, Aurecon 2011
www.solaria.com

EXECUTIVE SUMMARY

This Visual Assessment Study was carried out in November and December 2011 and it assessed a proposal by Mulilo Renewable Energy (Pty) Ltd, to establish a Photo voltaic installation on a site at Copperton, close to Prieska, in the Northern Cape, South Africa. The site is on Struisbult Farm (Farm No. 104 Portion 1), (also known as Vogelstruisbult), on land currently used for small stock grazing, and 1km away from, and to the east of, the settlement.

There were Alternatives to assess; the Activity alternatives which were a PVF and the 'No Go'; two layout alternatives, the Preferred and the Alternative, and seven Technology Alternatives which were four alternatives for the foundations and support posts, and three Alternatives for the different types of tracking that are being investigated.

The proposed infrastructure that was assessed:

- The installation of photovoltaic infrastructure
- The installation of a transmission line to existing sub-station
- The installation of, *inter alia*, local sub-station, fencing, small buildings, access roads

Of the two Alternative Layouts, the Preferred would generate 100MW over 300ha, and the Alternative 900MW on a site of 900ha. The study considered these proposals, took into account the cumulative impacts of other similar developments locally.

The development would be executed in one phase. Locally, there is a PVF proposal submitted by the same proponent and which has received approval. The assessed zone of visual influence extends up to 5km.

The *Preferred* layout would lie on a site about 1km from the remaining built up area of Copperton, and extend to the south-east of the settlement; the *Alternative* would be more extensive, extending to all compass points and closer to houses.

This development was rated medium for significance of visual impact because it would have a local extent, a long-term duration and a medium magnitude. It changes the rural agricultural character of the locality to one with a high-tech, semi-industrial land use. It was noted that there is local context from the local abandoned Mine, with its remnant visible infrastructure. With increasing maturity of the development its visual significance is not expected to change.

The significance rating for each of the site layout alternatives and for the Technology Alternatives, (tracking) was also medium. The *No-Go Alternative* would have a low significance, as the status quo would not alter.

Visual Statement, Technology:

The tracking option deemed to be most visually significant is the Concentrated dual axis system in which the array will re-orient during each day in two directions. These are complex movements and to receptors would appear hi-tech and unusual within the context of Copperton. The panels may catch and reflect the sun to receptors during certain times of day.

Initially either tracking option impact would be significant but it is anticipated that these developments could be accepted, because they will be seen to operate.

Visual Impact Rating

The study concluded that the overall visual impact of the proposed development would be medium, and recommended the *Preferred* layout for its smaller scale beside a residential area. The development would be shielded to a degree by local tree planting. But the study also assessed the cumulative impact, in the context of the landscape scale the numbers and types of receptors, as *medium for both magnitude and significance*.

It was noted that the semi-industrial nature of a PVF was not incompatible with the industrial uses locally and the transmission lines. A number of mitigation measures was proposed which could moderate that visual impact.

Construction Period:

It is important that the works to deliver the materials, and undertake the construction works on site are undertaken timeously and with due care to the adjacent communities which would be affected visually.

Recommendation

The *Preferred* layout would have a significantly lesser footprint than the *Alternative* layout and is rated less for visual significance. Option 1 has a lesser impact, but Option 2 could be acceptable visually due to the scale and character of the existing receiving environment. Due to the location of the site, and to the small number of potential receptors, the single and dual axis tracking options are acceptable. Therefore it is recommended that from a visual perspective, the *Preferred* layout could proceed, if an Environmental Management Plan would be implemented, and if mitigation measures are undertaken relating to:

Contract time to the minimum
Traffic control measures
Disposal of surplus materials
Location of lay-down areas
Environmental awareness and Environmental Management Plan
Use of non-reflective materials and receding colours
Height, location, finishes of building(s)
Discussions with local people

1.0 INTRODUCTION

1.1 General

Mulilo Renewable Energy (Pty) Ltd proposes to construct a PVF to generate 100MW(preferred) to 300MW (alternative) on areas covering 300ha to 900ha on the Struisbult Farm (Farm No. 104 Portion 1), (also known as Vogelstruisbult), to the immediate east of Copperton of in the Northern Cape.The property is zoned Agriculture Zone 1.

The visual impact assessment will consider these proposals,take into account their cumulative impacts, and also considerother similar developments locally.
Source: Draft Scoping Report, (DSR) Aurecon

Aurecon South Africa (Pty) Ltd, (Aurecon), has been appointed to provide environmental consulting services on this project and has commissioned Karen Hansen, Landscape Architect, as an independent Visual Impact Assessment practitioner to provide this study. The main aspects of this project, involve:

- The installation of photovoltaic infrastructure
- The installation of a transmission line to existing sub-station
- the installation of, *inter alia*, local sub-station, fencing, small buildings, access roads

1.2 Terms of Reference

The scope of the work in this specialist Study is as follows:

- Source and review baseline information.
- Undertake a level 3 impact assessment to include the following areas of study for the Preferred Layout, Alternatives, and the 'No-go' Alternative in a Visual Impact Assessment report
- Identify issues raised relating to visual, aesthetic and scenic resources through any existing reports, baseline studies and framework plans, any public scoping phase, and site visits. The study must take into account the expected community response as well as the applicable South African standards.
- Describe the receiving environment and the proposed project in terms of landscape types, landscape character and land use patterns.
- Describe the sense of place and contributing factors, (spatial and non-spatial).
- Establish the view catchment area, view corridors, viewpoints and receptors
- Determine the relative visibility or visual intrusion of the proposed project
- Determine the relative compatibility or conflict of the project with the surrounding land uses in terms of visibility.
- Determine significant/sensitive receptors.
- Indicate potential visual impacts using established criteria and including:
- _ Potential lighting impacts at night
- _ Consideration of impacts at the construction phase
- _ Consideration of the implications of the phased development

- Describe alternatives, mitigation measures and monitoring programs
- Describe the opportunities and constraints of the alternatives
- Use mapping and photo-montage techniques as appropriate.
- In terms of evaluation criteria, use the criteria specific for Visual ImpactAssessments listed in the Department of Environmental Affairs and Development Planning guideline document “Guideline for involving visual and aesthetic specialists in EIA processes”.

Source: DSR Aurecon

1.3 Methodology

1.3.1 The following sequence of work was employed in this Visual Impact Study

A desktop survey was made using 1:50,000 Surveyor Generalssurvey maps to assess the site setting, to identify landform, landscape and habitation patterns as well as to assess the viewshed.Aerial photography, Google Earth, was used to assist in this part of the study.Terrain analysis software, Global Mapper, was used to start the visual envelope definition process.Adobe photo-shop and CAD software were used to manipulate some images to test the visual effect of the proposed installation.

1.3.2 Written and Drawn Material was made available by Aurecon:

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- Struisbult PV2 Draft Scoping Report 081111.pdf
- Prieska PV plants 2, 3 4
- Possible transmission – Struisbult.kmz
- Examples 1: (Aurecon document describing Technology Alternatives, Tracking).pdf
- Examples 2: (Aurecon document describing Technology Alternatives, Foundations).pdf
- 07-Inverter Sub-station Center.pdf
- 08 Control Center.pdf
- 09 Connection Center.pdf
- Mounting.docx
- 30 MW Alamoosa Photos_June 2011.pdf
- 8700 Spec Sheet.pdf
- Amonix Corporate Presentation02_South Africa_Aug 2011.pdf

Further emails containing clarification of issues. All used as source reference material.

1.3.3 Site Assessment

The receiving site was assessed, and also areas of the locality from where the site appeared to be likely to be visible. This study was conducted during the months of November and December 2011.

- A photographic survey of the site and parts of the surrounding areas was carried out; this determined the extent of the visibility of the site.
- The visual impacts were evaluated using standard criteria such as geographic viewsheds and viewing distances as well as qualitative criteria such as compatibility with the existing landscape character and settlement pattern; referring to The Guidelines, Provincial Government of the Western Cape, Department of Environmental Affairs and Development Planning, June 2005.

- Relevant mitigation measures were considered.

The assessment evaluates direct, indirect and cumulative effects and was undertaken in accordance with defined impact assessment criteria. It includes recommendations for management actions and monitoring programs, measures for avoiding negative impacts, measures for mitigating risk, and compensating for negative impacts.

1.3.4 Determination of the Theoretical Viewshed

The theoretical viewshed has been determined in two ways for this study. First the locality has been thoroughly explored in publicly accessible areas and photographed from places where the view appeared to be significant.

Secondly, Global Mapper software was used to generate a viewshed by inputting the exact position and heights of a representative sample of the infrastructure. Global Mapper is terrain analysis software and as such contains detailed information on the terrain, transportation routes and centres of habitation, but not on lesser elements in the landscape that can delineate a view, such as trees and the height of buildings. The resulting images were useful, but the information they contained was interpreted with information gathered on site.

1.4 Rating Criteria

The following impact rating categories apply:
No significance: evaluation of a potential impact or concern indicates zero magnitude with any combination of extent and duration, i.e. no significant impact at all.

Very Low significance: - 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

Low significance: Impacts have a site specific extent and temporary. Potential impacts result in small-scale alterations to the environment and can be softened by the implementation of effective mitigation measures.

Moderate significance: impacts with a moderate magnitude with a local to regional extent and medium duration. Impacts resulting in average modifications to the environment and can be restricted by the implementation of effective mitigation measures.

High significance: Impact with high magnitude with a local/regional extent and long term duration.

The rating criteria which apply in this study are identified in Addendum 1 and 2. Addendum 1 lists those criteria referred to in material provided by DEA+DP and Addendum 2 lists those developed by the EAP, Aurecon Group.

These categories inform the impact ratings before and after effective implementation of mitigation measures which will take into account the full range of potential impacts under normal and abnormal operating conditions and where appropriate will rate both long-term impacts and short-term impacts associated with the establishment of the proposed development.

Mitigation measures include an indication of how they would influence the significance of any potential environmental impacts. The mitigation measures would be informed by the detailed studies, professional experience and comment received from I&APs.

1.5 Key Issues

Some of the issues relating to visual concerns arising from the assessment of the site and the proposed development will be:

- The potential visibility of the development from the surrounding terrain, residential areas, and transport corridors
- The ability of the landscape to absorb the development
- The technical specifications of all the infrastructure elements
- The potential negative visual impact during the construction phase
- The potential visual impacts at night, in a rural area in terms of glare, light trespass and sky glow, where relevant
- Views under the worst (least visible) and best (most visible) weather conditions
- The potential visual impacts during the life of the project
- The consideration of the alternative layouts and the no development alternative
- Possible Mitigation measures to reduce the impacts

Fig 1.1: The location of Copperton/Prieska, in the Northern Cape, in relation to Cape Town. Source: www.google.com/Hansen

Fig 1.2: The location of Copperton, outside Prieska. Source: www.google.com / Hansen

1.6 Assumptions and Limitations

The information and deductions in this report are based on information received from Aurecon Group.

There will be **two** Site Layouts to consider, **two** Activity Alternatives to consider, (the proposal and the no-go alternative), and **eight** Technology Alternatives to consider.

2.0 PROJECT CONTEXT

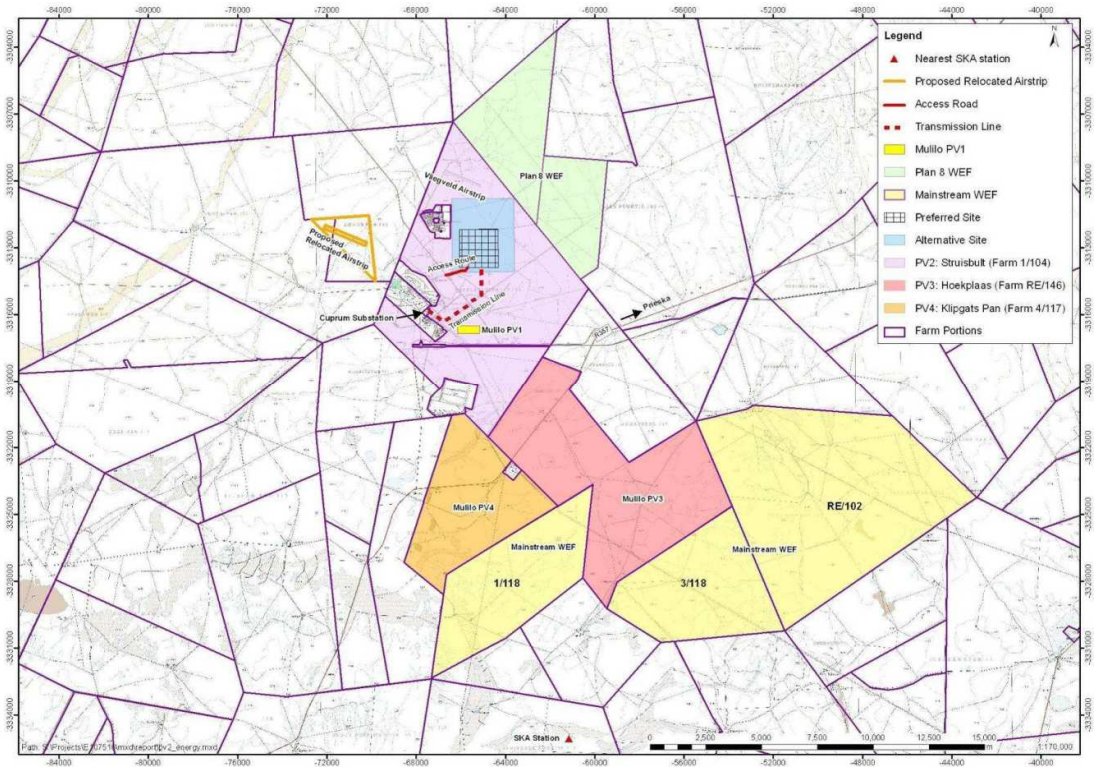

Fig 2.1: This study is assessing the site coloured pink, and developments with a grid hatch and coloured blue. The other colours represent other alternative energy developments locally; WEFs are green and yellow, PVFs are orange and red. Source:DSR, Aurecon

2.1 Overview of Photo-voltaic Energy Facility: Technical Context

This project aims to provide electricity generation from a renewable energy source, to benefit from recently established feed-in tariffs agreed by Eskom. Photo-voltaics (PV) use solar cells to convert sunlight into direct current (DC).

The individual PV cells can be connected and placed behind a protective glass sheet to form a photovoltaic panelA PV system consists of units of cells containing the photovoltaic material, mechanical and electrical connections, mountings and ways of regulating and modifying the electrical output.

Several solar cells are combined into PV modules (solar panels), which are in turn connected togetherinto an array. The electricity generated is fed into the electricity grid. This requires the conversion of direct current (DC) from the PV array into alternating current(AC) by a specialised, grid-controlled inverter. These solar inverters contain special circuitry (transformers, switching and control circuits) to precisely match the voltage and frequency of the grid and to disconnect from the grid if the grid voltage is turned off.

It is intended that the PV panels are treated with an anti-reflective coating to reduce theglare and reflectiveness of the panels to mitigate the potential negative visual impact, (DSR).

2.1.1The advantages of this means of electricity generation are:

- Renewable source of power from the sun, even on days with cloud
- Free of pollutants, and noise, and generally low maintenance
- PV systems have a long life and durability. Cells can last 25-30 years (due to the immobility of parts and the sturdiness of the structure), and, as the system is modular, it can expand if demand increases.
- Less demanding in its location requirements than a wind farm, for example.

