PROPOSED PHOTO-VOLTAIC FACILITIES NEAR DE AAR, N CAPE: PAARDE VALLEY, BADENHORST DAM, ANNEX DU PLESSIS

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Level 3 Visual Impact Assessment

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VIA: PROPOSED PHOTO-VOLTAIC FACILITIES NEAR DE AAR

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Abbreviations used in the Report:
Asl : above sea level
PVF: Photo voltaic installation, or facility
Glossary:
Farmstead refers to a habitation, rather than the whole farm

Bibliography:
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. 1st Edition, Landscape Institute, UK, 1998
Draft Scoping Report_Badenhorst Dam PV3 DSR 02112011.pdf Source Aurecon
Draft Scoping Report_Paardevalley_02112011.pdf. Source Aurecon

EXECUTIVE SUMMARY

This Visual Assessment Study was carried out in November and December 2011 and it assesses a proposal by Mulilo Renewable Energy (Pty) Ltd, to establish three Photo voltaic installations in sites around De Aar in the Northern Cape, South Africa. All the sites are on land currently used for grazing and all are within two to three kilometres of the town centre. The projects are assessed separately and cumulatively and in context with other proposed Alternative Energy projects locally.

The development would be executed in one phase. One of the proposed installations would be adjacent to a PVF proposal submitted by the same proponent and which has received approval. The assessed zone of visual influence extends to 5km.

There were Alternatives to assess for each site; the Activity alternatives which were a PVF and the 'No Go'; two layout alternatives, the Preferred and the Alternative, and eight Technology Alternatives: Option 1 low panel modules with four alternatives for the foundations and support posts, and three Alternatives for the different types of tracking that are being investigated. Option 2, CPV technology, panel modules much higher and wider at 15.4m by 22m, dual axis tracking, pedestal fixed, and fewer in number. In addition there were access road alternatives and also transmission line alternatives.

Issues
General:

The three sites under consideration in this report are:
PV2 Paarde Valley, to generate 75 to 150MW, north of the town and in a mixed uses setting.
PV3 Badenhorst Dam, to generate 75MW, to the east of the town, in an urban fringe setting
PV3 Annex Du Plessis, to generate 19MW, to the north east of the town, in a rural setting.

None of the developments is rated high for visual impact, although they would change the character of the local landscape from agricultural and rural to semi-industrial. The site to the north of the town, (PV2), is most able to fit in with the local landscape due to compatible adjacent uses. The other two sites lie beyond the built up area in rural locations; of these the north east site, (PV4), is assessed lowest for overall visual impact.

The remaining site in the east is visually exposed to residential areas and there is inter-visibility between PV3 and PV4. The impact of PV3 could be mitigated by giving preference to the alternate layout as it would impact fewer sensitive receptors.

It is significant that receptors viewing PV2 and PV4 would do so, in the main, from the south, where the support structures would be seen and not the panels. PV3 would be seen, in the main, from the side.

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 De Aar.

Initially their impact would be significant but it is anticipated that these developments would be accepted because they will be seen to operate.

Visual Impact Rating

The study concluded that the overall visual impact of the proposed developments would be moderate, due to the scale of the development, the numbers and types of receptors directly affected, and the shielding by built form. 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.

The solar arrays will be close to De Aar, but the scale of the landscape is sufficient to provide a setting for these developments as they are widely spaced, and the area is already partly industrialised.

The local landscape character is changed; the *cumulative* impact is assessed as *medium for both magnitude and significance*.

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

It is recommended that from a visual perspective, the developments could proceed provided that the mitigation measures listed below are undertaken, all as follows:
PV2: *Preferred* Layout, its access road, and the transmission line to De Aar substation.
PV3: *Alternative* Layout, its access road and the transmission line direct to Eskom infrastructure.
PV4: *Preferred* Layout, preferred access road, and the transmission line direct to Eskom infrastructure.
Options 1 and 2, (technology) would be acceptable in these locations.

Timing and location of traffic movements
Disposal of surplus materials
Location of lay-down areas
Use of non-reflective materials and receding colours
Height, location, finishes of building(s)

1.0 INTRODUCTION

1.1 General

Mulilo Renewable Energy (Pty) Ltd proposes to construct three PVFs as follows:

- **PV2** to generate approximately 75-150 MW on an area covering 225 ha to 450 ha on the Paarde Valley farm (Farm No. 145 Portion 2) to the immediate north of De Aar in the Northern Cape. The property is zoned Agriculture Zone 1.

- **PV3** to generate approximately 75 MW on an area covering 225 ha on the Badenhorst Dam farm (Farm No. 180 Portion 1) to the immediate east of De Aar in the Northern Cape. The property is zoned Agriculture Zone 1.

- **PV4** to generate approximately 19 MW on an area covering 64ha on the Annex du Plessis farm to the immediate north-east of De Aar in the Northern Cape. The property is zoned Agriculture Zone 1.

The visual impact assessment will consider these proposals and also take into account their cumulative impacts including other 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 each project involve:

- The installation of photovoltaic infrastructure
- The installation of transmission lines to existing sub-stations
- the installation of, *inter alia*, local sub-station, fencing, 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 any 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 Impact Assessments 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 Generals survey 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 (PV2): Written and Drawn Material was made available by Aurecon:

- 1-Report cov.pdf DSR cover page
- 2-DSR_Paardevalley_02112011.pdf DSR
- De Aar cadastrals.kmz
- De Aar PV 2, 3, 4.jpg
- De Aar PV contours.kmz
- Geotechnical Report – De Aar.pdf
- J1596 FDP 2011-10-05 Paardevalley Farm Agricultural Assessment.pdf
- Mulilo PV De Aar 101011.kmz
- Old Dam.kmz
- Examples 1.pdf
- Examples 2.pdf
- Map of PV 2, 3, 4.pdf
- De AarPV2.kmz
- De Aar Farm boundaries.kmz
- De Aar Alternatives.kmz
- 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 (PV3): Additional Written and Drawn Material was made available by Aurecon:

- 2-DSR_Badenhorst Dam PV3 DSR 02112011.pdf
- De Aar pv3.jpeg
- De Aar PV3 transmission lines.jpeg
- De Aar PV contours.kmz
- Old Dam.kmz
- De Aar Farm boundaries.kmz
- De Aar Alternatives.kmz

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

1.3.4 (PV4): Additional Written and Drawn Material was made available by Aurecon:

- De Aar cadastrals.kmz
- De Aar PV 2, 3, 4.jpg
- Map of PV 2, 3, 4.pdf
- De Aar PV4.kmz
- De Aar PV4 Alternatives.kmz

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

1.3.5 Site Assessment, all sites

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 proposed.

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.

1.3.6 Determination of the Theoretical Viewshed, all sites

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 Structure of the Report

The proposed development is divided into three separate PVFs, (PV2, PV3, PV4) in three separate locations around De Aar. This report provides jointly relevant information on all projects together, assesses the impacts of each project in separate sections, and also assesses their cumulative effect with relation to one another.

1.5 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.

1.6 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

1.7 Assumptions and Limitations

This report is based on information received from Aurecon Group and the independent assessment.

(PV2): 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.

(PV3): 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.

(PV4): 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.

Fig 1.1: The location of De Aar in the Northern Cape, S Africa. Source: www.google.com/Hansen

2.0 CONTEXT OF PROJECTS

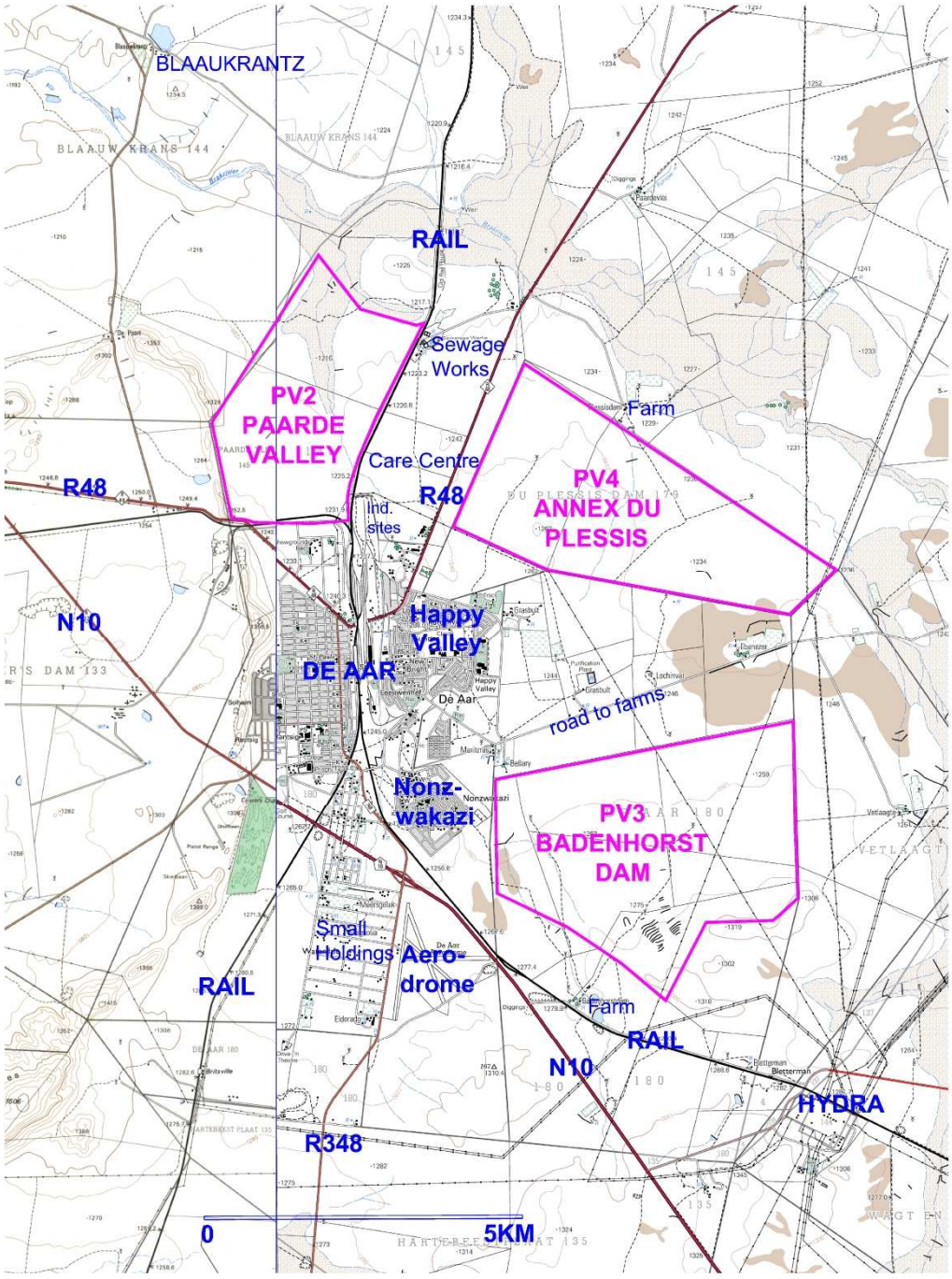

Fig 2.1: The town of **De Aar**, and the location of the **PV2 Paarde Valley** site, **PV3 Badenhorst Dam** site, **PV4 Annex du Plessis** site in relation to the built up area. Source: National Geo-Spatial Information.1:50 000 Raster Images Surveyor General/Hansen

2.1 Overview of Photo-voltaic Energy Facility: Technical Context: All sites

2.1.1 Overview

These projects aim 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 panel. A 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 together into 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 would be intended that the PV panels are treated with an anti-reflective coating to reduce the glare and reflectiveness of the panels to mitigate the potential negative visual impact, (DSR).

2.1.2 The 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.

2.1.3 Proposed 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
- Inverter – Sub-station centre, 8.08m by 3.05m and 2.79m high
- Guard cabin
- An electrical substation
- Cabling which may be underground or overhead
- Overhead electricity distribution lines (from substation to Eskom power line)
- A perimeter fence and internal roadways

During the construction phase a construction camp would be located on the site for the storage of components. There may be mess facilities and offices.

Fig 2.2: An example of an individual solar panel similar to those 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

2.2.1 **PV2**: Paarde Valley

PV2: Paarde Valley PV Installation would be established on a portion of farmland which extends northwards from the R48 towards the Brak River. The site is located at latitude and longitude coordinates 30°37'8.57"S; 24°0'4.95"E. There is a preferred and an alternative layout to assess.

Part of this site has been the subject of a previous successful application on behalf of the same proponent to establish a small PVF of 10MW generating capacity.

2.2.3 **PV3**: Badenhorst Dam

PV3: Badenhorst Dam PV Installation would be established on a portion of farmland which extends to the immediate east of the township of De Aar, Nonzwakazi, and to the south east of the Happy Valley township. It is located at latitude and longitude coordinates 30°40'34.24"S; 24°03'40.29"E, 1 250ha in extent. The ground appears flat and open. There is a preferred and an alternative layout to assess.

2.2.3 **PV4**: Annex du Plessis

PV4: Annex du Plessis PV Installation would be established on a portion of farmland which lies to the north east of the township of De Aar, Happy Valley, to the immediate east of the R48 and to the south of the Brak River. The site is located at latitude and longitude coordinates 30°37'52.62"S; 24°03'23.35"E.; 1 330ha in extent. The ground appears sloping and open. There is a preferred and an alternative layout to assess.