2.1.2Proposed Infrastructure

- PV solar panels arranged in arrays, and module mountings
- Connection Centre, building, 5.44m by 2.5m by 2.55m high
- Control Centre, 6m by 10m and 2.55m high
- Guard cabin
- Inverter – Sub-station centre, 8.08m by 3.05m and 2.79m high
- An electrical substation
- Cabling which may be underground or overhead
- Overhead electricity distribution lines (from substation to Eskom sub-station)
- A perimeter fence and internal roadways

Fig 2.2: An example of an individual solar panel similar to those proposed for the development. Source www.odec.za

Fig 2.3.Image of Ray tracker utility scale solar tracker installation. Tech Option 1 Source Mulilo

Fig 2.4 Image of CPV technology Option 2. Source Aurecon

2.2 The Study Area

The Struisbult PV2 Installation would be established on a portion of farmland which extends eastwards from the settlement and north-east of the abandoned copper mine. The site appears flat and open, with long views, and is used for grazing.

South of this site and closer to the mine, the proponent has successfully applied to develop a smaller, 10MW PV installation. The *Preferred layout* of the proposal currently being considered is situated to north of the first, (earlier), application. The site is located at latitude and longitude coordinates 29°55'57.46"S; 22°19'36.94"E.

3.0 PROJECT DESCRIPTION

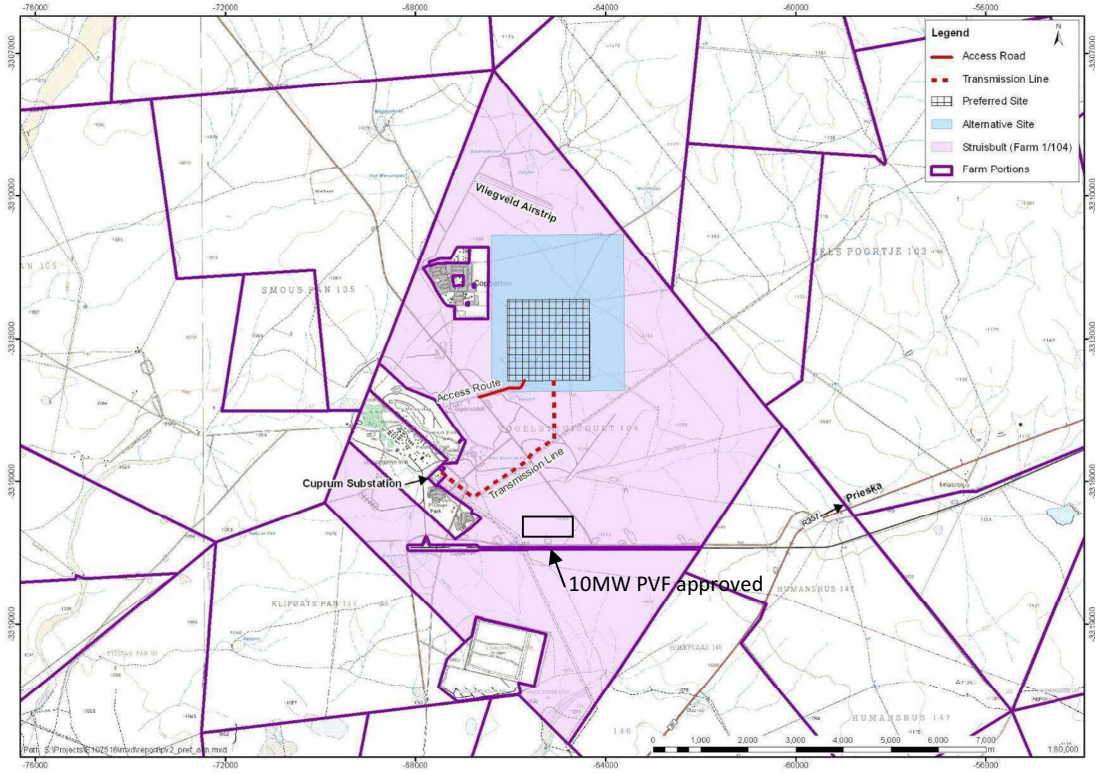

Fig 3.1: The site indicating the location of the *Preferred* layout in grid hatch, and the Alternative layout in blue. The red dotted line indicates the proposed transmission lines; the other red line indicates the access road. The settlement of Copperton is to the immediate west of the proposals. Source:DSR, Aurecon

3.1 Project Description:

The *Preferred* layout installation would generate an estimated 100MW of energy in total. The development area would be 300ha in extent; it is 2.5km to the north of the similar development by the same Proponent, which is at a later stage of Assessment.

This project aims to provide electricity generation from a renewable energy source, to benefit from recently established feed-in tariffs agreed by Eskom. Outline proposals include:

i A series of photo-voltaic panels aligned in a grid and lying due N/S. There are two specifications being assessed in this report. Solar generating infrastructure about 4m high from ground level, (Option 1). Solar generating infrastructure about 15.4m high, from ground level, (Option 2). The foundations for the supporting framework would be cast *in situ.*

ii The rectangular shaped area will be electrified security fenced.

iii A road access onto the site will be from the local Copperton Road.

iv The sub-station will be located where the new 132kV lines exit the site, cables within the site will be buried; power will be transmitted to Cuprum substation 4km away.

v There will be other buildings and internal roadways
vi The installation will not be lit at night, shrubbery will be kept down to less than 30cms in height to avoid interference with the installation.
vii A water supply will be required for both the construction and operational periods.

3.2 Infrastructure: Solar Panels

3.2.1 Layout

The PV panels will be fixed onto a metal framework and face to the north, in long lines, (arrays). There is a fixed distance between the panels and a fixed distance between the rows. The development will be fenced with an electrified security fence. A new under-ground electricity feed will link through to the proposed new site sub-station.

From the south the supporting structure would be visible as a network of metal supports. From the side, (west and east), the support structure and the panels would be seen as a long series of sloping panels. From the front, or north, the front line of panels will be visible, an extensive field of grey or blue-grey sheets with tops of panels behind, if the ground rises. The panels on their framework are modular and a constant height and follow the terrain which varies by about 20m.

The development will not be lit or visible at night. There will be very little, if any,sky-glow or light trespass as the development is comparatively low to the ground and moonlight bounce would be limited. The development will be seen in conjunction with the existing Eskom transmission lines, timber pylons, other possible alternative energy projects, and the existing mine infrastructure to the south-west.

3.2.2 Construction Phase

The proposed facility will be constructed over a period of 18 to 30 months; during which time the land will be cleared of vegetation, and all removed from the site by road transport. Then the foundations and other infrastructure will be constructed followed by installation of the panels.

During the construction phase between 200 and 900 individuals would be employed dependingon the procurement method used, as well as the primary contractor. If non-locals are employedthey may be housed in temporary dwellings on site or in accommodation within Copperton. Therefore there may be a construction camp on site for the duration of the works.

On site between two and five digger loaders/ bulldozers would be required for land clearing and five toten trucks with cranes would be required for the assembly of the facility.

Approximately 450truck deliveries conveying approximately 900 40-foot container loads would be required toconstruct the PV solar facility. These deliveries would be distributed over the 18 to 30 month construction period. Their proposed route is not known at this time, but it is likely that the deliveries will come from Prieska on the N10, to the locality via the R357, and to Copperton via the local road.

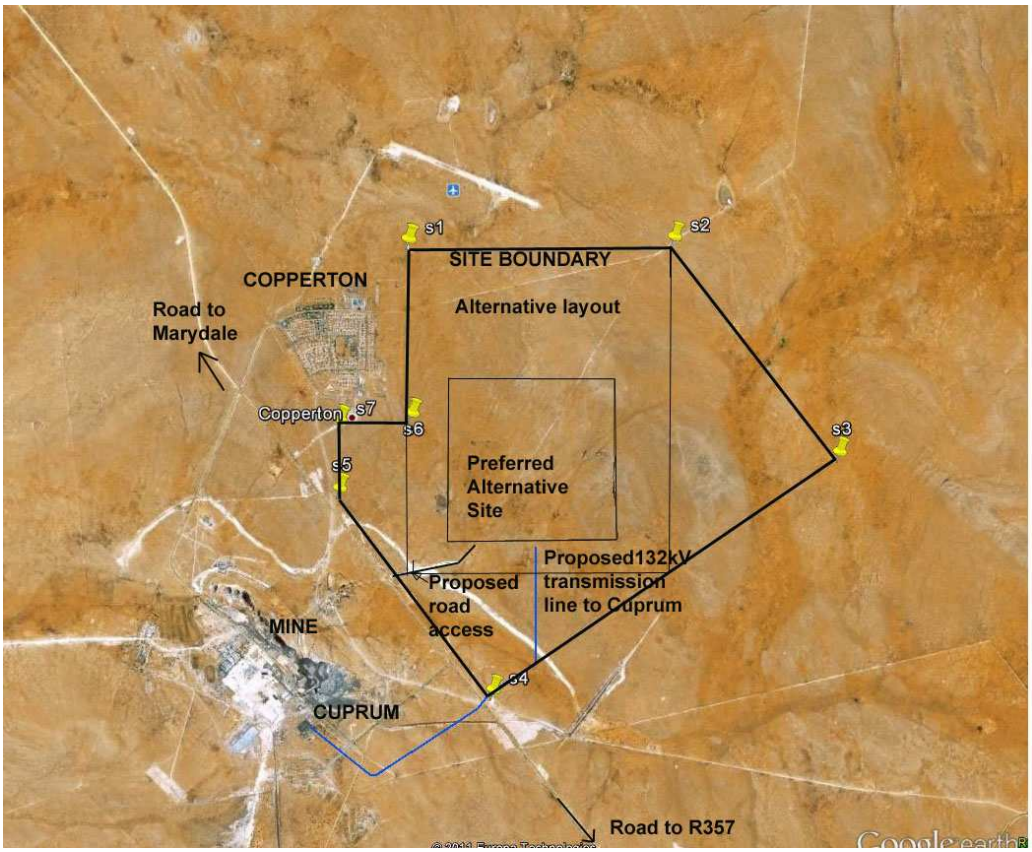

Fig 3.2: The location of the Site, the Preferred layout and the Alternative, in relation to Copperton, the Mine, Cuprum, and local roads. The proposed transmission line is in blue and the proposed road access is noted. Source: Google Earth/Hansen

3.2.3 Operation Phase

The project is expected to last the full period of the Power Purchase Agreement which is approximately 20 years.

The operational phase of the development will not differ in appearance following completion of construction. During the operational period and for the full life of the project, the site will be visited by maintenance crews to clean the panels; (panels would be washed with a water based detergent), and to control the vegetation; the frequency of these operations will depend on the site conditions. (DSR) They will use the same site access road used for the Construction phase. The infrastructure and electricity generation is monitored off site.

3.2.4 Decommissioning phase

The PV site would be decommissioned at the end of the Power Purchase Agreement (20 yearsfrom the date of commissioning). The decommissioning is expected to take between 6 to 12 months. The module components would be removed and recycled as the silicon and aluminium could be re-used in the production of new modules. (DSR). This may result in increased traffic movements on and around the site for that period; it may also result in a construction camp and lay-down area.

3.3 Infrastructure: Transmission lines

An under-ground feed connects to the new on-site sub-station and from thereanew 132kv transmission line would evacuate the generated energy to the adjacent Cuprum sub-station. The proposed 132kV line exits the installation to the south, meets the site boundary then aligns west, crosses the Copperton road directly adjacent to an existing Eskom servitude to Cuprum.

3.4 Alternative Layouts

The development of a PVF is constrained by many technical issues relating to: the location of thePVF in an area where the capacity factor is high – that is, the amount of power that can be generated; the terrain must be suitablewith good access, and the site must be close to Eskom transmission, and distribution network.

It is the opinion of Mulilo Renewable Energy, as advised by their technical consultants that the preferred sites have the optimum layout and specification, hence these preferredsites are being pursued. However the following Alternatives are also presented for analysis in this assessment:

3.4.1 Activity Alternatives:

Solar Power generation via photo-voltaic panels **or** the "No-go" Alternative to solar energy production. The PVF, its roads and pylons, etc., will not be built and the ground will remain unchanged, the visual status quo will remain.The land may be considered for development in the future.

3.4.2 Site layout Alternatives:

Reference to the layout drawing, Fig 3.2, illustrates the *Preferred* layout, and the *Alternative* layout. The *Preferred* layout, 300ha,is placed centrally on the site; the *Alternative*layout, 900ha, occupies a large proportion of the site, including that of the Preferred. Both are close to Copperton.

3.4.3 Technology Alternatives:

3.4.3.1 Mounting of PV panels: Infrastructure

Option 1: Solar generating infrastructure using traditional silicon solar cells of which the total height above ground level would be between 3.5 and 4.4m. Ground clearance level may range from 0.5m to 1.5m The foundations for the supporting framework would be cast *in situ* and could be covered with existing surface material from the site to facilitate low vegetation growth.

Option 2: Solar generating infrastructure using CPV technology, (using refractive Fresnel lenses to focus sunlight), of which the total height above ground level would be a maximum of 15.4m. Minimum ground clearance level would be 0.6m; pedestal diameter would be 0.9m. The foundations for the supporting framework would be cast *in situ* and could be covered with existing surface material from the site to facilitate low vegetation growth. This technology would only use dual axis tracking; it

stows upright at night and would be visible at its highest in the early and late parts of the day.

3.4.3.1 Mounting of PV panels: Tracking

There are various ways to mount the PV panels in order to maximise the area exposed to sunlight for the maximum amount of time. In a fixed axis system the PV panels are installed at a set tilt and cannot move, whereas in a one or two axes tracking system the panels follow the sun to ensure maximum exposure to sunlight.

The following alternative mounting options for the PV solar panels will be considered, and in this study, their visual implications will be assessed:

Fixed axis photovoltaic (a)
Single axis tracking PV (b)
Concentrated dual axis tracking (c).

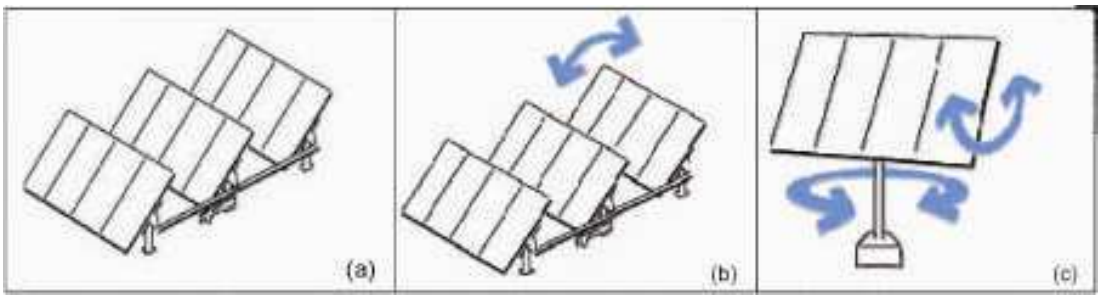

Fig 3.3. Panel mounting Options referred to above. Static, (a), and single axis, (b) refer only to Option 1. Source: DSR Aurecon

3.4.3.2 Foundation alternatives

There are various methods for anchoring PV arrays, but it is important to select the best optiondepending on the soil characteristics of the area; a geotechnical assessment will be undertaken. The followinganchoring options will be considered, (see Fig 3.3) and their visual implications will be assessed in this study:

Isolated concrete bases
Continuous concrete bases
Concrete pile
Thrusted supporting structures.