3.0 DESCRIPTION OF PROJECTS

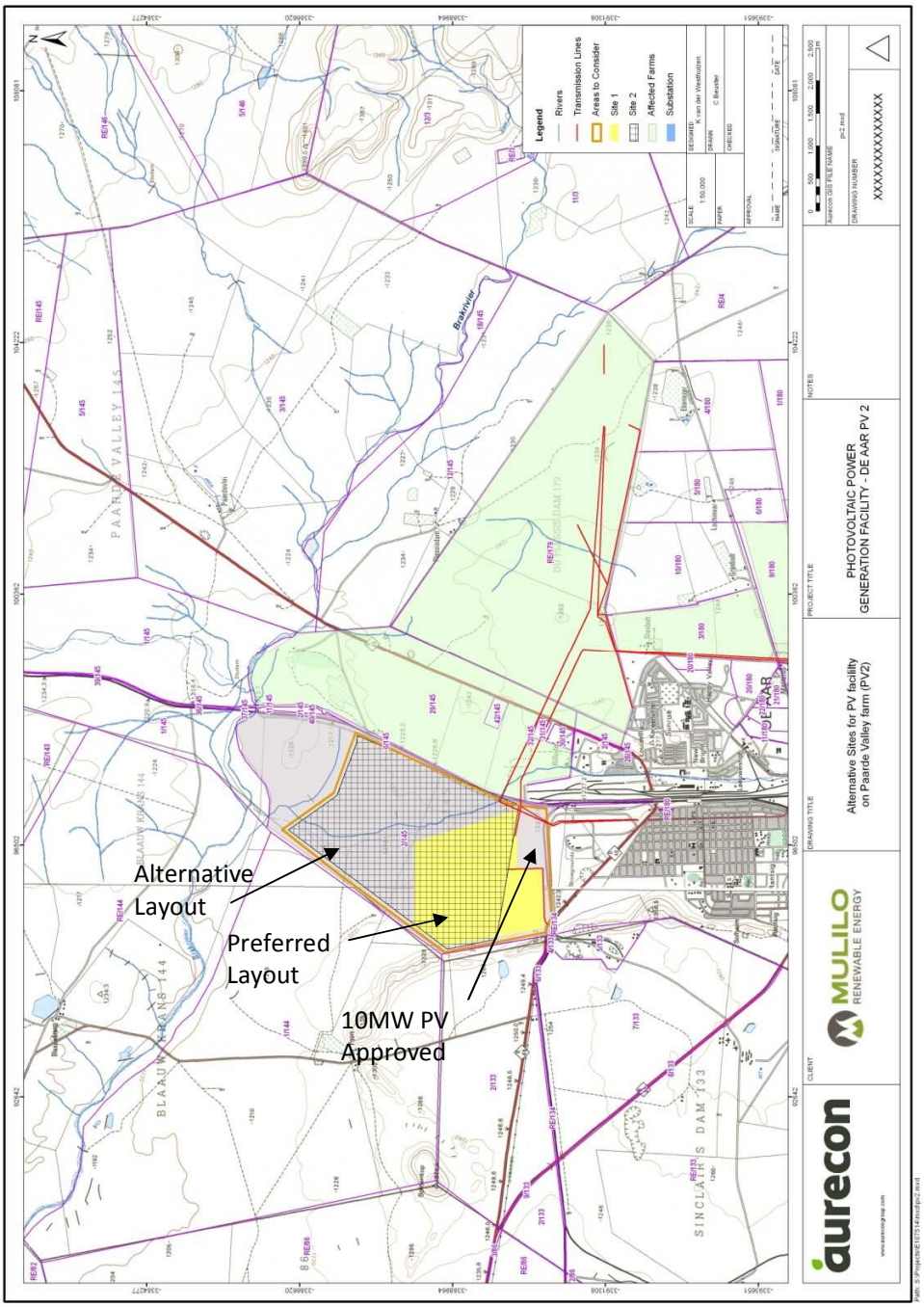

Fig 3.1: **PV2 Paarde Valley**. The site indicating the location of the *Preferred* layout in yellow, and the *Alternative* layout in the grid hatch. Red lines indicate the alignment of proposed transmission lines. Areas coloured green are affected farm portions. Source: Mulilo Renewable Energy and Aurecon

3.1 Project Description (PV2) Paarde Valley:

The site is currently used for grazing and this land use fits with the generally peri-urban to semi-industrial lands to the north of the town. The site appears generally flat, views are long north and south but more contained east and west. Its overall extent is about 990ha. The site is accessed off the R48 which passes very close by. The site lies between a ridge of low hills to the west and a railway line to the east. South of the R48 is the show-grounds site with a residential area of De Aar further to the south.

The *Preferred* layout installation would generate an estimated 75 MW of energy in total; its development area would be approximately 250 ha in extent; it is directly to the north of the similar development, by the same Proponent, which is at a later stage of Assessment.

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 would be electrified security fenced.
iii A road access onto the site would be from the R48.
iv The sub-station would be that serving Phase 1, cables within the site would be buried; power would be transmitted by a new 132kV line to the De Aar substation 2.5km away, and also by a second new 132kV transmission line to Hydra 20km away.
V There would be other buildings and internal roadways
v The installation would not be lit at night, shrubbery would be kept down to less than 30cms in height to avoid interference with the installation.
vi A water supply would be required for both the construction and operational periods.

3.2 Project Description (PV3) Badenhorst Dam:

The site is used for small stock grazing, it is open, undulating and fenced, and views are long. The *Preferred* layout and the *Alternative* layout installations would generate an estimated 75MW of energy in total. The development area would be 225ha in extent.

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 would be electrified security fenced.
iii A road access onto the site would be from N10 via local and new farm roads.
iv Upgrade to the existing access road (2.4 km long and 6 m wide).
v There would be a new sub-station, cables within the site would be buried; power would be transmitted by a new 132kV line to Hydra 12.6km away.
Vi There would be other buildings and internal roadways

vi The installation would not be lit at night, shrubbery may be cleared or be kept down to less than 30cms in height to avoid interference with the installation.

vii A water supply would be required for both the construction and operational periods.

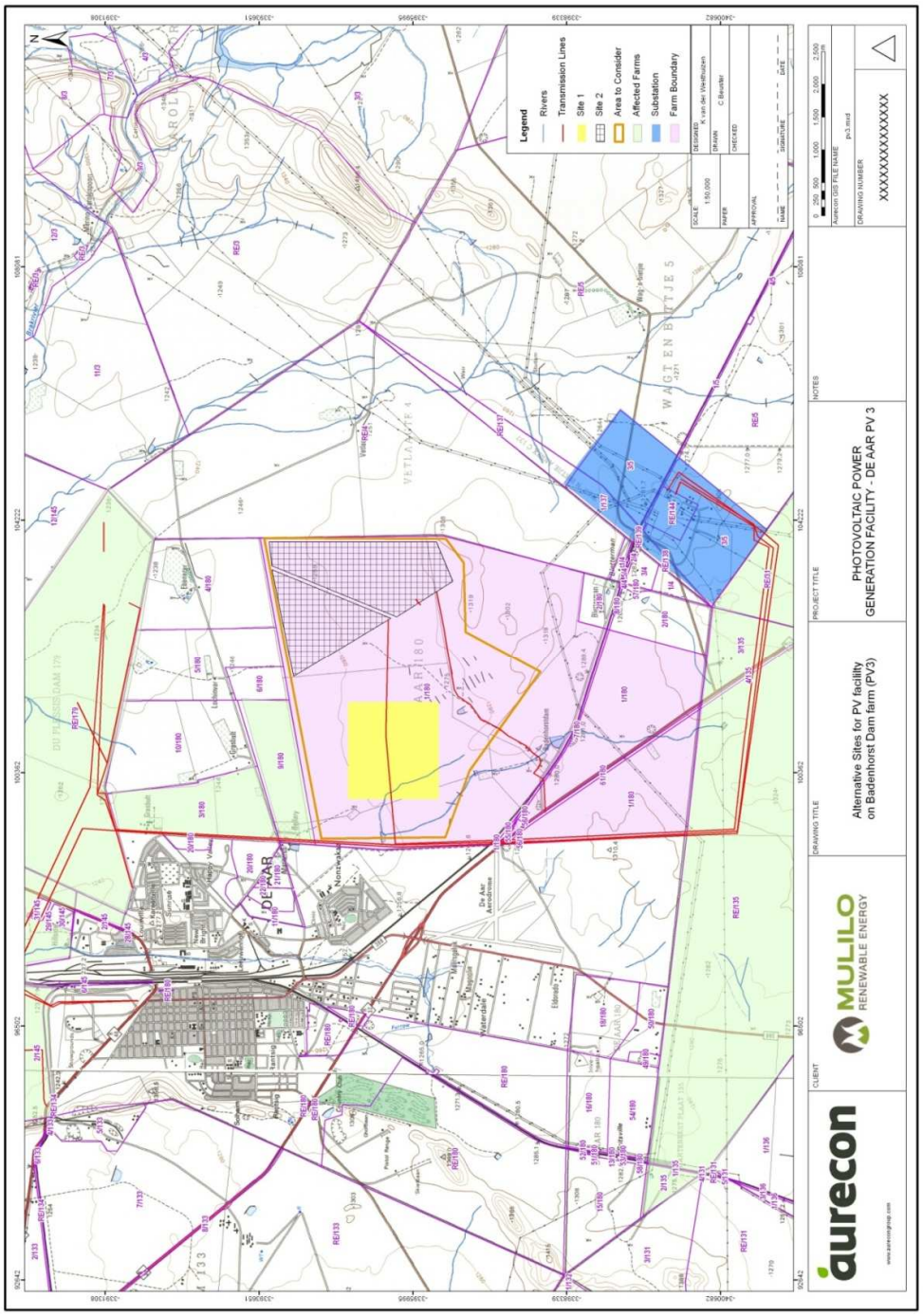

Fig 3.2: **PV3 Badenhorst Dam**. The site indicating the location of the *Preferred* layout in yellow, and the *Alternative* layout in the grid hatch. Red lines indicate the alignment of proposed transmission lines. Areas coloured green are affected farm portions. Source: Mulilo Renewable Energy and Aurecon

3.3 Project Description (PV4):

The site is used for small stock grazing, it is open, undulating and fenced, and views are long. The *Preferred* layout and the *Alternative* layout installations would generate an estimated 19MW of energy in total. The development area would be 64ha in extent.

Outline proposals include:

i A series of photo-voltaic panels aligned north-south in a grid. 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 would be electrified security fenced.
iii A road access onto the site would be from the Happy Valley road
iv There would be a sub-station, cables within the site would be buried; power would be transmitted by a new 132kV transmission line from the site to Hydra.
v The installation would not be lit at night, shrubbery would be kept down to less than 30cms in height to avoid interference with the installation.
vi A water supply would be required for both the construction and operational periods.

Fig 3.3: **PV4 Annex du Plessis**. *Preferred* layout with its *Preferred* and *Alternative* road access. The *Preferred* road access is shorter, connecting the south east corner of the development with the existing farm road to the south; the *Alternative* road access is from Happy Valley Road. Source: Aurecon

Fig 3.4: **PV4 Annex du Plessis**. *Alternative* layout and proposed road access, (white line from south west corner of the development.. Source: Aurecon

3.4 Infrastructure: Solar Panels

3.4.1 Layout, all sites

The photovoltaic panels would 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 system is modular and will follow the terrain. The development would be fenced with an electrified security fence. A new under-ground electricity feed would 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 PV modules would be seen as a long series of sloping panels. From the front, or north, the front line of panels would 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 a constant height and follow the terrain which varies by about 20m.

The development would not be lit or visible at night. There would 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 would be seen in conjunction with the existing Eskom transmission lines, timber pylons, other possible alternative energy projects, and transport corridors.

3.4.2 Construction Phase, all sites

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

During the construction phase between 200 and 900 individuals would be employed depending on the procurement method used, as well as the primary contractor. If non-locals would be employed they may be housed in temporary dwellings on site or in accommodation within De Aar. Therefore there could 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 to ten trucks with cranes would be required for the assembly of the facility.

Approximately 450 truck deliveries conveying approximately 900 40-foot container loads would be required to construct 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 would use the N10, to the sites.

3.4.3 Operation Phase, all sites

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

The operational phase of the development would not differ in appearance following completion of construction. During the operational period and for the full life of the project, the site would 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 would depend on the site conditions. (DSR) They would use the same site access road used for the Construction phase. The infrastructure and electricity generation would be monitored off site.

3.4.4 Decommissioning phase, all sites

The PV site would be decommissioned at the end of the Power Purchase Agreement (20 years from the date of commissioning). The decommissioning could be 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 could result in increased traffic movements on and around the site for that period; it could also result in a construction camp and lay-down area.

3.5 Infrastructure: Transmission lines

3.5.1 PV2

An under-ground feed would connect to the new on-site sub-station and thence would connect to a Preferred and an Alternative line. *Preferred*: 132kV overhead, 2.5km long, direct to De Aar substation along a servitude close to similar Eskom power lines. *Alternative*: 132kV overhead, 20km long, direct to Hydra substation.

The longer line to Hydra would exit the site in the south-east corner, would proceed in an easterly direction over currently vacant ground north of the industrial sites, continue over the R48 then it would change direction to head south, running parallel with the gravel road to the east of Happy Valley. From there it would continue south, on a new servitude to the east of Nonzwakazi, crossing over the N2 and a rail line and on to Hydra. The proponent advises that this route may be changed to the northern side of the existing Eskom line.

These routes apply to both the *Preferred* and the *Alternative* layouts.

3.5.2 PV3

Preferred Layout:
An under-ground feed would connect to the new on-site sub-station and thence would connect to a *Preferred* and an *Alternative* line. *Preferred*: 132kv overhead, 2.2km long to connect to existing Eskom transmission line. *Alternative*: 132kV overhead, 12.6km long, east of Nonzwakazi, crossing over the N2 and the rail line, connecting to Hydra

Alternative Layout:
An under-ground feed would connect to the new on-site sub-station and thence would connect to a Preferred and an Alternative line. Preferred: 132kv overhead, 2.2km long to connect to existing Eskom transmission line. Alternative: 132kV overhead, 15km long, east of Nonzwakazi, .crossing over the N2 and the rail line, connecting to Hydra

3.5.3 PV4

Preferred Layout*:*
An under-ground feed would connect to the new on-site sub-station and thence would connect to a Preferred and an Alternative line. *Preferred*: 132kv overhead, <1km long to connect to existing Eskom transmission lines crossing the eastern part of the farm boundary. *Alternative*: may still be subject to change but may lie on the northern side of the existing line.

Three Alternative transmission lines are being proposed to connect the *Preferred* layout to the De Aar sub-station: A 132 kV line (3 km in length) [referred to as Alternative 1]; a 22 kV line (8 km in length) [referred to as Alternative 2] and a transmission line (approximately 3 km in length) [referred to as Alternative 3] are being proposed.

Alternative Layout
An under-ground feed would connect to the new on-site sub-station and thence would connect to a Preferred and an Alternative line. *Preferred*: 132kv overhead, 2.3km long to connect to existing Eskom transmission lines crossing the eastern part of the farm boundary. *Alternative*: may still be subject to change but may lie on the northern side of the existing line.

Three Alternative transmission lines are being proposed to connect the *Preferred* layout to the De Aar sub-station: A 132 kV line (1.5 km in length) [referred to as Alternative 1]; a 22 kV line (6.7 km in length) [referred to as Alternative 2] and a transmission line (approximately 3 km in length) [referred to as Alternative 3] are being proposed.

3.6 Alternative Layouts

The development of a PVF is constrained by many technical issues relating to: the location of the PVF in an area where the capacity factor is high – that is, the amount of power that can be generated; the terrain must be suitable with 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 preferred sites are being pursued. However the following Alternatives are also presented for analysis in this assessment:

3.6.1 Activity alternatives, (all sites)

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

3.6.2 Site layout alternatives:

3.6.2.1 PV2:
Reference to the layout drawing illustrates the *Preferred* layout, and the *Alternative* layout.

The *Preferred* layout occupies the south part of the site, and would be adjacent to the PV to be established, probably, within the next 2 years. This location is closer to a residential area of De Aar. The *Alternative* layout occupies the centre and northern parts of the development site, 450ha in extent, to generate 150MW. Both sites would be accessed off the R48.

3.6.2.2 PV3
Reference to the layout drawing illustrates the *Preferred* layout, and the *Alternative* layout.

The *Preferred* layout is closer to Nonzwakazi, (1km from the Nonzwakazi cemetery and 1.5km from De Aar Aerodrome runway); the *Alternative* is further away. The road accesses for both layout alternatives would use a farm road off the N10, cross the rail line, and then turn north using existing tracks.

3.6.2.3 PV4
Reference to the layout drawing illustrates the *Preferred* layout, and the *Alternative* layout.

The *Preferred* layout would be further from the R48 and the *Alternative* closer (and 2.3km from Happy Valley). The road access for both layouts would use existing farm roads and link to the existing perimeter road around Happy Valley.

3.6.3 Technology Alternatives, (all sites):

3.6.3.1 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.

3.6.3.1 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 in this study and their visual implications will be assessed, (see Fig 3.2):

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

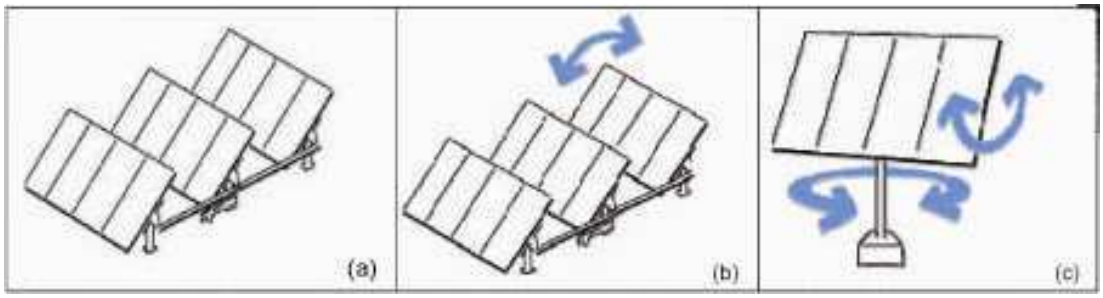

Fig 3.5. Panel mounting Options referred to above. Static, (a), and single axis, (b) refer only to Option 1. Source: DSR Aurecon

3.6.3.2 Foundation alternatives

Foundations for Option 1: There are various methods for anchoring PV arrays, but as it is important to select the best option depending on the soil characteristics of the area, a geotechnical assessment would be undertaken. The following anchoring 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.

Foundations for Option 2: these larger panels are supported by a single 0.9m diameter pedestal, root fixed into a below ground concrete foundation covered by local substrate.

3.6.4 Summary of alternatives

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

Location alternatives:

- One location on each site.