3.4.4 Summary of alternatives

To summarise, the alternatives to be assessed in this study include the following:

Location alternatives:

One location alternative on Struisbult farm.

Activity alternatives:

Solar energy generation via PVs; and
"No-go" alternative to PV solar energy production.

Site layout alternatives:

Two layout alternatives, (Preferred and Alternative)

Technology alternatives:

Option 1: panels about 4m high using traditional silicon solar cells
Option 2: panels about 15.4m high using CPV technology

Mounting of PV Panels for Option 1:

- Fixed axis photovoltaic;
- Single axis tracking PV; and
- Concentrated dual axis tracking.

Panel mounting for Option 2 is concentrated dual axis tracking

Foundation alternatives for Option 1:

- Isolated concrete bases;
- Continuous concrete bases;
- Concrete pile; and
- Thrusted supporting structure.

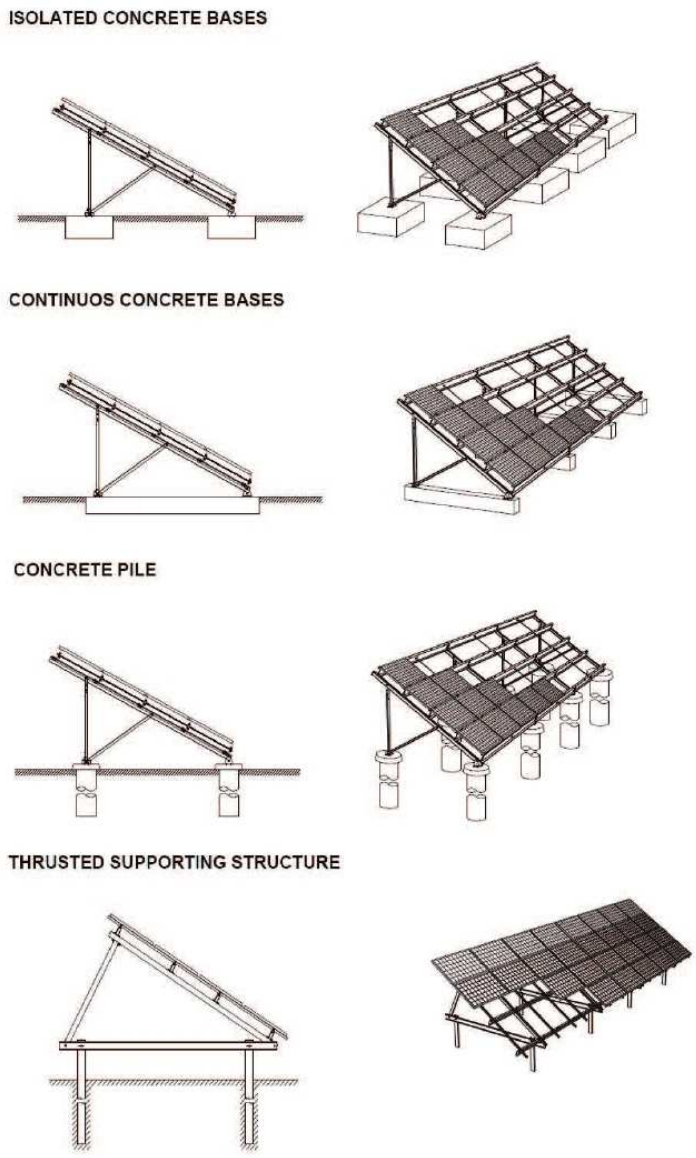

Fig 3.4.Foundation Alternatives, referred to above. Source: DSR Aurecon

3.5Significant Changes to Levels

It is not anticipated that ground levels would vary from those existing; the foundations for the framework supporting the panelswould be placed onto the land.

3.6Access

Access to the south west corner of the development would be gained off the tarred road to Copperton, which in turn, is accessed off the tarred road to the mine, which connects with the R357. The new access road would be less than 1km long, would follow an existing track, and would then connect to other proposed site roads.

During construction, the infrastructure components will be delivered to the site from a port, either Cape Town or Port Elizabeth and driven by road transport, probably via the N10.

3.7Proposed Built Form

There would be the superstructure supporting the panels, distribution boxes, and a site sub-station. There would also be a number of buildings: a Connection Centre, 5.44m by 2.5m by 2.55m high, a Control Centre, 6m by 10m and 2.55m high, an Inverter – Sub-station centre, 8.08m by 3.05m and 2.79m high, and a security cabin. These buildings are likely to be grouped together close to the entrance to the site and, along with the site sub-station, to where the new transmission line evacuates the generated power.

The entire site would be fenced with electric fencing to prevent illegal trespassing and livestock from roaming between the PV arrays and causing accidental damage,(DSR).

3.8Proposed Landscape Treatment

Vegetation would be retained, and kept at a maximum height of about 300mm300mm, but the ground may be maintained as completely clear.

3.9Services

Water required during the construction period and the operational period would come either from new local boreholes on the site or be piped in from the town's municipal supply. Therefore there may need to be a pipeline and water storage facilities on the site.

4.0NATURE OF THE RECEIVING ENVIRONMENT

4.1 General

Landscape Character is the distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this pattern is perceived. It reflects particular combinations of geology, landform, soils, vegetation, river systems, land use and human settlement. It creates the definite sense of place of different areas of the landscape.

4.2 Location and Routes

The community at Copperton was established for the copper mine. Copperton is 13.4km by tarred road from the R357, and from that point to Prieska, is about 50km. Prieska is located on the N10. The local roads are either tarred or gravel, and in good condition. The R357 continues south, after Copperton, to Vanwyksvlei, a small community 72kms away. There was a railway line to serve the Copperton Mine, but it was abandoned and removed about 10 years ago.

There is a local airfield, about 2.5kms to the north of the town, and used regularly by people working at Alkantpan, (source: Pers comm. Mrs H Meyer) and occasionally by recreational users, (source, Aurecon). It would be within 4km of the development site. There are plans to relocate this airfield to Alkantpan. There is a small civilian airport at Prieska.

At Alkantpan, 5 or 6 km to the west of Copperton, ammunition is tested by many parties, both local and international. This facility is on Government land, is long established, and is likely to continue for the foreseeable future.

Copperton and its surrounds are therefore quite remote. The mine is now closed and, without the rail line to transport mined ore to Okiep for smelting, may not reopen.

4.3 Copperton

Originally a small settlement, (1.5 km^2 in extent), compact, and laid out in a grid pattern, to serve the mine; there were single storey houses built for married quarters and a barracks constructed for single quarters. The majority of the houses were demolished along with their services infrastructure when the mine closed. There are about 42 houses remaining, the resident population is around 70 people, none is owner occupied, all are rented. The people are mainly retired, but a few work at Alkantpan, a few work at IetsNeitz and a few own and work on local farms but live in Copperton.(source: Pers. Comm. Mrs H Meyer).

All the buildings are single storey; the vertical elements are provided by garden trees, telegraph poles and the un-used, tall lighting structures. There used to be community facilities here, rugby fields and a drive-in cinema for example, but these are derelict. There is one small shop, but no clinics, etc. Some roads are tarred; some are surfaced in material from the slag heap, which is black.

There is tree planting in the gardens, (6 to 9m in height, pines, gums, acacias and ornamentals); there is a wide, but low and open, strip of trees and shrubs along the eastern boundary, relating to derelict erven, which provides an indication of the original built-up edge.

The area has a low-key tourism profile, and is mainly visited by the residents, the users of Alkantpan and local farmsteads.

4.4 The Mine

The Mine is disused, about 4km from the site, and occupies an area of about 4.5 km^2. The remaining built structures are the mineshaft, a tall, handsome structure; a large, tall, concrete shed stands beside it and a series of large concrete storage tanks adjacent. There are tall, unused, lighting pylons. There were two residential areas, but all the houses, except for one small apartment block, have been demolished. There are some workers still living there. There is a large 4-5m high slag heap, and other piled and ridged materials on the site. The railway halt at the end of the line and the railhead still stand, although much of the line has gone.

Cuprum sub-station, built to serve the mine, still operates; the transmission lines feeding in and out of it link to the major switching-station at Kronos several kilometres to the south, and thence to the national grid.

The ground in and around the mine is of no use to agriculture, covered in concrete and other debris; scrubby trees are encroaching. The mine is closed to the public, and is not believed to be a source of attraction for industrial or mining archaeology, and therefore, tourism.

4.5 Alkantpan

Located 6km on a gravel road to the south west of Copperton, and extends out to 9km away. A high security area with low concrete bunkers and low observation buildings. No residential component to the installation; people visit only to work.

4.6 Farmsteads

There are scattered farmsteads locally, all widely spaced and not all are still regularly inhabited. None are on the site, but there is one, (off the Marydale road), which is within the area visually impacted upon.

4.7 Topography Rivers and Climate

The main geographic features defining the development site locality are the wide, almost flat to slightly undulating, open spaces, big skies and sparse settlements. The site lies between 1075m and 1100masl; Copperton at approximately 1085masl, the mine at 1075m asl, Alkantpan at 1060m asl. The land slopes down gradually from the N10 in the north-east, (1200m asl), towards the south west.

Gradients across the site, north-east down to south-west, range from 1:75 to 1:100; slope analysis of the local terrain shows that there are gently downward valleys carrying seasonal

streams and separated by equally gentle upward ridges. There is a seasonal watercourse through the site which makes its way through the area of the Mine.

The local area lies at an interface between the Namaqua metamorphic provinces and the Kalahari group, and where there is a fault line. (Source Simplified Geology, Council for Geoscience, August 2003).

This is a low rainfall area, (205mm per year on average, source: DSR, Aurecon), and fires can be prevalent in the dry season, (source: Pers Comm Mr M Meyer); the wind comes from all compass points, but predominately are northerly.

There are no perennial rivers locally, but during the rains, there are seasonal watercourses evident. Artesian water is available from boreholes on farmsteads; most of the Copperton community uses municipal water from Prieska.

4.8 Vegetation

There are grasslands and scrub on the site; there are few trees locally, apart from those planted around Copperton and those at farmhouses. There are sporadic bushes to 1m in height but most of the scrub is lower; the road verges are grassed. There are yellow-green grasslands with grey scrub interspersed with the pale brown roads. In winter the grasslands are dry and many of the trees are bare.

The vegetation type in the locality is Bushmanland Basin Shrubland and it is considered to be Least Threatened,although it is not well conserved. This vegetation type occurs on slightly irregular plains with dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs and grasses. In years of high rainfall annuals are abundant (DSR: Mucina and Rutherford, 2006).

4.9 Agriculture

The dominant land use locally is agriculture, (apart from the area given over to munitions testing). There is pasture mainly for sheep and goats, and for a few cattle, there are some fodder crops. All the stock requires supplementary feeding all year. The large fields are mainly defined by fencing. There are infrequent small dams fed by seasonal rainfall, and wind pumps.

4.10 Other Land Uses

Apart from land being used for residential, agriculture, and transmission lines, there are a number of renewable energy projects within the Copperton area in various stages of approval, including Mulilo's approved 10 MW PVF close to the Mine. Two additional 100MW PVFs are being assessed to the south of the mine at Hoekplaas and at Klipgats.

A 140MW, 56 turbine, WEF is being assessed on the erven to the immediate north west of thisstudy area. A 190 turbine WEF which will occupy two sites between the R357 towards Vanwyksvlei and the R386 to Carnarvon has received approval. The proponent for this development is Mainstream Renewable Energy.

4.11 Landscape Character

The character of the landscape is defined as open, flat, remote, sparsely populated land, typical of the rural open plains of the Karoo. Vertical elements in the landscape are the lines of transmission pylons leading to and from existing sub stations, telegraph poles, the mine shaft and other tall, bulky, remnant mine buildings. These bring some industrial character into this rural area.There are no formally protected areas in the vicinity.

Views are very long and open to all compass points.

4.12 Landscape Value

A landscape may be valued for many reasons, which may include landscape quality, scenic quality, tranquillity, wilderness value, or consensus about its importance either nationally or locally, and other conservation interests and cultural associations.

This site landscape has value for its use for grazing; the site does not have a strong or identifiable sense of place.Measured by its accessibility and the absence of settlement, it would be valued for a degree of scenic remoteness.

4.13 Visual significance of the area

There is little in the local landscape to provide visual definition and a visual signpost to signal the exact location of the development site, until a receptor would be close enough, say within 5km, to see Copperton. The flatness and sameness of the local landscape results in the sites' definition fading away at its edges and blending with other flat open areas on most sides; with the exception of the side adjacent to Copperton.

This is a completely uncluttered landscape; even the clutter of the mine and of the settlementis set in a landscape of such a scale that they barely form a visual focus. The overall visual impression of the locality is one of an open, flat, rural, landscape with some industry, offering long expansive views.

Fig 4.1: Existing 132vV lines and other pylons locally, around Kronos. Source: Hansen

5.0 VISUAL IMPACT ASSESSMENT

5.1. The Viewshed Envelope definition

This refers to the theoretical outer-most extent of the area from which an object, (in this case the whole development site), may be seen. Visibility can be obscured in part or in whole by objects within the viewshed such as existing buildings, trees, or landform.

Objects can also appear to be obscured by distance, where an object can seem to blend into its background by virtue of the distance between it and the viewer. In this part of the study the viewshed for the whole of the development site is defined.

5.1.1 Information from the Proponent

Option 1 Final design has not yet been undertaken but the proponent is expecting the maximum height of the tracking arrays to be below 4.5m; (taken for the purposes of this study to be between 3.5 to 4.2m). The image, (Figure 2.4), in paragraph 2.2, was provided by the proponent and is of the preferred design which is below 2m in height. The height will also be affected by the Technology Alternatives, (mountings and foundations) that will be assessed.

However as the Viewshed is influenced by the total height of the proposed PVF, a height of 3.8m has been taken as likely to apply to the alternatives. A distance of up to 5km has been taken as the maximum distance of visual significance.

Option 2 The height of CPV technology, as stated before, is 15.4m high, 22m across.

5.2 View Catchment Areas

Views of greatest significance are those from transportation corridors, from local places of habitation and work.

- The development site and peripheral areas
- Copperton
- Road transport corridors.
- The Mine

The viewshed envelope is therefore defined partly by views from transport corridors, existing places of habitation and employment, and topography.

The degree of visual influence within the View Catchment Area is considered to be moderate as the development would only influence the view and act as a visual focus, within a 4 to 5km radius, (locally).

Viewshed images:
Figure 5.1: Option 1 (technology) *Preferred* layout
Figure 5.2: Option 1 (technology) *Alternative* layout
Figure 5.3: Option 2 (technology) *Preferred* layout
Figure 5.4: Option 2 (technology) *Alternative* layout

5.3 Viewsheds

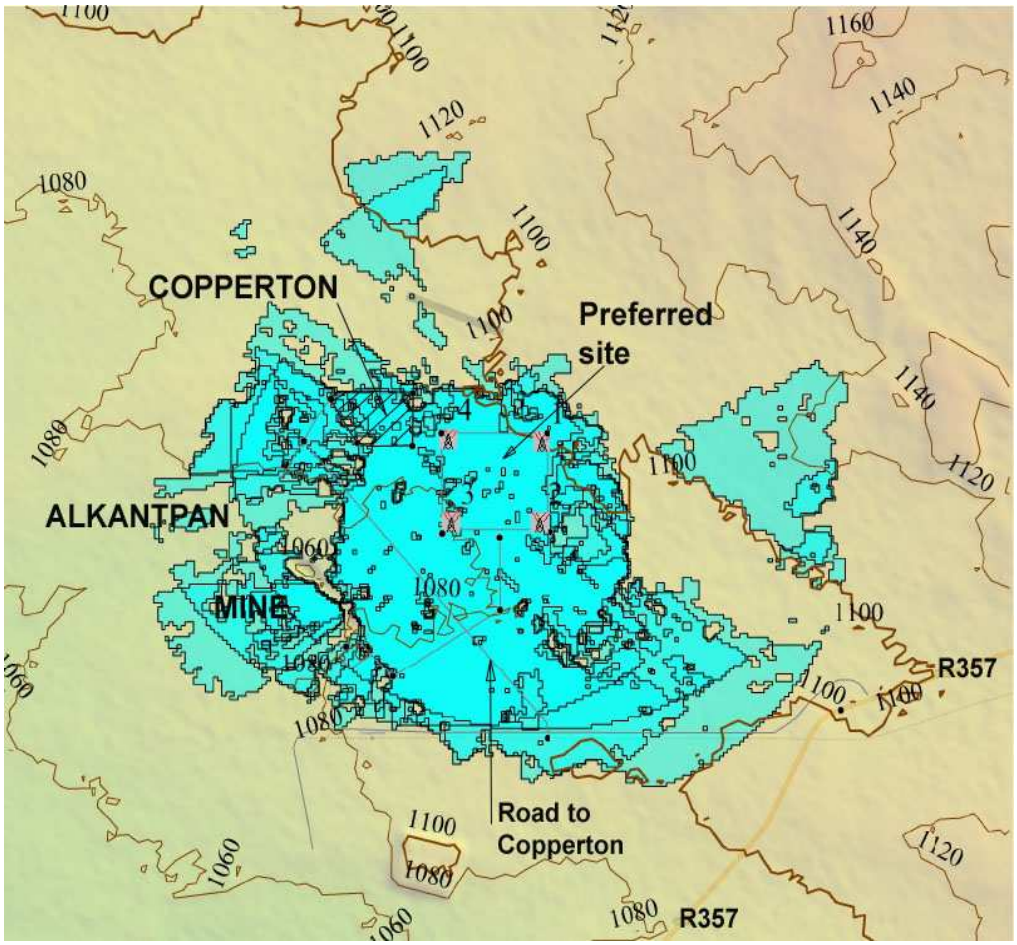

Fig 5.1: **Option 1**Visual envelope calculated at a radius of 5km from the proposed *Preferred* installation, showing contours at 20m,and showing the locations of receptors.

5.3.1 Areas affected:

- The development site, and lands beyond
- Copperton, (hatched area)
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine

Description:

- The site environs would be affected, and similar lands within and around the site boundary
- The affect on Copperton was tested on site and it was observed that it was shielded by intervening scrub and trees around the settlement.
- A clear view of the site will be obtained from the road to Copperton.
- An intermittent view will be obtained from the Mine.

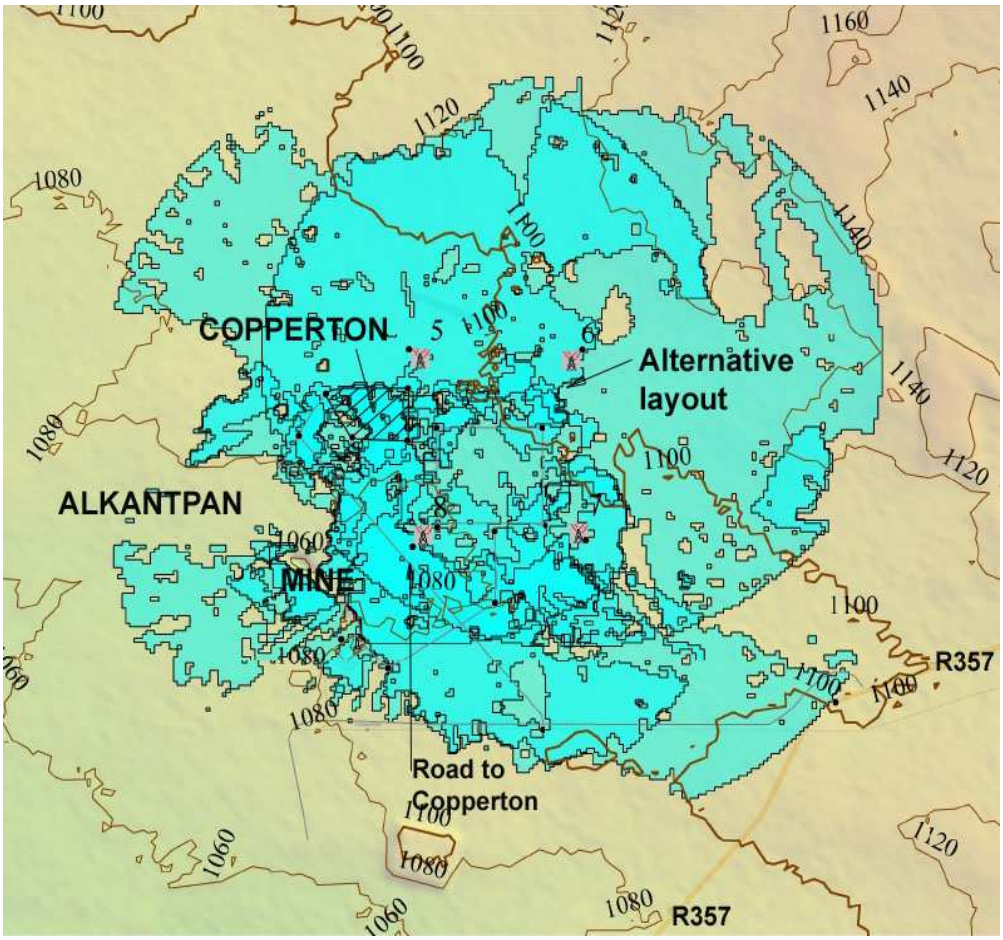

Fig 5.2: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Alternative* installation, showing contours at 20m, and showing the locations of receptors

5.3.2 Areas affected:

- The development site, and lands beyond
- Copperton, (hatched area)
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine

Description:

- The site environs would be affected, and similar lands within and around the site boundary
- The affect on Copperton was tested on site and it was observed that it was shielded by intervening scrub and trees around the settlement.
- A clear view of the site will be obtained from the road to Copperton.
- An intermittent view will be obtained from the Mine.

The Alternative layout is three times the extent of the Preferred, and its zone of visual impact is significantly greater.

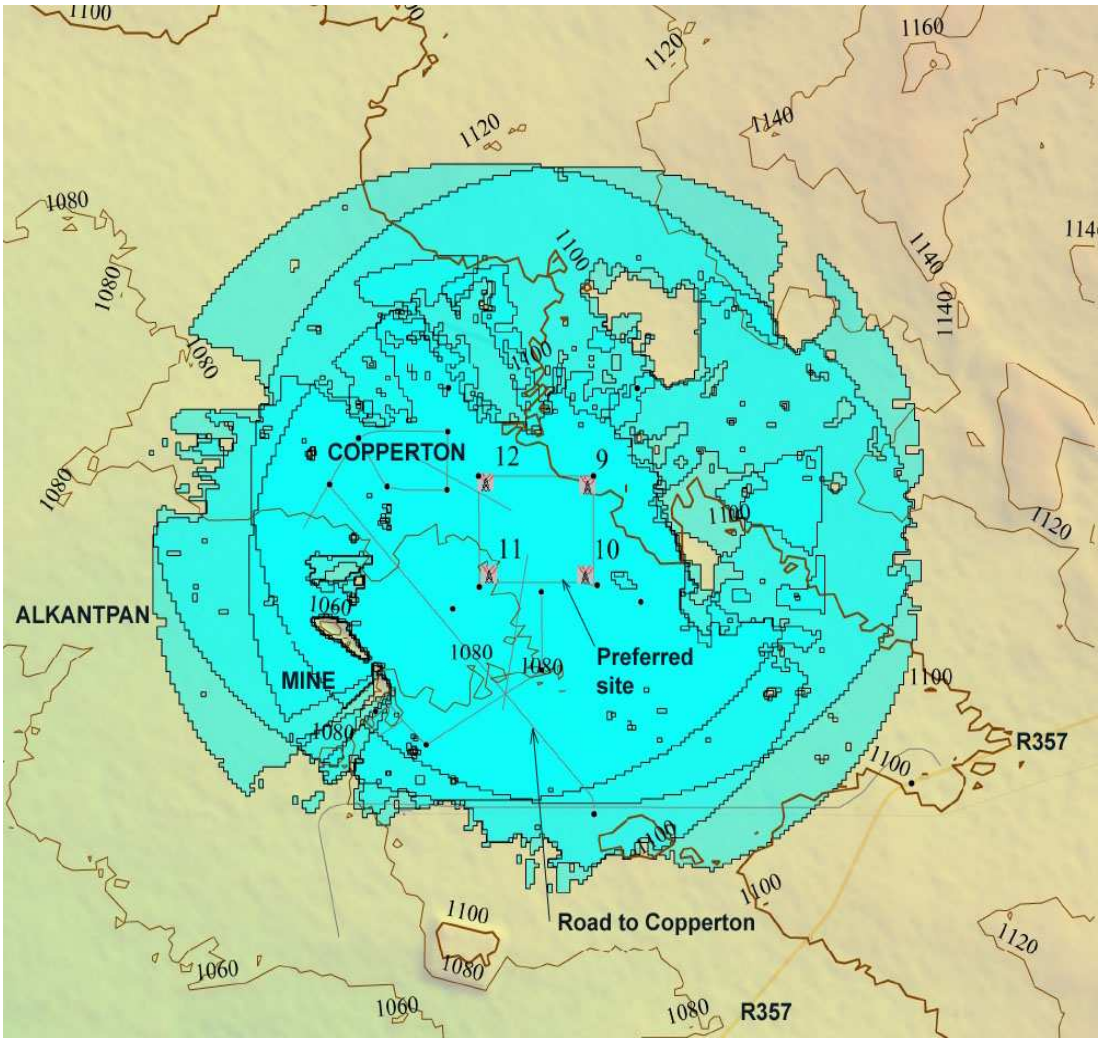

Fig 5.3: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Preferred* installation, showing contours at 20m, and showing the locations of receptors.

5.3.3 Areas affected:

- The development site, and lands beyond
- Copperton
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine and part of Alkantpan

Description:

- The site environs would be affected, and similar lands within and around the site boundary
- The affect on Copperton was tested on site and it was observed that it would be partially shielded by intervening scrub and trees around the settlement.
- A clear view of the site will be obtained from the road to Copperton.
- An intermittent view will be obtained from the Mine.

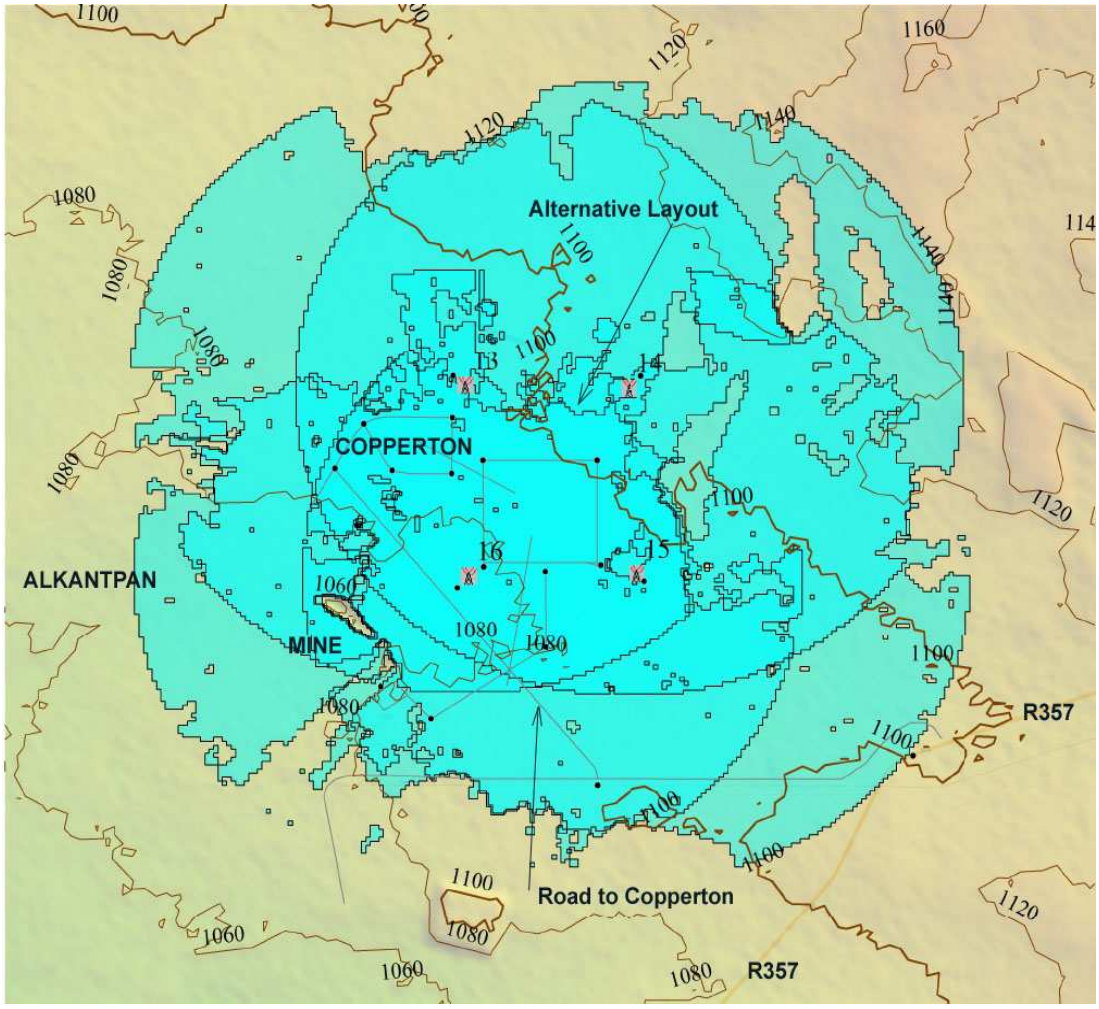

Fig 5.4: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Alternative* layout installation, showing contours at 20m, and showing the locations of receptors

5.3.4 Areas affected:

- The development site, and lands beyond
- Copperton
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine and part of Alkantpan

Description:

- The site environs would be affected, and similar lands within and around the site boundary
- The affect on Copperton was tested on site and it was observed that it would be partially shielded by intervening scrub and trees
- A clear view of the site will be obtained from the road to Copperton.
- An intermittent view will be obtained from the Mine.

The Alternative layout is three times the extent of the Preferred, and its zone of visual impact is significantly greater.

5.3.5 Extent of *actual* visibility of the proposals against *potential* visibility

Metadata extracted from the terrain analysis software gave the following data for the individual portions of the photo-voltaic layout assessed as a representative sample. This figure expresses the area of land visually affected by the proposed development as a percentage of the overall sampled area; so a low percentage means that that portion of the installation affects a smaller proportion of the locality.

As the ground level height of the installation also plays a part in the extent of its visibility, heights in metres above sea level (asl) are also given.