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:

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

Panel mounting for Option 2 is concentrated dual axis tracking

Foundation alternatives:

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

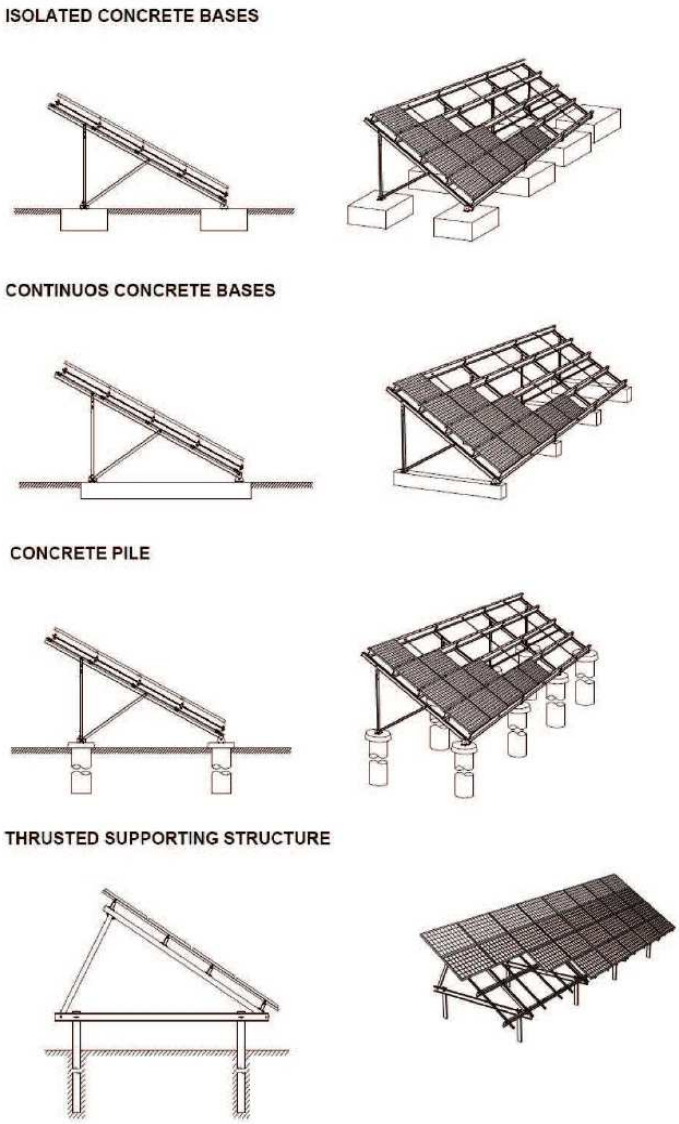

Fig 3.6.Foundation Alternatives, referred to above. Source: DSR Aurecon

3.7 Significant Changes to Levels, all sites

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

3.8 Access

PV2:Access to the development would be gained off the R48 and into the south west corner of the site; the R48 links the N10 with the north part of De Aar, and continues to Philipstown. As

there is high ground to the immediate west of the access road entrance, the sightlines seem less than ideal on this stretch of the RR48 for traffic travelling east.

Preferred: one proposed road (± 1 km in length). *Alternative*: one proposed road (± 1.4 km in length). All the proposed roads will be gravel roads and will range from 4 to 6 meters wide.

PV3: Access to the development would be gained off an existing farm track off the N10.

Preferred: one proposed road (± 2.2 km long). *Alternative*: one proposed road (± 4.5 km long). All the proposed roads will be gravel roads and will range from 4 to 6 meters wide.

PV4: Access to the development site would be off the existing perimeter road around Happy Valley, or off the farm road south of the site.

Preferred: one proposed road (± 1.5 km long) and one alternative road (± 4.7 km long). *Alternative*: one preferred road (± 2.7 km long). All the proposed roads will be gravel roads and will range from 4 to 6 meters wide.

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

3.9 Proposed Built Form, all sites

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)

PV2: Storm water management infrastructure, such as concrete channels, would be required to manage the onsite runoff and to direct the flow of storm water.

3. 10 Proposed Landscape Treatment, all sites

Vegetation may be retained, and kept below 300mm or the ground under the installation footprint may be maintained as completely clear.

3.11 Services, all sites

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.

4.0 NATURE 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

De Aar is located just to the north of the N10, which links Port Elizabeth on the south coast of the Eastern Cape, crossing the N1, with Upington in the north. De Aar is an important railway junction; there are extensive railway sidings, marshalling yards and repair shops in the town.

The town is also linked north south by the R48 which goes north and east to Philipstown and south via the R348 to Richmond on the N1. The railway radiates to all compass points; the north south route is the passenger service of Shosholoza Meyl, and Premier Classe twice a week; the route to Middelburg is mainly freight. There is an airstrip for light aircraft to the south of the N10 and close to the town.

The South African Armed Services has an installation to the west of the town which includes buildings, underground bunkers and an airstrip.

The population is about 45,800, and the town is laid out on a grid system, mainly north-south; and on the west side of the railway junction. There are several townships to the east of the railway junction; a line of smallholdings extending south along the R348 and scattered farmsteads locally. The De Aar sub-station is close to the junction of Voortrekker Street and the R48; to the east of the town is the major local sub-station, Hydra.

The gravel roads are of a light sandy colour; they provide access to farmsteads and to the network of transmission lines.

De Aar has a tourism profile focused on its connections with Olive Schreiner, and also hang gliding and para gliding.

4.3 Topography Rivers and Climate

The main geographic features defining the locality of De Aar are the wide, almost flat to undulating open spaces, big skies and sparse settlements.

Emerging from the plain are conical and ridge shaped hills and larger flatter plateaux which are intrusions of dolerite rock, and form the only vertical relief. The hills are about 100m above the plain, and the plateaux are about 250m above the plain.

There are two perennial rivers locally, the Elandsfontein running south to north, and passing De Aar to the west, and the Brak which runs from the east to the west and passes De Aar to the north. The Brak lies close to the north boundary of thePV2 and PV4 sites.

PV2: The site appears flat but varies in elevation between 1216 and 1231m asl, an average elevation for De Aar is 1245m asl. The development site falls very gently to the north and the Brak River and rises also very gently to the south and the housing. A line of low hills lies to the immediate west of the site, up to 1280m asl; they would offer screening in that direction to users of the Britstown Road, (R48), the railway line and the N10.

PV3: the site appears flat and open at around 1260 to 1270m asl; surrounding landform is similar.

PV4: the site appears undulating and open at around 1230 to 1265m asl; there is higher ground between the R48 and the development which could shield the development.

The Northern Cape experiences semi-desert climatic conditions. De Aar is located within the low rainfall area of the Northern Cape and typically receives about 196 mm of rainfall per annum. Approximately 45 mm are received during March. Mean temperatures range between 30ºC and 40ºC during summer months and the temperature can drop to -10ºC during winter nights. (DSR)

4.4 Vegetation

The study areas lie near the eastern edge of the Nama Karoo biome, which has a single mapped vegetation type namely the Northern Upper Karoo. The characteristics of vegetation in the area are mainly influenced by soil type and habitat rockiness. Shrubs that rarely exceed 70 cm in height dominate the plains and the hills and mountains tend to be grassy (DSR: Aurecon: Bird Life International, 2011).

There are grasslands and scrub on the sites; there are few trees locally, only around De Aar and at farmsteads, poplar and eucalypt. The overall colour of the landscape is grey-green and yellow-green grasslands with grey scrub interspersed with the pale brown roads. The scrub vegetation pattern appears uniform in colour and this provides strong visual clarity and lack of clutter.

4.5 Agriculture

The dominant land use on the sites is pastoral agriculture, either cattle or small stock grazing and this also appears to form the major agricultural land-use in the immediate locality. There are also lands given over to fodder crops, grasslands, along with land that is unused. There are scattered farmsteads around and the large fields are mainly defined by fencing. There are small dams fed by seasonal rainfall, and wind pumps.

4.6 Other Land Uses

Apart from land being used for residential, industry, agriculture, small holdings and transmission lines, there are a number of renewable energy projects within the De Aar area in various stages of approval, including Mulilo's approved 100 MW, 67WT, wind energy facility, (WEF), in the

Kasamberge/Maanhaarberge south west of De Aar. This WEF has a northern extension on Swartkoppies; the nearest turbine is about 7.5km from the centre of De Aar and there are also proposed transmission lines from there to Hydra.

There are two proposed WEFs being considered for sites on the Eastern Plateau, about 20km north east and east of De Aar. The combined total is 250 turbines.

There is a 10MW PVF approved on a site to the immediate east of PV2 and another PVF is being considered to the south-east of De Aar.

4.7 Landscape character

PV2: An open and almost flat grassy landscape devoted to agriculture, but also surrounded by semi-unused land in the show-grounds site with its Eskom infrastructure, and on the edge of the industrial part of town, with its railway sidings and industrial estates.

The character of the landscape is described as peri-urban fringe, with Eskom and rail infrastructure, grass and scrublands, few trees, and some farmland. Views are of medium length, (longest to the north), and partly enclosed, being mainly defined by topography.

PV3: A more undulating landscape with grasses and low shrubs used for small stock grazing. It is more visually exposed to residential areas. These residential areas are increasing in extent. There are no vertical elements in the immediate landscape; the site would be close to a cemetery and also some farmsteads.

The character of the landscape is described as rural and agricultural. Views are long.

PV4: A more undulating landscape with grasses and low shrubs, used for grazing and close to the R48 which is shielded by the site topography.

The character of the landscape is described as rural and agricultural. Views are long and are defined by topography.

4.8 Landscape Value

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

These sites have some value for agriculture, but do not have a strong or identifiable sense of place. Measured by lack of accessibility and the relative absence of settlement, they would be valued as an undeveloped edge to the urban area.

4.9 Visual significance of the area

The overall visual impression of the localities is one of undulating lowland landscapes, offering medium to long views. The urban fringe nature of the PV2 site results in it being a rather cluttered landscape with less visual clarity. The PV3 and PV4 sites are much less cluttered.

There are significant elements in the local landscape that define the location of the PV2 site. The visual signposts are, to the east, the railway line running on embankment, to the south, the R48, and to the west, the distinct line of low hills. The PV3 and PV4 sites do not have visual signposts.

Fig 4.1: Existing 132kV lines as an example of those to be used for the developments. Source: Hansen

5.0 PV2 PAARDE VALLEY 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. At that height a distance of 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 would be those from the transportation corridors of the R48 and the rail line; additionally from local places of habitation and work.

- The site itself, the hills to the immediate west.
- Road and rail transport corridors.
- The showground site and the residential area both to the immediate south.
- The farms on the Blaaukrantz Road
- Industrial Estates and Sewage Works

The viewshed envelope is therefore defined by views from transport corridors, existing places of habitation and employment, and by topography; views of the proposed development would be obtained from transport corridors, and adjacent high ground.

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

5.3 Viewsheds

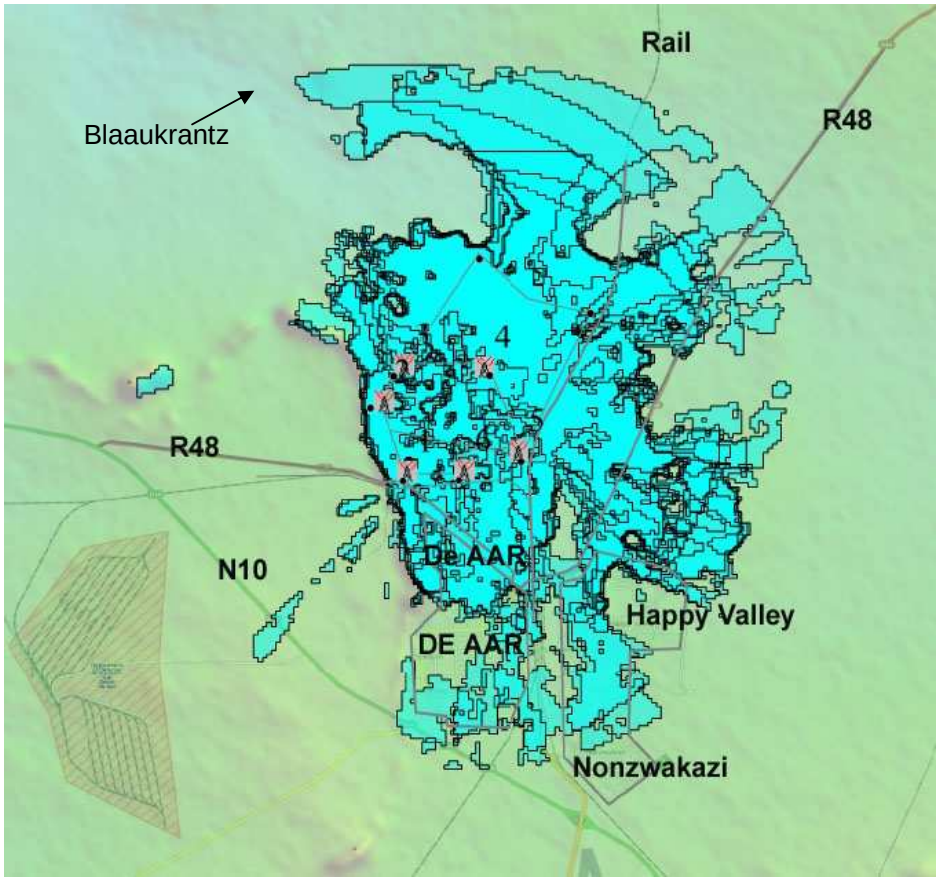

Fig 5.1: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Preferred* installation, and using 6 of its perimeter points; showing the locations of De Aar and townships, transport corridors.

Areas which appear to be affected:

- The development site.
- R48.
- Rail line to Kimberley.
- Portions of De Aar: the northern suburbs and those on the southern edge.
- Agricultural land between Happy Valley and the R48.

Description:

- The site environs would be affected, including the show-grounds site.
- The R48 could be affected from the ridge, into De Aar and out beyond the industrial sites, north of the town. When tested on site most of the road was shielded.
- The rail line could be affected for a distance of about 8km north of the town, (the line is along part of the site boundary).
- Portions of De Aar appear to be impacted upon, but when tested on site it was noted that the intervening trees and housing broke up the view to the extent that the development would not be visible.
- The agricultural lands north of Happy Valley. When tested on site it was seen that the proposed development would be experienced only intermittently.