Table 5.1 Actual visibility as a percentage of potential visibility. Fig 5.3 shows location of sampled points.

PV point	**Height in m asl**	**Percent visible Option 1**	**Percent visible Option 2**	**Analysis**
PV point 1 Preferred (NW)	1090	39.7%	82.3%	Least visible
PV point 2 Preferred (NE)	1102	50.6%	93.4%	Least visible
PV point 3 Preferred (SW)	1090	48.4%	80.8%	Moderate
PV point 4 Preferred (SE)	1079	37.9%	65.8%	Least visible
PV point 5 Alternative (NW)	1 094	51.6%	81.4%	Moderate
PV point 6 Alternative (NE)	1 114	77.5%	94.6%	Most visible
PV point 7 Alternative (SW)	1 090	41.4%	78.9%	Least visible
PV point 8 Alternative (SE)	1 078	41.4%	68.3%	Least visible

This shows that the section of the installation that has the greatest visibility, (though not necessarily to the most receptors) is the northern portion of the *Alternative* Layout; this affects agricultural areas. The remainder of the Option 1 installation would have a moderate visual impact in terms of potential area affected. Option 2 installation would have much greater visibility.

5.3.6 General Conclusions

An over-view of these visual envelopes for Option 1 indicates that they are all, statistically within a similar band of visibility, with the small exception of the northern portion of the *Alternative* layout. The height of the Option 2 infrastructure and the openness of the landscape combine to explain the greater impact.

Option 1: mean visibility is 48.5% of the sampled areas are visually impacted upon.
Option 2: mean visibility is 80.7% of the sampled areas are visually impacted upon.
The greater extent of the Option 2 visual envelope (66.4% more visible) can be attributed to the increased infrastructure height.

5.4 Cross Sections

To assist in the understanding of the viewshed, cross sections have been drawn through the site, from Copperton to the sites and from the road to the sites. These cross sections are at a scale of 1:4 horizontal to vertical. They show the relationship between the site and its environs.

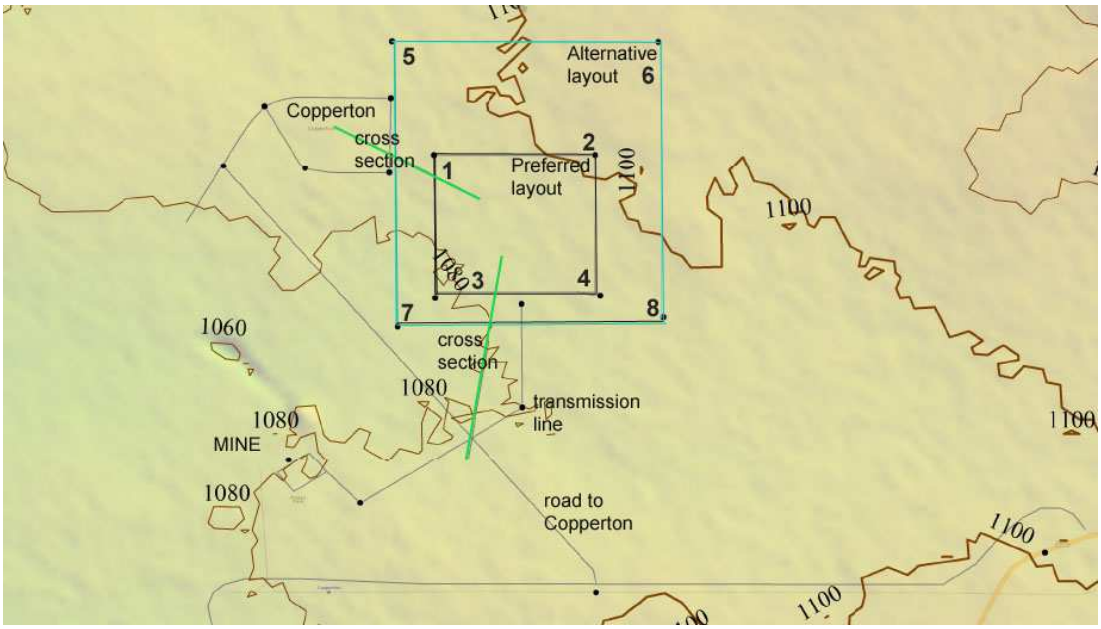

Fig 5.5: Location of two cross sections shown in bright green; from Copperton to the site, and across the road to the site. The extent of the *Preferred* and the *Alternative* layouts are also shown along with Copperton, the road to the settlement and the sampled points.

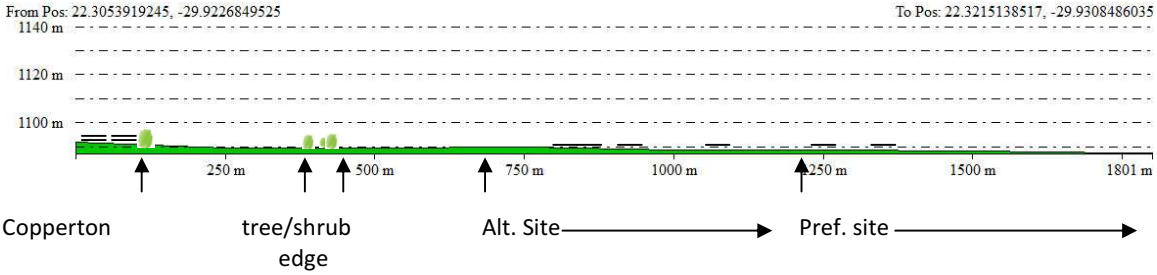

Fig 5.6: Option 1: Cross section Copperton to the sites. There is tree planting among the housing and at the edge of the settlement, which would screen the proposed development.

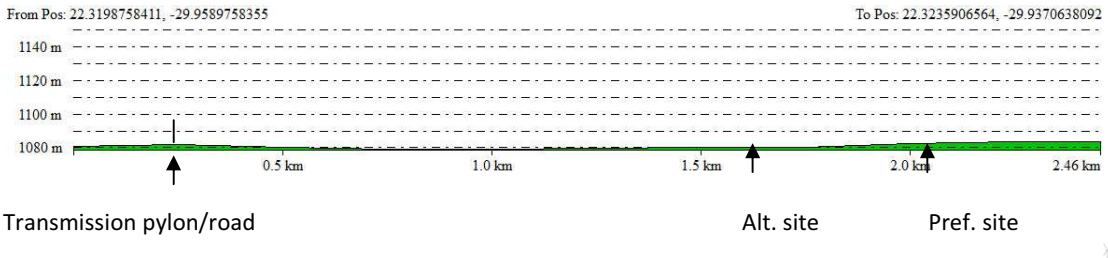

Fig 5.7: Option 1 Cross section from the road connecting the R357 with Copperton; the new transmission line will cross the road. There would be a clear and open view from the road of the development.

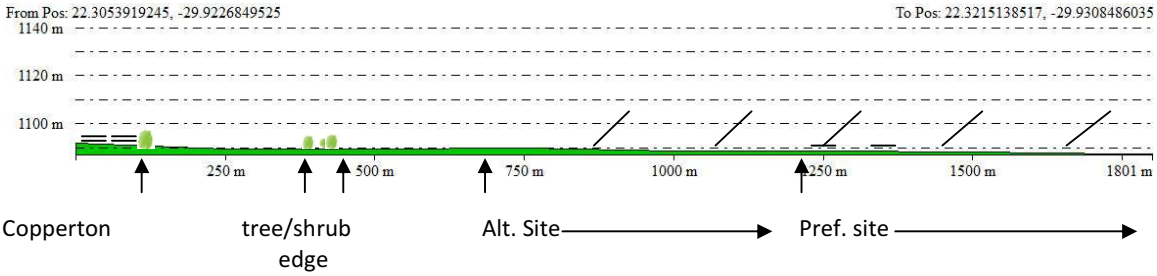

Fig 5.8: Option 2: Cross section Copperton to the sites. There is tree planting among the housing and at the edge of the settlement, which would partially screen the proposed development.

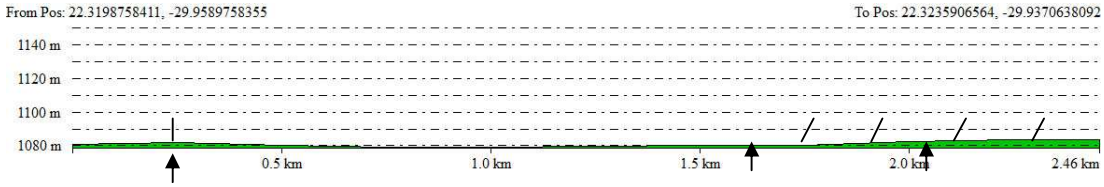

Fig 5.9: Option 2 Cross section from the road connecting the R357 with Copperton; the new transmission line will cross the road. There would be a clear and open view from the road of the development.

5.5 Description and Comparison of Alternatives

The physical form that the development will take has been described in preceding paragraphs. Under these paragraphs the elements of that development relating to the Alternatives are noted.

5.5.1 Activity Alternatives

Two Alternatives based on proposed site usage: *Preferred activity* is a PVF, or solar farm. *Alternative activity* is No-Go, (no development) and remains rural land.

5.5.2Site Layout Alternatives

Preferred layout is designed to generate 100MW in an area of 300ha. The site for the *Alternative* layout is more extensive, designed to generate 300MW in 900ha; it would occupy, and extend beyond, the *Preferred* site, and would be closer to Copperton.

5.5.3 Technology Alternatives.

Option 1: relating to the use of traditional silicon solar cells in panels about 4m high.
Option 2: relating to the use of CPV technology in a fewer number of larger panels about 15.4m high, and 22m wide.

Option 1: relating to the mounting of the PV Panels and whether they are static or they move:

I. Fixed axis photovoltaic which is static, the panels do not move
II. Single axis tracking which provides for the panels to orient in unison with the passage of the sun across the sky from east to west

III. Concentrated dual axis tracking which provides for the panels to orient in unison not only with the passage of the sun from east to west but also to follow the sun as it appears to rise in the sky

5.5.3.1 Fixed axis photovoltaic

The panels in their arrays will be static; they will have the same appearance whenever they are seen.

5.5.3.2 Single axis tracking

This installation will appear to follow the passage of the sun by orienting from side to side, facing towards the east, and eventually moving to face towards the west.

Any element in the landscape that moves is judged to be more visually evident than an element that is static; this will apply equally to a PVF. The rate of movement would be, on average, equal to that of the passage of the sun across the earth's surface. Due to the extent of the proposed development there would be awareness of panels facing in a certain direction in the morning and in another direction an hour later, and so on through each day. If the installation realigns on a continuous basis through the day, it could be akin to watching a shadow move.

However many tracking installations realign at certain times of the day, and that is when there would be a greater visual impact as the entire field of panels will, to the observer, suddenly re-orient. It is understood that the visual impact while great at the outset, reduces with time as receptors habituate to the visual effect. The panels would be seen to glint with reflected sunlight intermittently.

5.5.3.3 Concentrated dual axis tracking

These panels will orient side to side but also tilt up and down in a parabola. The movement is more complex but will also be at the same pace, of the passage of the sun. The overall visual impact is however expected to be greater as the movements are more complex providing for the panels to appear thin and thick, facing down and up. In the middle of the day the panels will face to the sky and there will be more light seen below them; the installation may appear to float. Realignment of the field of panels at certain times would have the same impact as described in the preceding paragraph.The panels would be seen to glint with reflected sunlight intermittently.

Option 2 panels are designed to only operate by dual axis tracking.

Option 1: relating to the various methods of constructing Foundations:

I. Isolated concrete bases which are pad foundations at each support
II. Continuous concrete bases which are trench foundations at each pair of supports
III. Concrete piles which are pads smaller in footprint and deeper into the ground
IV. Thrusted supporting structure which has the smallest footprint

5.5.3.4 Isolated and continuous concrete bases

The visual implications of concrete bases (I and II), whether isolated or continuous, is assessed on the basis of the degree of visible ground disturbance after construction. The more the

ground disturbance is visually evident, the greater the impact. The Continuous bases are slightly greater in scale and therefore would have a slightly greater visual impact.

5.5.3.5 Piles and thrusted structures

The visual implications of concrete piles and thrusted structures would be assessed as having less impact as they are smaller in visible plan form and there is less ground disturbance.

It is the scale of the foundations in plan formwhen the installation is viewed as a whole which is what is assessed in this study and the conclusions are:
Options III and IV have the least impact due to apparently lighter structure.
Option I would have a lesser impact than option II.

It is the panels and their supporting framework that has the greater visual impact for receptors.

Option 2: relating to the Foundations: these panel modules are supported by a pedestal, root fixed into a concrete foundation below ground.

5.6 Visibility of the Proposed Development

5.6.1 General

As images taken from viewpoints evidence, the sites visibility up to 5km has been tested on site. Viewpoints experienced from further away became limited due to intervening features and distance; the zone of **theoretical** visibility was tested beyond 5km but there was little or no visual impact to assess at that distance.

The degree to which the development is visible is determined by the height of the infrastructure and the extent of the area under development, but is moderated by:

- distances over which this group will be seen.
- weather and season conditions
- built form, trees, and terrain

Factors affecting visibility are the open aspect of the site and the surrounding land uses and land cover. It is the overall visibility of the development site that is being examined and the scheme is appraised as a whole.

The key issues are:
Visual effects: does it make a difference visually if the photo voltaic installation is in an area of existing visual clutter or in an area where it creates new patterns or acceptable clutter?
The site is in an area of no visual clutter; the development would bring some clutter to the view.

Visual order: specific arrangements of objects recognisable as a pattern. Visual disorder – where it is not possible to perceive a pattern. *The site offers no visual order or disorder, it is a simple landscape*

Visual composition: which is a deliberate arrangement of objects in a view in order to achieve a particular visual relationship, (e.g., placing arrays only where they will be back grounded).*The site itself offersno visual composition opportunities.*

5.6.2 The localities from which the development will be seen are:

- The development site, and lands beyond
- Copperton
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine

5.6.2.1 The development site

Development would be visible to receptors on the site who will be people directly involved with the installation and any people working on the land adjacent.

5.6.2.2 Copperton

Close enough to be impacted upon, but partially shielded by the many trees around the remaining houses, and dotted around the edge of the previously built up area.

5.6.2.3 Local roads

Because of the flat open landscape, clear views will be obtained from the roads from the R357 to both Copperton and the Mine.

5.6.2.4 Mine

There are remnant buildings and spoil heaps which intercept the view; but only one of the apartments is lived in.

5.6.3 Construction Period

5.6.3.1 Large scale of proposed works

The extent of the visual envelope, (viewshed), will be materially affected by the construction period, as the construction access would be off theR357. There could be 450 truck deliveries, and/or 900 40'container loads. Other developments are being considered locally and there may be economies of scale but it is noted that there will be many deliveries of components.

5.6.3.2 Impact on the site and environs:

Construction traffic may start by upgrading the site accesses, constructing new site roads, excavating for foundations, etc. The works would involve excavations, provision of services, construction of concrete foundations, and installation of all above ground infrastructure.

There would be increased traffic movements especially of heavy construction vehicles; and there may also be a visible lay-down area(s) within the development site. These would be at their most visible within 2km, especially as construction plant is often fitted with warning lights and sounds.

5.6.3.3 Impact beyond the site

Road haulage via the R357, from Prieska on the N10; these local roads carry light traffic, therefore there may not be much visual conflict with local traffic.