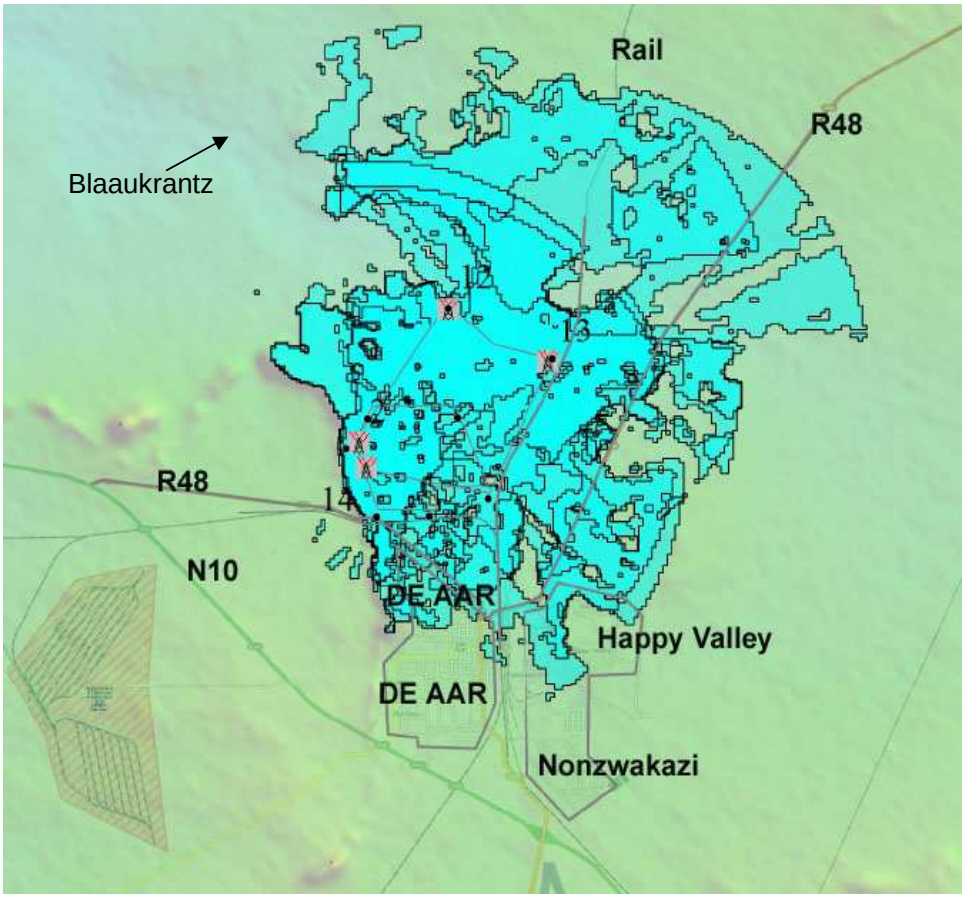

Fig 5.2: **Option 1**Visual envelope calculated at a radius of 5km from the proposed *Alternative* installation, using 5 of its perimeter points; showing the locations of De Aar and townships, transport corridors

Areas which appear to be affected:

- The development site
- R48
- Rail line to Kimberley.
- Portions of De Aar: north suburbs
- Agricultural land between Happy Valley and the R48

Description:

- The site environs would be affected, including the show-grounds site.
- The R48 from the ridge into De Aar and out beyond the industrial sites, north of the town. When tested on site most of the road was shielded.
- The rail line is visible for a distance of about 9.4km north of the town, (the line is along part of the site boundary).
- Northern suburbs of De Aar. When tested on site it was noted that the intervening trees and housing broke up the view to the extent that the development would not be visible.
- The agricultural lands north of Happy Valley. When tested on site it was seen that the proposed development would be experienced only intermittently.

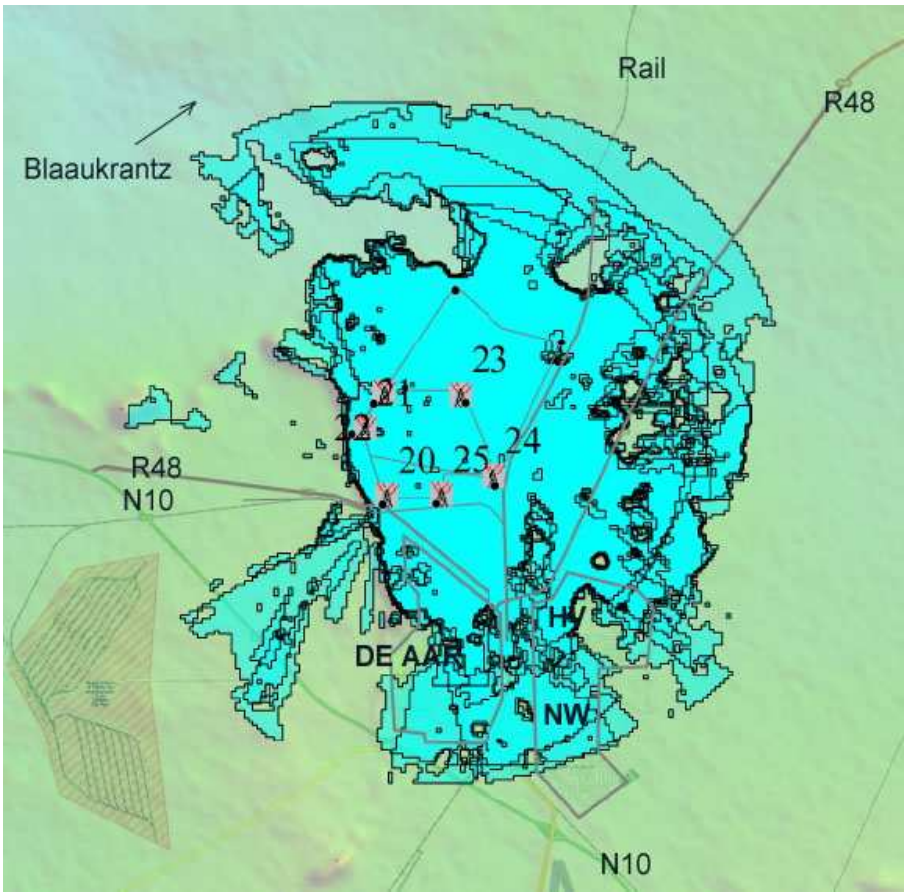

Fig 5.3: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Preferred* installation, and using 6 of its perimeter points; showing the locations of De Aar and townships, transport corridors.

Areas which appear to be affected:

- The development site.
- R48.
- Rail line to Kimberley.
- Portions of De Aar: the northern suburbs and those on the southern edge.
- Agricultural land between Happy Valley and the R48.

Description:

- The site environs would be affected, including the show-grounds site.
- The R48 could be affected from the ridge, into De Aar and out beyond the industrial sites, north of the town. When tested on site most of the road was shielded.
- The rail line could be affected for a distance of about 8km north of the town, (the line is along part of the site boundary).
- Portions of De Aar appear to be impacted upon, but when tested on site it was noted that the intervening trees and housing broke up the view to the extent that the development would not be visible.
- The agricultural lands north of Happy Valley. When tested on site it was seen that the proposed development would be experienced only intermittently.

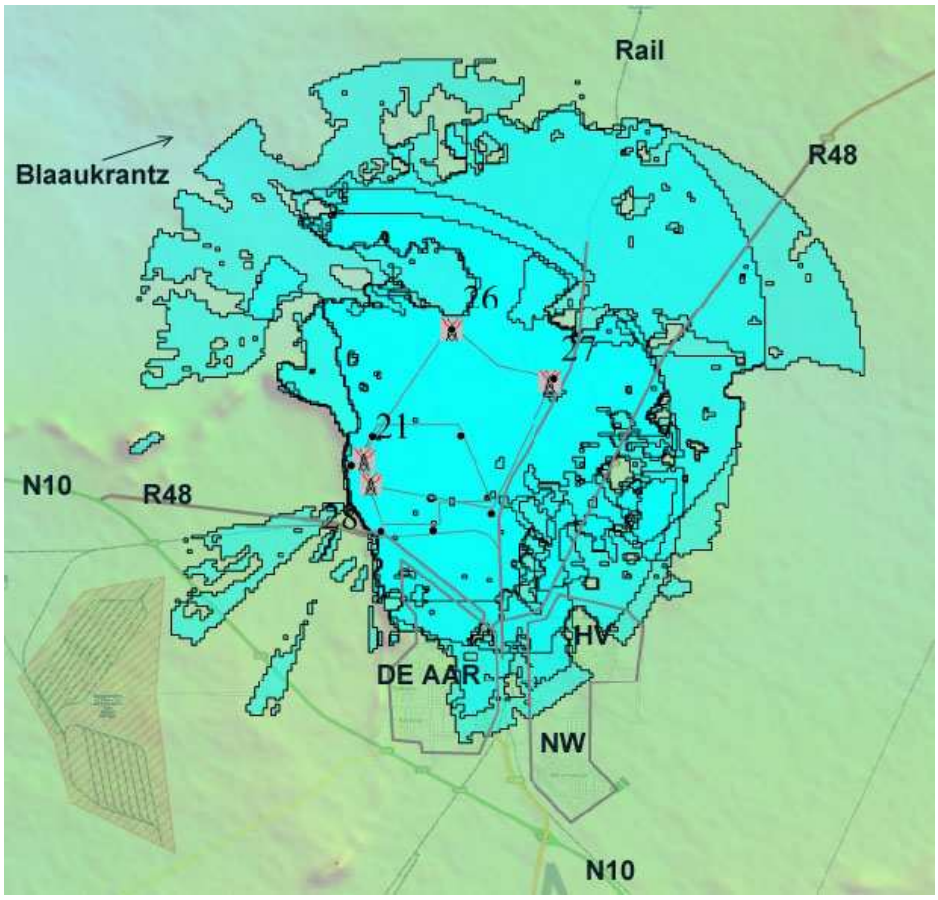

Fig 5.4: Option 2 Visual envelope calculated at a radius of 5km from the proposed *Alternative* installation, using 5 of its perimeter points; and showing the locations of De Aar and townships, transport corridors

Areas which appear to be affected:

- The development site
- R48
- Rail line to Kimberley.
- Portions of De Aar: north suburbs
- Agricultural land between Happy Valley and the R48

Description:

- The site environs would be affected, including the show-grounds site.
- The R48 from the ridge into De Aar and out beyond the industrial sites, north of the town. When tested on site most of the road was shielded.
- The rail line is visible for a distance of about 9.4km north of the town, (the line is along part of the site boundary).
- Northern suburbs of De Aar. When tested on site it was noted that the intervening trees and housing broke up the view to the extent that the development would not be visible.
- The agricultural lands north of Happy Valley. When tested on site it was seen that the proposed development would be experienced only intermittently.