5.6.4 Comparison with other layouts

5.6.4.1 *Activity Alternatives*: As the visual envelope is defined by the edge of the development site, the visibility of the *no-go alternative* is deemed to be constant.

5.6.4.2 *Layout Alternatives:* As the *Alternative* is closer to the residential centre it is deemed to have a greater visual impact than the *Preferred*.

5.6.4.3 *Technology Alternatives*: Option 2 is higher than Option 1 and is therefore deemed to have a greater visual impact. The foundation/fixing alternatives are deemed to have equal visual impact; the tracking options increase in visual impact with complexity of movement.

5.7 The Extent of the Visual Impact

Rates the impact in terms of the geographical area that will be influenced by the visual impact, as follows:

- *no impact: no visual impact*
- *site specific: on site or within 100m of the candidate site*
- *local: within a 10km radius of the candidate site*
- *regional: beyond a 10km radius of the candidate site*

5.7.1 The extent of the impact

The extent of the impact is local. The extent to which the major infrastructure is considered visible in clear weather conditions is taken to be up to 5km and has been tested both on site, and theoretically, to that distance.

5.7.2 Extent varies with available light

The visual Impact is assessed in optimum weather conditions when there is good visibility, i.e. non – rain days from sunrise to sunset. The extent of the impact will be reduced in poor light, induced by time of day, (dusk and dawn) haze or dust in the air, and rain.

It is anticipated that during times of less than optimum weather conditions, the extent of the visual impact could reduce below5km to around 3 to 4km.

5.7.3 Extent of Impact of Alternatives

The extent of the impact of the *No-Go Alternative* is rated as having zero impact
The extent of the impact of the *Preferred* layout, Option 1, is rated at local
The extent of the impact of the *Preferred* layout, Option 2, is rated at local
The extent of the impact of the *Alternative* layout, Option 1, is rated at local, (a greater distance affected due to a more extensive base area).
The extent of the impact of the *Alternative* layout, Option 2, is rated at local, (a greater distance affected due to a more extensive base area).

5.8 Visual Exposure

Visual exposure refers to the visibility of the project site in terms of the capacity of the surrounding landscape to offer screening. This is determined by the topography, tree cover, built form, etc.

- *no exposure: the site is hidden by topography, planting, etc*
- *low: the site is largely hidden*
- *medium: the site is partially hidden*
- *high: there is little in the surrounding landscape that can shield the development from view*

There only elements on the site itself and directly adjacent to the site which affect visual exposure are topographical. They are considered as follows:

5.8.1 Elements **on** the Site which affect Visual Exposure, both layouts

Topography: the site is gently undulating, in a landscape of this scale it appears flat.

Tree Planting and Built form: there is none on the site, which would provide any shielding of the proposed development.

5.8.2 Elements **beyond** the Site which affect Visual Exposure, *Preferred* layout

Topography: rising ground to the north-east offers some containment to the site. Copperton is at a similar elevation and so lands to the north-west, west and south west would experience a visual impact over a greater distance before the receptor would experience a shielding effect.

Tree Planting and Built Form: the buildings, trees and sporadic vegetation within and around Copperton offer shielding.

5.8.3 Elements **beyond** the Site which affect Visual Exposure, *Alternative* layout

Topography: rising ground to the north, east and south east offer much less containment to the site because the more extensive layout would lie on higher ground and would expose a much greater area to the impact. Copperton would be similarly shielded but the larger site would affect a greater area.

Tree Planting and Built Form: the buildings, trees and sporadic vegetation within and around Copperton would offer shielding.

5.8.4 Conclusion

The visual exposure is rated as high and also high for the construction period.

5.8.5 Because the visual exposure assessment refers primarily to the site and its surroundings rather than to the development itself, the extent of the impact will be high to the same degree for the *No-Go Alternative*.

5.9 Zones of Visual Influence orTheoretical Visibility

Describes the areas visually influenced by the proposed development, and assesses the amount of influence
Ratings:

- *non-existent: the site cannot be seen from surrounding areas*
- *low: the development is largely shielded from view by topography, planting, etc*
- *moderate: the development is partially shielded*
- *high: the development strongly influences the view and acts as a visual focus*

Areas to be assessed:

- The development site, and lands beyond
- Copperton
- Road from the R357 to Copperton, Road to Marydale, Road to the Mine
- Mine, and Alkantpan

The zones of visual influence, viewsheds, are recorded in Figures 5.1 and 5.2and from them itcan be seen that significant areas will be visually affected. The degree is adjudged to be high as the development will influence the view and act as a visual focus.

5.9.1 The development site, and lands beyond

There are no receptors on the site itself and lands around the site, apart from people working with grazing animals. There are no farmsteads within the viewshed. If the development were to proceed, the only receptors on the surrounding lands would be farm workers and Eskom maintenance operatives. There are no obstructions which would shield the view, apart from the topography referred to in paras 5.8.2 and 5.8.3.

The zone of visual influence is therefore assessed as high; the development will strongly influence the view, but to very few receptors.

5.9.2 Copperton

The remaining houses total about 42, the houses are single storey, and most gardens have trees and shrubs. The perimeter of the settlement where houses and other facilities used to stand still has tree and shrub vegetation. There are no dwellings facing on to the development site; the nearest would be over 1km from the *Preferred* site and about half a km from the *Alternative* site.

Option 1: The residents would not be visually aware of the development when they are at home, but would be visually aware as they travel beyond the edge of town.
Option 2: the residents would be visually aware of the development; top of the infrastructure likely to be visible at some times during the day.

The zone of visual influence for Option 1 is assessed as moderate due to distance and shielding.
The zone of visual influence for Option 2 is assessed as high due to distance and shielding.

5.9.3 Local Roads

5.9.3.1Road between the R357 and Copperton

Traffic on the R357 would not be aware of the proposed development, whether travelling in either direction, but from just after the Copperton turn-off, they would begin to be aware. After about 5km there is a turn off this road to Copperton. From here to the next junction, a distance of 6.5km, the view would be clear and unimpeded for both the *Preferred* and the *Alternate* layouts.

At the junction, a right turn takes the driver into the built up area. For the length of this road and travelling in either direction the view of both layouts would be clear and unimpeded. For over 12km and travelling at 80km/h, the view would last between 8 and 9 minutes. This would also apply to both Options.

5.9.3.2 Road to Marydale

The road to Marydale is accessed off the Copperton road and south bound traffic approaching the junction would be aware of the *Preferred* layout for just over 1km, and of the *Alternative*, for about 3.5km. The junction is less than 2km from the *Alternative* and over 2km from the *Preferred* layout. This would apply to both Options.

5.9.3.2 Road to the Mine

The Copperton turn off from the R357 connects with the Mine, after the road to Copperton is passed; this east-west road eventually turns north-south and re-joins the R357. Most of the connecting roads off this one that took traffic into the Mine are now blocked off. This means that the roads are very little used, and, while within the cone of visibility, there would be little impact. This would apply to both Options.

The zone of visual influence for Options 1 and 2 is assessed as moderate as, of all the local roads, only that to Copperton is affected.

5.9.4 Mine and Alkantpan

The Mine is closed and not visited by people except the few who still live there, and work locally. The view would be intermittent as it would be broken up by buildings, spoil and planting. There would be a view of the Option 2 development for people leaving Alkantpan, and for about 3km.

The zone of visual influence for Options 1 and 2 is assessed as low due to few receptors and shielding.

5.9.5 The Construction Phase

During this phase the roads selected for the transport of the construction materials and the infrastructure components would be visually impacted upon. The zone of visual influence would not vary from the foregoing, as Construction traffic will use the R357, and the Copperton road. Site lay-down areas would likely be visible from the Copperton road.

5.9.6 Comparison with other Layouts

The *Preferred* layout is less extensive than the Alternative and slightly further from receptors. As the visual envelope is defined by the edge of the development site, the visibility of the N*o-Go Alternative* is not deemed to be different.

Option 1 would have a lesser zone of visual influence than Option 2 due to the height of the infrastructure.

If either of the *Technology* Alternatives (tracking) were specified, the visual influence rating would not vary from the foregoing, (moderate), as the affected road would be at a lower elevation than the site. Residents of Copperton would be screened from any such impact by intervening trees and shrubs.

5.10 Visual Absorption Capacity

This refers to the ability of the surrounding area to visually absorb the development. In this assessment, high is a positive and low is a negative.

- *low: the area cannot visually absorb the development*
- *medium: the area can absorb the development to a degree but it will look somewhat out of place*
- *high: the area can easily visually absorb the development*

The ability of the terrain to visually absorb the development is low. The site at present is an open, fairly flat area, with long views and the development would follow the contour of the land. The Option 1 development would be around 3.5 to just over 4m high which is the height of a small house. The Option 2 development would be over 15m high. Thehe *Preferred* layout would be 300ha in extent. Therefore it would be extensive but in a very large scale landscape. There are few vertical elements in the local landscape, apart from the mineshaft, mine buildings, spoil heaps and the electrical infrastructure, but these all contribute an industrial quality.

Therefore the visual absorption capacity is rated medium, (the area can absorb this development to a degree) but it will look somewhat out of place.

Visual absorption capacity is rated more slightly more positively for the *Preferred Alternative* than for the *Alternative layout*, due to the lesser footprint. Visual absorption capacity is rated slightly more positively for the Option 1 than for the Option 2, due to the lesser height. The visual absorption capacity does not vary for the Technology Alternatives mainly relating to Option 1, (tracking and foundations).

For the *No-Go Alternative* the visual absorption capacity is high because the status quo would not change.

5.11 Compatibility with Surrounding Landscape

This refers to the extent to which the proposed development and land usage is in line with the surrounding development and land usage.

- *appropriate: the development will fit in well with the surrounding landscape*

- *moderately appropriate: the development can blend in, but to a lesser degree and only with care*
- *inappropriate: the development introduces new elements into the landscape that do not fit in.*

The existing landscape setting isrural, pastoral agriculture; open, flat, used for grazing and vegetated by low shrubs and grasses, and in a landscape where views are long. Its compatibility with surrounding landscape does not vary throughout its physical extent.

This development proposes to change the use of these rural lands to that of a Photovoltaic Energy Facility, which is a semi-industrial land use. The power lines component of the proposed development will fit in because in proximity to the development site is other electrical infrastructure. This development will extend the industrial character of parts of the locality.

This development is judged to have a moderately appropriate capacity for compatibility with the surrounding landscape; the development can blend in, to a lesser degree, and only with care.

Comparing the compatibility with the surrounding landscape of the *Preferred* and the *Alternative layouts* indicates positively that as the *Preferred* is one third the extent of the *Alternative*, it is also more compatible in scale. If either of the tracking options of the technology alternatives were to be introduced, the degree of compatibility would reduce to a degree.

Comparing the compatibility with the surrounding landscape of Option 1 and Option 2 indicates that as Option 1 is of lesser height, it would be more compatible in scale.

The *No-Go Alternative* will be seen as a part of the surrounding landscape as the status quo will not change.

5.12 Intensity or Magnitude, of Visual Impact

This refers to the degree to which the visual nature of the landscape will be altered.
zero: natural and/or social functions and/or processes remain unaltered
very low: natural and/or social functions and/or processes are negligibly altered
low: natural and/or social functions and/or processes are slightly altered
medium: natural and/or social functions and/or processes are notably altered
high: natural and/or social functions and/or processes are severely altered

5.12.1 Local site Landscape

The area which forms the development site is extensive, agricultural, and close to a small residential community, transportation corridors, power lines and the Mine. The local landscape is characterised by open views, and grazing; the visual nature of the landscape will be altered by the introduction of this infrastructure.

The magnitude of the visual impact is judged to be medium. The impact will be noticeable but there is local context.

5.12.2 Between 1 km and 3 km

The visual receptors will be users of local roads. The magnitude of the visual impact will remain medium.

5.12.3 Beyond 3 km to 5 km

The visual intensity is reduced by distance and shielding; viewpoints within this zone of theoretical visibility may notice that the visual nature of the landscape has altered. Therefore the magnitude of the visual impact will be low.

5.12.4 Construction period

The visual intensity assessed for the construction period is rated as medium as the access routes and access points will be visible to receptors locally and there will be many traffic movements.

5.12.5 Alternatives

Comparing the magnitude of the visual impact of the *Preferred* and the *Alternative layouts* indicates positively that as the *Preferred* is half the extent of the *Alternative*, the intensity of its visual impact is rated lower than that of the *Alternative* layout. The intensity of the visual impact of the *No-Go Alternative* will be low because no changes to the landscape are currently anticipated.

The intensity of the visual impact of Option 1 is rated less than the impact of Option 2 because of the significantly greater height and apparent mass of the Option 2 infrastructure.

Option 1 Technology: The options for the foundations do not vary in their visual intensity. The tracking options vary, with the fixed axis providing the least visual intensity and the Concentrated dual axis tracking the greatest. This is caused by movement in the landscape, but the development is low to the ground and while noticeable to receptors after commissioning, the impact of the intensity will reduce with habituation. In addition, the tracking options may produce intermittent sunlight flare which would increase the intensity ratings.

To conclude, the alternative with the least intensity or magnitude of visual impact is the *Preferred* layout with Option 1 and no tracking; the greatest intensity will be from the *Alternative* layout, with Option 2.

5.13 Duration of the Visual Impact

The duration of the impact upon its surroundings, from one year, (temporary) up to beyond 15 years, (long term).

It is understood that the whole development, (civil engineering services, erection of infrastructure, roads, etc.) will be completed in one phase, and the length of time of the construction period is 18-30 months.

The duration of the development is intended to be as long term as any photo-voltaic development. This may extend beyond20 years. New infrastructure could be erected on the site

and on the same foundations, or the site could be abandoned. The duration of both the *Preferred* and the *Alternative* layouts, and of Options 1 and 2, are judged to be long term.

The duration of the *No-Go alternative* cannot be known at this time but may not be long term as another use or uses may be found for this site.

5.14 The Significance of the Visual Impact

The significance of the visual impact is assessed as a combination of:

- the extent of the impact (para5.7 local)
- the length of time over which it may be experienced, (para5.13 long term)
- and the intensity of the impact, (para5.12 medium).

and the significance ratings in para 1.4 and Addendum 2

Examining all these impacts allows an assessment of the significance to be made.

Initially, the overall significance of the development can be assessed to be medium as there will be permanent change in the local landscape. This will be due to the activities associated with the construction period as well as the development, but within a partly industrial landscape. The disturbance during the construction of foundations will be irreversible. With increasing maturity of the development its visual significance is not expected to change.

The significance rating for each of the site layout alternatives, for Options 1 and 2, and for the Technology Alternatives, (tracking).is also medium

The *No-Go Alternative* will have a low significance, as the status quo will not alter.

5.15 Potential Cumulative Visual Impacts.

Looks at the accretion of similar developments over time

5.15.1 This development

While no additional phases to this development are proposed, it is not known if the proponent, or any other body, would consider a further phase on this site. That would depend upon factors outside the scope of this study. However it is noted that a 10 MW PVF about 2.5km away to the south and close to the Mine may proceed, and the two developments could be experienced together.

If the ground is not developed, and the *No Go Alternative* remains, there may or may not be cumulative impacts; the site appears stable in its land uses at this time.

5.15.2 Other Alternative Energy Projects in the Locality

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.

PVFs

The 10MW Solar Farm, (PVF) has been approved and is to be located 4km to the south and close to the Mine.There are two additional proposed 100MW PVF sites currently being assessed; Hoekplaas site (PV3) is on one side of the R357, due east from, and inter-visible with Klipgats Pan PVF (PV4), and between 8 to 9km from Struisbult farm PVF.

WEFs

There is an approved 190 turbine development which will occupy two sites between the R357 and the R386 to Carnarvon; this would be located on two sites 8 to 15km to the south-south-west and the south of this study. The proponent for this development is Mainstream Renewable Energy.

A proposed 56 turbine WEF is being considered on a site to the north of the Struisbult PVF site and it would be directly to the north-east and about1.5km from the *Preferred* layout and less than 0.5km from the *Alternative* layout. The proponent for this development is Plan 8 Infinite Energy.

There would be new transmission lines, sub stations and new access roads associated with all the new developments. The construction periods may not run concurrently with consequent increased impact on local roads.

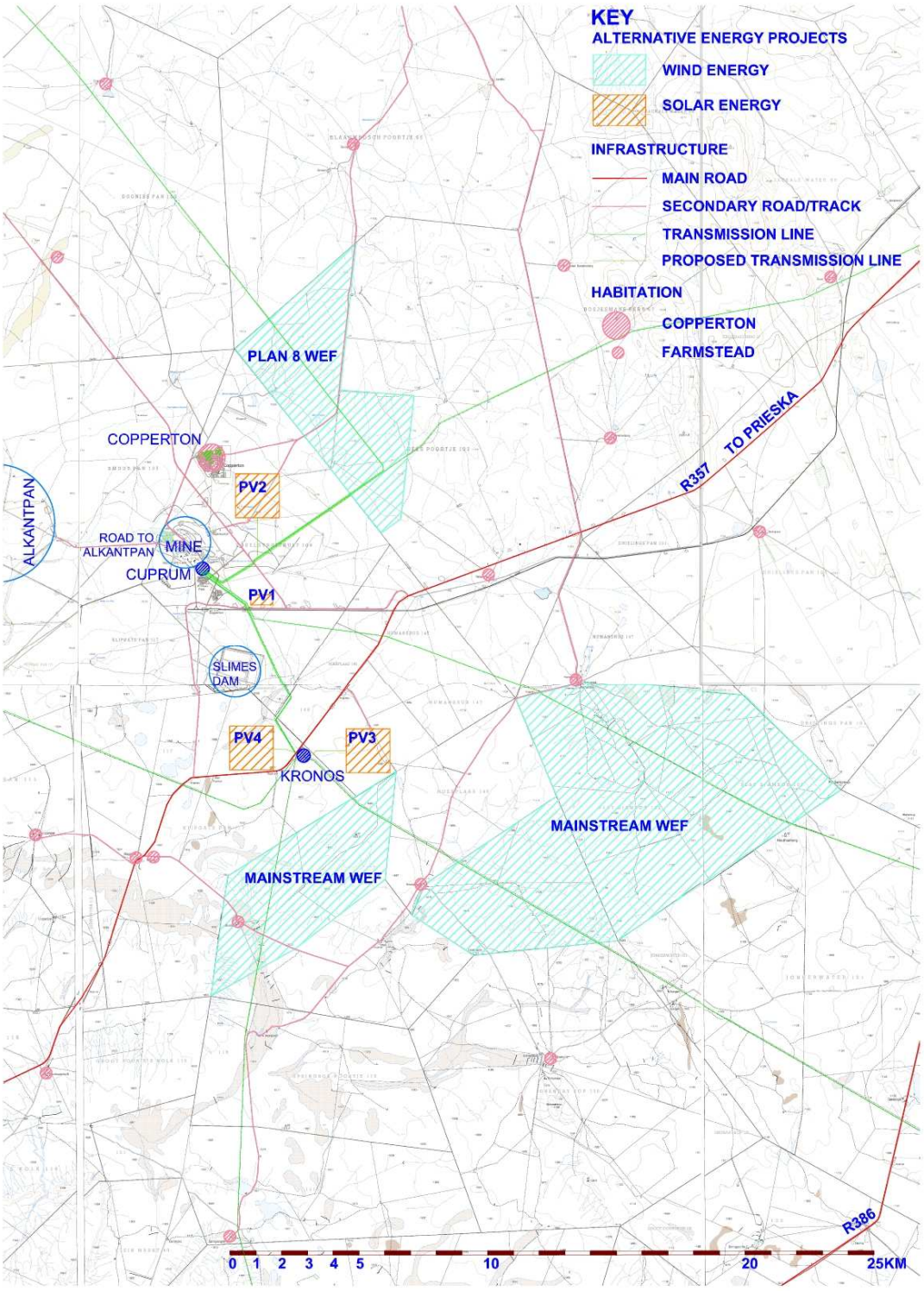

Fig 5.10. The locality around the settlement of Copperton and showing the two proposed WEFs and four proposed PVFs in context with existing habitations, transmission lines and roads.

5.15.3 The Scale of the Local Landscape

The local landscape, both north and south of the settlement and the Mine, and along the R357 may therefore change in character from one which is open, and without many visual incidents, to one of wind turbines and solar arrays. The scale of the landscape is extensive enough to provide a setting for these developments, the roads serve mainly local traffic, the area is already partly industrialised.

5.15.4 The scale of this Cumulative Impact

Consideration must be given to local residents in Copperton, the people who work in Alkantpan, people who live locally on the farmsteads, and people who drive through the area. To what degree will the proliferation of these developments visually impact upon these receptors and how will it be assessed.

5.15.5 Concerns:

5.15.5.1 Construction

The construction period will have an increased impact due to longer timeframes; road access junctions will be more impacted upon and lay-down areas will be more visible.

5.15.5.2 Infrastructure

There will be additional new transmission lines crossing the landscape from the developments and into Cuprum and Kronos. Each PVF will have a local substation and other buildings, and have electrified security fencing. Each WEF is extensive, the turbines may be around 150m in height and each development will also have its own local sub-station. Should all these developments, (two WEFs and 4 PVFs), be constructed, Copperton will have a more industrial, (security fenced), and a more contemporary, (high-tech developments), setting.

5.15.5.3 Single or Dual Axis Tracking, PV3, PV4 and R357 users

When assessed together these two proposed installations could affect road users negatively at certain times of the day due to intermittent glare from sunlight off the panels being seen by drivers who are at a higher elevation, or at the same elevation, as the panels.

5.15.5.4 Single or Dual Axis Tracking, PV2 and Copperton residents

For people leaving Copperton and driving towards the R357 on the Copperton Road in the afternoons, it is not expected to be a concern as the road is at a lower elevation. Residents of the settlement would be screened from any sunlight flare by local trees and shrubs.

5.15.5.5 Experience

Receptors could find that with the WEFs being only 10km apart, and all the PVFs either close to habitations and/or transport corridors, the remote and rural character of the locality could change to one with more visual incidents and which is much more high-tech.

In addition, receptors may become habituated to the change in character of the locality. The high-tech nature of the installations may encourage visitors and may also provide visual relief to drivers on long open roads. The wider area may also change in landscape character if the SKA were to be developed.

5.15.6 Conclusion

In a more populated area, with more complex landscape patterns, this number of proposed developments within a 13km radius, or so, could result in a high visual impact. In this context, the long views, few roads with little traffic, and the low numbers of habitations, combine to reduce this cumulative impact. There is no doubt that the landscape character would change and that therefore the public participation stage will be a particularly important part of this EIA process.

The local landscape character would be changed and made more industrial, and this cumulative impact is assessed as *medium for both magnitude and significance*.

5.16Viewpoints and Images.

The images were created on site and within the surrounding landscape from locations where the development site would be deemed to be visible. They were created during the morning and afternoon in November 2011. The weather was clear and open, and deemed to be typical.

The camera was set at a focal length deemed to be as close to natural eye experience as possible. No filters were used. Panoramic images have been overlapped and stitched.

Fig 5.11 View of the proposed Preferred and Alternative layouts for Struisbult, from the road to the Mine, showing the relationship with the proposed PV1 installation and the proposed WEF, (Plan 8).

6.0 RECOMMENDED MITIGATION MEASURES

6.1 Construction phase:

Potential Impacts*: materials haulage to and from the site; dust, site development works.*

6.1.1 Location of construction access:

Construction access is intended to be off the existing road to Copperton by means of an upgraded farm road. Site lines for vehicles, appear good for oncoming traffic and visually acceptable. For the duration of the civils contract there will be the need for earthmoving equipment, transport of concrete for foundations, and transport of the entire infrastructure. Mitigation of these issues can be offered by keeping the contract time to the minimum, and by ensuring that road junctions have good sightlines, necessary traffic control measures, and signage.

Access roads are to be kept clean, and measures taken to minimise dust from construction traffic on gravel roads.

6.1.2 Measures to deal with surplus materials from excavations

It is anticipated that following the excavation of ground for foundation construction there will be surplus material for disposal. This should not be left on the site in piles and also should not be spread around the site. If it can be used locally for the construction of roads, for example, that would be acceptable on the basis that the resulting roads would match existing gravel roads in colour.

If there are no uses to which the material can be put, or if it is of a different colour than that encountered locally, then it must be removed off site.

6.1.3Visibility of Contractors compound or Lay-Down Areas, and site offices:

Careful consideration should be given to the visual implications of the siting of the construction camp, (lay-down area(s)). It is advised that their likely, somewhat negative, visual impact from the Copperton road, should be addressed.

Site offices, if required, should be limited to single storey and they should be sited carefully using temporary screen fencing to screen from the wider landscape.

6.1.4 Fires and litter:

All site operatives to receive training in awareness of these issues. In addition, no fires to be allowed, litter to be regarded as a serious offence and no contaminants to be allowed to enter the environment by any means. An Environmental Management Plan would be drawn up.

6.2 Infrastructure

Potential impacts: *disturbance of the landscape from installation of roadways, and infrastructure.*

6.2.1 New roads in the site

Roads and hard-standings will be constructed as part of the works. Due to the apparent flatness and scale of the terrain and the location of receptors these new roads are not regarded as likely to have any visual significance.

6.2.2 Concrete footings

The need to provide concrete footings for all the support structures will result in inevitable scarring of the existing land cover. Provision of an interface between the concrete and the natural ground will prevent local contamination.

Retention of the first 50-100mm of naturally occurring substrate, conserving it, and then spreading it over finished levels may be of some benefit but this would have to be examined by the Flora Specialist to ascertain if it would be worthwhile. The developer will be required to ensure that all excess material is removed off-site, and all the ground is returned as far as possible to original levels/gradients.

6.3Visibility of Buildings and Ancillary infrastructure

It is generally advised that any new structures be placed where they are least visible to the greatest numbers of people, in places where topography can offer shielding. This development would require the installation of buildings and a local sub-station. It is advised that sensitivity should be employed to ensure that they will not be clearly visible to receptors, by cladding the buildings in non reflective colours and materials that will blend in. Acceptable examples for external walls are: either cladding with local stone, should it be available, or plastered and painted using earthy tones for paint colours. Appropriate colours would be muted site colours referencing vegetation and/or the ground. Roofs should be grey and non reflective. Doors and window frames should reference either the roof or wall colours.

Building heights should be kept to single storey, less than 3.5m to roof apex, where possible.

6.4 Visibility of Transmission pylons

The proposed overhead line from the site into Cuprum sub-station will, for most of its length, run in parallel with an existing line on a similar servitude.

6.5 Visibility of the delivery of components during the construction phase

Components may be delivered from the N10, R357, and the local, tarred roads. The local roads are not heavily trafficked and haulage will not be assessed as visually intrusive.

6.6 Layout

The most significant view of the proposed development will be obtained by traffic on the Copperton road. There are few other receptors and they will be impacted upon by the edges of the development that will be visible. Therefore no changes to the layout under assessment in the report are proposed.

The most important aspect of the visibility of the layout that can be mitigated is the finishing materials of the infrastructure and every effort should be taken to use finishing materials and colours that are non-reflective, and in dark and receding colours that will blend in. The panels would have a non-reflective coating; the support structures would be finished in dark matte colours such as dark grey or charcoal.

6.7Presenting the scheme to Interested and Affected Parties

There may be benefits accruing to the proponent in the acceptance of this installation, by providing some information to local people with interpretation information, and through discussions in local community centres.

In the context of other similar developments being planned around Copperton it is noted that it may become more important to provide information to local people.

Visual Significance of Impacts associated with the Construction and Operation of PV2 Struisbult Farm PV Installation, Copperton.

Note: 'Long term' means the whole life of the project which could be up to 20 years

	Nature of impact	Extent of impact	Duration of impact	Intensity	Probability of occurrence	Status of impact	Degree of confidence	Reversibility	Level of significance	Mitigation Measures	Significance after mitigation
	CONSTRUCTION PHASE										
	1.0 Layout and Technology Alternatives										
1.1	Impact of the hauling and delivery of PV components from port of entry to site	Regional and surrounds	Construction period	High	Definite	Negative	Sure	Reversible	High	Good traffic management and keeping local people informed	Medium
1.2	Impact of the hauling and delivery of cement and other construction materials on a regular basis during the contract period	Sub-regional and surrounds	Construction period	High	Definite	Negative	Sure	Reversible	High	Good traffic management and keeping local people informed	Medium
1.3	Location of access road, off existing roads	Local and surrounds	Construction period	Medium	Definite	Negative	Sure	Irreversible	Moderate	Upgrade road junctions as required and rehabilitate after works	Low
1.4	Impact and visual disturbance of the Construction site and lay down area for contract duration	Local and surrounds	Construction period	Medium	Definite	Negative	Certain	Reversible	Moderate	Screen site, operate site within Construction Industry Management Guidelines	Low
1.5	Movement of construction vehicles around the site, with lights	Local and surrounds	Construction period	Medium	Definite	Negative	Sure	Reversible	Moderate	No night and weekend working	Low
1.6	Construction of trenches for underground cables	Local and surrounds	Construction period	Medium	Definite	Negative	Sure	Reversible	Moderate	Return ground to original state	Low
1.7	Construction of pv installation, buildings, etc	Local and surrounds	Construction period	Medium	Definite	Negative	Certain	Irreversible	Moderate	Use of local materials so that buildings blend in	Low
1.8	The impact of the construction of the transmission lines from the site	Local and surrounds	Construction period	Medium	Definite	Negative	Certain	Irreversible	Moderate	None	Medium

Table 6.1:Table of Visual Significance of Impacts

	Nature of impact	Extent of impact	Duration of impact	Intensity	Probability of occurrence	Status of impact	Degree of confidence	Reversibility	Level of significance	Mitigation Measures	Significance after mitigation
1.9	Completion of all site works and fencing	Local and surrounds	Construction period	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Good site management, avoidance of litter, etc	Low
	OPERATIONAL PHASE										
	2.0 Activity, Layout and Technology Alternatives										
2.1	Maintenance visits by maintenance crew, using the existing roads access	Local and surrounds	Long term	Low	Definite	Neutral	Certain	Irreversible	Low	Good management practices	Low
2.2	The visual impact of the installation during lifetime	Local and surrounds	Long-term	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Local consultations, mitigation measures, EMP. Impact may reduce with habituation	Medium
2.3	Site buildings, and perimeter fence	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Carry out repairs promptly and keep tidy	Medium
2.4	The impact of the transmission line from the site to adjacent Eskom line	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	None	Medium
2.5	No-Go Option: Retention of status quo	Local and surrounds	Long term	Medium	Probable	Status quo	Unsure	Reversible	Neutral	N/a	N/a

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Issues

7.1.1 The Development

There would be an extensive array of photovoltaic panels, 2 to 4.0m high, erected on the proposed development site, to the east of Copperton, in a rural area. Also planned are security fencing, roads, single storey buildings, a transmission line, and a sub- station.

The 100MW *Preferred* layout would occupy the centre of the site under assessment and lie to the south east of Copperton. The 300MW Alternative layout would occupy the majority of the site. The *Preferred* is one third the extent of the *Alternative*, and somewhat further way from the built up area; its visual impact is rated medium.

7.1.2 Visual Statement:

This development follows on from a similar, but much smaller in scale, proposal about 2.5km away to the south and close to the Mine. A PVF is a semi-industrial land use and would be located in an agricultural area but it is noted that there are some industrial uses nearby. It would be especially visible to users of the Copperton road, (Copperton residents, and people accessing Alkantpan, people people working the lands, Eskom maintenance people).

The *Preferred* layout is recommended because of its more acceptable scale.

The tracking Technical Alternatives could have a greater impact due not only to the movement of the arrays, but also to the possibility of intermittent sunlight flare, or bounce from the panels. However this was not identified as key in this study.

It is important that mitigation measures are complied with and it is advised that an environmental management plan be drawn up to set out principles for the implementation of these measures.

7.1.3Construction Period:

It is important that the works to deliver the materials, and undertake the construction works on site are undertaken timeously and with due care to the adjacent communities which will be affected visually.

7.1.4Visual impact Rating:

The study concluded that the overall significance of the visual impact of the proposed development would be high, due to its local extent, long term duration and medium magnitude. Also considered were the scale of the development,the numbers and types of receptors directly affected, and the shielding by built form and vegetation. It was noted that the semi-industrial nature of a PVF was not incompatible with the industrial uses locally and the transmission lines. A number of mitigation measures was proposed which could moderate that visual impact.

7.1.5 This Development in Context with other approved developments locally:

The visual impact of this proposed development was assessed in the context of the other renewable energy projects within the Copperton area that are in various stages of approval.

The local landscape may therefore change in character from one which is agricultural and remote to one where there are isolated hi-tech developments, i.e. wind turbines and solar arrays. The most significant developments, the WEFs, are quite far apart from each other but one is very close to this study area. The solar arrays would also be extensive but the scale of the landscape is sufficient to provide a setting for these developments as they are widely spaced and the area already has an industrial component.

The local landscape character is changed and made more industrial, the *cumulative* impact is assessed as *medium for both magnitude and significance*.

7.2 Recommendations

The *Preferred* layout would have a significantly lesser footprint than the *Alternative* layout and is rated less for visual significance. Option 1 offers a large number of lower panel modules and Option 2 offers a lesser number of taller panel modules; Option 1 has a lesser impact, but Option 2 could be acceptable visually due to the scale and character of the existing receiving environment. Due to the location of the site, and to the small number of potential receptors, the single and dual axis tracking options are acceptable.

Therefore it is recommended that from a visual perspective, the *Preferred* layout could proceed, and Option 2 could proceed, if an Environmental Management Plan would be implemented, and provided that mitigation measures are undertaken relating to:

Construction Phase:	Paragraph 6.1.1: Contract time to the minimum
	Paragraph 6.1.1: Traffic control measures
	Paragraph 6.1.2: Disposal of surplus materials
	Paragraph 6.1.3: Location of lay-down areas
	Paragraph 6.1.4: Environmental Management Plan
Operational Phase:	Paragraph 6.3: Height, location, finishes of building(s)
	Paragraph 6.6: Use of non-reflective materials and receding colours
	Paragraph 6.7: Discussions with local people

Addenda 1 - 4

Addendum 1 : Visual Impact Assessments : Definitions and Ratings

Visual Impact Assessments : Definitions and Ratings
Referred to are criteria specific to visual impact assessments referred to in the DEA&DP guideline document and which are as follows:

Viewshed
The viewshed refers to the theoretical outer-most extent of the area from which an object may be seen. Visibility can be obscured in part or in whole by objects within the viewshed such as existing buildings, trees, or landform.

Rating – not rated, a description given

Visibility of the Site
A description of the actual places within the view shed from which the site can be seen; significant views are discussed

Rating: not rated, a description given

The Extent of the Visual Impact
Rates the impact in terms of the geographical area that will be influenced by the visual impact

Ratings :

- no impact: no visual impact
- limited: visual impact is small, generally confined to the site
- local: the site and the immediate surrounding area, (1-5km)
- sub-regional: a greater area is influenced, (5-10km)
- regional: the influence extends to an entire region
- national: the influence has national importance and extends beyond boundaries

Visual exposure
Visual exposure refers to the visibility of the project site in terms of the capacity of the surrounding landscape to offer screening. This is determined by the topography, tree cover, buildings, etc.

Ratings:

- no exposure: the site is hidden by topography, planting, etc
- low: the site is largely hidden
- medium: the site is partially hidden
- high: there is little in the surrounding landscape that can shield the development from view

Zones of visual influence
Describes the areas visually influenced by the proposed development, and assesses the amount of influence
Ratings:
non-existant: the site cannot be seen from surrounding areas
low: the development is largely shielded from view by topography, planting, etc
moderate: the development is partially shielded
high: the development strongly influences the view and acts as a visual focus

Visual Absorption Capacity
This refers to the ability of the surrounding area to visually absorb the development. In this assessment, high is a positive and low is a negative

Ratings:

- low: the area cannot visually absorb the development
- medium: the area can absorb the development to a degree but it will look somewhat out of place
- high: the area can easily visually absorb the development

Compatibility with Surrounding Landscape
This refers to the extent to which the proposed development and land usage is in line with the surrounding development and land usage.

Ratings:

- appropriate: the development will fit in well with the surrounding landscape
- moderately appropriate: the development can blend in, but to a lesser degree and only with care
- inappropriate: the development introduces new elements into the landscape that do not fit in.

Intensity or Magnitude, of Visual Impact
This refers to the degree to which the visual nature of the landscape will be altered.

Ratings:

- low: the impact is noticeable but does not act as a strong focus in the landscape
- moderate: the landscapes visual nature is altered in a way that is noticeable
- high: the visual impact of the development intrudes into the landscape in a noticeable way

Duration of visual Impact
The duration of the impact upon its surroundings

Ratings:

- temporary: one year or less
- short term: one to five years
- medium term: five to fifteen years
- long term: more than fifteen years

Significance of the Visual Impact
This rating combines the other ratings and looks at the overall impact

Ratings:

- very low: the visual impacts will be limited to the site itself
- low: the impacts will be local, and/or in the short term
- moderate: the impacts will be experienced locally and may lead to permanent change in the local landscape
- high: these impacts will be experienced over a wide area, or sub regionally and will be irreversible

Potential Cumulative Visual Impacts
Looks at the accretion of similar developments over time

Ratings: not rated, a description given

Assessment of impacts for all specialists should be done according to the following criteria[1]:

Nature of the impact - This is an appraisal of the type of effect the activity would have on the affected environment. This description should include what is being affected and how.
Extent - Here it should be indicated whether the impact will be: *local* extending only as far as the activity; will be limited to the *site and its immediate surroundings*; will have an impact on the *region*; will have an impact on a *national* scale; or will have an impact across *international* borders.
Duration - Here it should be indicated whether the lifetime of the impact will be: *short term* (e.g. 0 – 5 years); *medium term* (e.g. 5 – 15 years); *long term* where the impact will cease after the operational life of the activity, either because of natural process or by human intervention; or *permanent*where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.
Intensity – Here it should be established whether the impact is destructive or benign and should be indicated as: *low,* where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected; *medium,* where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and *high,* where natural, cultural or social functions or processes are altered to the extent that it will temporarily or permanently cease.
Probability – This should describe the likelihood of the impact actually occurring indicated as: *improbable,* where the possibility of the impact to materialize is very low either because of design or historic experience; *probable,* where there is a distinct possibility that the impact will occur; *highly probable,* where it is most likely that the impact will occur; or *definite,* where the impact will occur regardless of any prevention measures.
Significance – The significance of impacts can be determined through a synthesis of the aspects produced in terms of their nature, duration, intensity, extent and probability and be described as: *low,* where it will not have an influence on the decision; *medium,* where it should have an influence on the decision unless it is mitigated; or *high,* where it would influence the decision regardless of any possible mitigation. Note that wherever possible, the specialist should refine and customize these criteria to their particular study (e.g. a positive impact of "high" significance is when the project could reduce local unemployment by 5% or more).

[1] DEA&DP, 2005

Addendum 2 : Method of Assessing the Significance of potential environmental impacts.

This method has been drawn up by the EAP and its ratings and criteria are adopted in this report and illustrated in Table 6.1

Method of assessing the significance of potential environmental impacts

For each impact, the EXTENT (spatial scale), MAGNITUDE and DURATION (time scale) would be described. These criteria would be 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 EIAR would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.[2]

The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories.

Table 0.1 Assessment criteria for the evaluation of impacts

CRITERIA	CATEGORY	DESCRIPTION
Extent or spatial influence of impact	**Regional**	Beyond a 10 km radius of the candidate site.
	Local	Within a 10 km radius of the candidate site.
	Site specific	On site or within 100 m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely* altered
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*

CRITERIA	CATEGORY	DESCRIPTION
Duration of impact	**Construction period**	Up to 2.5 years
	Short Term	Up to 5 years after construction
	Medium Term	5-15 years after construction
	Long Term	More than 15 years after construction

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 **Table 0.2**.

[2] The applicant will be requested to indicate at the Draft EIAR stage which alternative and mitigation measures they are prepared to implement.

Table 0.2Definition of significance ratings

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

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 **Table 0.3** and

Table 0.4 respectively. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly, the REVERSIBILITY of the impact is estimated using the rating system outlined in **Table 0.5**.

Table 0.3 Definition of probability ratings

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 0.4 Definition of confidence 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 0.5 Definition of reversibility ratings

REVERSIBILITY RATINGS	CRITERIA
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

Addendum 3 : Declaration of Interest

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/
NEAS Reference Number:	DEAT/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

Proposed Photo Voltaic Facility at Struisbult Farm near Copperton, Northern Cape

Specialist:	Karen Hansen Landscape Architect		
Contact person:	Karen Hansen		
Postal address:	Postnet Suite 15, P Bag 15 Somerset West, W Cape		
Postal code:	7129	Cell:	072 840 8900
Telephone:	021 855 2997	Fax:	021 855 2997
E-mail:	hansentk@cybersmart.co,za		
Professional affiliation(s) (if any)	Chartered Landscape Architect		

Project Consultant:	Aurecon South Africa (Pty) Ltd		
Contact person:	Franci Gresse		
Postal address:	P.O. Box 494, Cape Town		
Postal code:	8000	Cell:	
Telephone:	021 5266022	Fax:	086 7231750
E-mail:	Franci.gresse@aurecongroup.com		

4.2 The specialist appointed in terms of the Regulations_

I, **Karen Hansen** are 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:

Name of company (if applicable):

Date: 3rd January 2012

Addendum 4: CV

Karen Hansen, Independent Consultant Landscape Architect

Qualifications

Chartered Membership of the Landscape Institute, UK, in 1982, registered nr. 11994.
Strathclyde University, Scotland, 1995, a tutorial based course in Environmental Impact Assessment covering the legislative background to, and practice of, Environmental Impact Assessment, with particular reference to Visual Impact Studies.

Experience in South Africa

2011 onward: Independent Consultant Landscape Architect specialising in, inter alia, Visual Assessments
2010 to **2011**: Consultant Landscape Architect to Viridian Consulting (Pty) Ltd.
2006 to **2010**: Senior Landscape Architect with Viridian Consulting, Somerset West, undertaking a number of landscape design projects as well as environmental studies.

Environmental Studies:
Visual Impact Assessment, level 3, for residential development at L' Avenir Winery, Stellenbosch
Visual Impact Assessment, level 3, for Mixed Use Development at Mandalay, Khayelitsha, Cape Town
Visual Scoping Study for Industrial Uses at Blackheath, Cape Town
Visual Impact Assessment, level 2, of transmission lines for De Wijnlanden Residential Estate, Somerset West
University of Cape Town Middle Campus, Rondebosch, for Urbanscapes, MLH Architects and UCT; to assess impacts derived from change of use of multi-level piazza to new lecture theatre and administration buildings
Visual baseline study for tourism development at Kogel Bay Tourist Resort, Western Cape as part of the Development Framework Policy document
Visual Impact Assessment, level 3, for proposed residential development over 3,460ha at St Helena Bay, a core project of the St Helena SDI.
Visual Impact Assessment, level 3, for Phase 2 of De Zalze Golf Estate, Stellenbosch.
Visual Impact Assessment, level 3, for change of use to Mixed Use Development for Crammix Brickworks, Cape Town.
Visual Impact Assessment, level 3, for Agri-Industrial uses at Klapmuts, Paarl
Visual Scoping Study for Wind Turbines and Wind Measuring Masts in the N and W Cape
Visual impact Assessment, baseline studies, for Wind Measuring Masts, Vredendal, Worcester, and De Aar
Visual Impact Assessments, level 3, for the establishment of Renewable Energy sites: Windfarms, Photo-voltaic installations, Concentrating Solar Power Installations in six centres in the Western and the Northern Cape, (De Aar, Vredendal, Worcester, Namaqualand, Springbok, and Copperton/Prieska)
Visual Impact Assessment, Baseline Study, for a Photovoltaic Installation in Vredendal, W Cape.
Visual Impact Assessment, Baseline Study, for the extension of Palmiet Quarry, Grabouw, W Cape.
Visual Impact Assessment, level 3, for a Wind farm outside Koekenaap, W Cape
Visual Impact Assessment, level 3, for a Wind farm outside Copperton, N Cape
Visual Impact Assessment, level 3, for a Photovoltaic Installation outside Vredendal, W Cape
Visual Impact Assessment, level 3, for a Retail Mall in Cape Town, W Cape
Visual Scoping Report for a Photo Voltaic Installation outside Aggeneys, N Cape

Experience in UK

2000 to **2006**: Landscape Architect and Team Leader with Glasgow City Council. Master planning, design, implementation of the Heritage Lottery funded urban parks and urban dual carriageways.

1992 to **2000**: Partner with Kirklee Landscape Architects, undertaking a number of landscape design projects as well as environmental studies.

Selected Environmental Studies:
Visual Impact Assessment, level 3, design and Implementation of landscape works for major new road, Western Distributor Road, Glenrothes, Fife, Scotland.
Visual Impact Assessment, level 2, of proposed golf and housing estate in Prestwick, Scotland.
Visual Impact Assessment, level 2, of hotel in airport context at Edinburgh Airport.
Visual Impact Assessment, level 2, study of landscape aspects of felling and restocking of several areas of existing coniferous woodlands and change to native woodland species in loch catchment area for West of Scotland Water at Loch Katrine, Strathclyde.
Visual Impact Assessment, level 3, for Central Scotland Countryside Trust as part of the process to determine future access and tree planting policy in the Greenbelt surrounding Falkirk, Scotland.
Visual baseline studies for abandoned open cast mines for British Coal Opencast, at Knockshinnoch Nature Reserve, Ayrshire, Scotland and others.

Karen Hansen has no business, financial, personal or other interest other than fair remuneration for work performed in connection with these studies and there are no circumstances that may compromise her objectivity in pursuing and serving the interests of the public.