5.3.1 Extent of actual photo-voltaic visibility against potential visibility

Metadata extracted from the terrain analysis software gave the following data for the individual portions of the photo-voltaic layout assessed from a representative sample, (location of the points illustrated in Fig 5.3). This figure expresses the area of land visually affected by that portion of the proposal as a percentage of the overall sampled area which would be 100%. So a low percentage means that that portion of the installation affects a smaller proportion of the locality. The rankings are for purposes of comparison only.

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

Table 5.1 Actual visibility as a percentage of potential visibility

PV point	**Height in m asl**	**Percent visible Option 1**	**Percent visible Option 2**	**Analysis**
PV point 1 Preferred	1 246	38.7%	49.4%	Moderate
PV point 2 Preferred	1 235	28.5%	42.6%	Least visible
PV point 3 Preferred	1 229	36.8%	51.0%	Moderate
PV point 4 Preferred	1 223	39.1%	56.1%	Moderate
PV point 5 Preferred	1 230	27.7%	51.0%	Least visible
PV point 6 Preferred	1 237	38.7%	52.1%	Moderate
PV point 12 Alternative	1 217	46.9%	74.6%	Most visible
PV point 13 Alternative	1 219	43.7%	68.8%	Most visible
PV point 14 Alternative	1 241	34.1%	46.4%	Moderate

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 is due to the more open quality of the landscape. The remainder of the installation has a moderate visual impact in terms of potential area affected.

5.3.2 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. For Option 2 the northern portion of the *Alternative* layout is the most visible.

Option 1: mean visibility is 37.13% of the sampled areas are visually impacted upon.
Option 2: mean visibility is 54.66% of the sampled areas are visually impacted upon.
The greater extent of the Option 2 visual envelope (47% 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, north-south and west-east. These cross sections are at a scale of 1:4 horizontal to vertical. They show the relationship between the site and its environs.

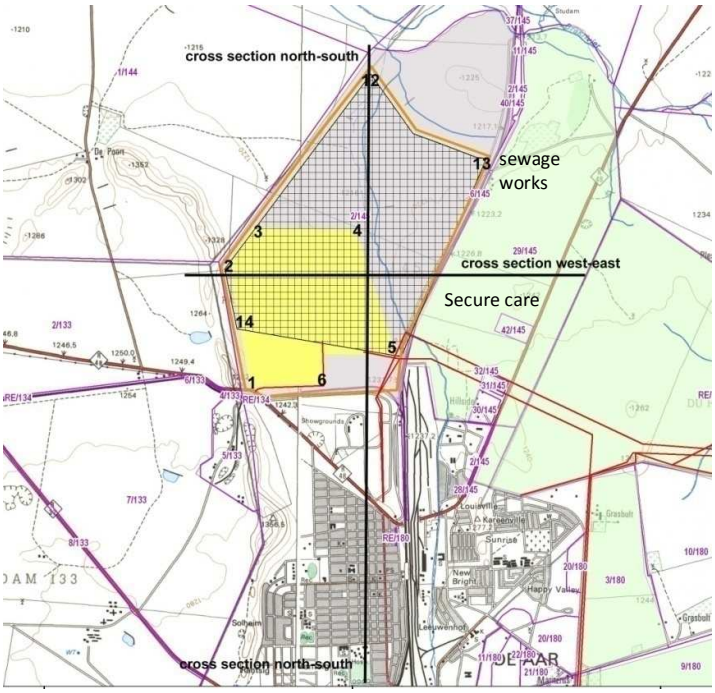

Fig 5.5: Location of sampled points of the proposed installation, and location of cross sections.

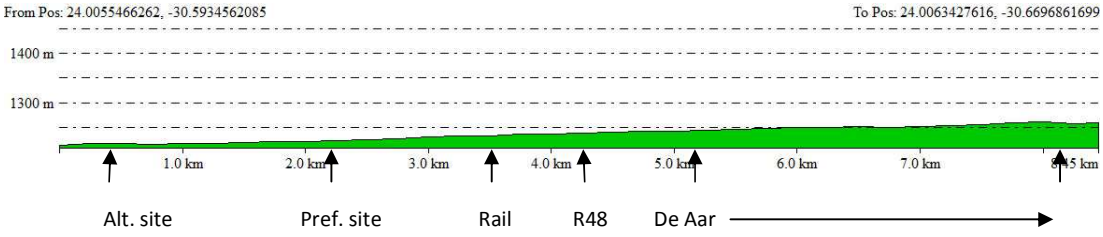

Fig 5.6: Cross section north-south. The bulk of the urban centre is on slightly rising ground. The development site is lower and should be visible but is shielded from the urban area by buildings, garden planting and walls. The development could be visible to those living on the north edge of the town, and to some receptors in the industrial sites.

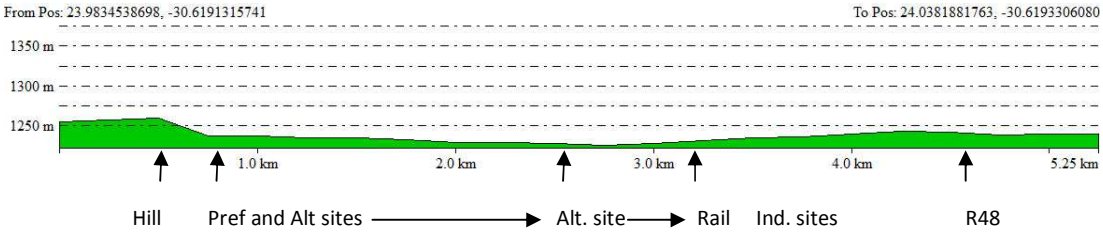

Fig 5.7: Cross section west-east. The site is in a dip, would be visible from points of high ground, and the rail line adjacent.

5.5 Description and Comparison of Alternatives

The physical form that the development would 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.

5.5.2 Site Layout Alternatives

Preferred layout is designed to generate 75MW in an area of 225ha, south part of site, and to the immediate west and north of a 10MW PVF to be constructed within 2 years. The site for the *Alternative* layout is more extensive at 450ha, occupies part of the preferred site but extends further to the north; this layout would be twice as extensive and generate 150MW.

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

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 equal to that of the passage of the sun across the earth's surface. It would be akin to watching a shadow move. Due to the extent of the development there would be awareness of panels facing in a certain direction in the morning and in another direction in the afternoon, but it is not likely that the panels will be seen to move.

The foregoing describes the cumulative effect but many installations re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will 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 cumulative pace, of the passage of the sun. The overall visual impact is however expected to be greater as the complex movements provide 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. Many installations would re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will re-orient.

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

The visual implications of concrete bases whether isolated or continuous are minimal when the installation is viewed as a whole which is what is being assessed in this study.

The visual implications of option (lll): less impact due to apparently lighter structure, and this would be slightly more apparent with option (lV).

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

5.5.4 There are transmission line alternatives to assess, a short route to De Aar substation. A longer route to Hydra.

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 better clutter? *The site is in an area of moderate visual clutter; more clutter will ensue.*

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 quite 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 offers some visual composition opportunities such as from the hills to the west which may offer some back-grounding and from the railway embankment to the east.*

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

- The site itself, the hills to the immediate west.
- Road and rail transport corridors.
- The showground site and the residential area both to the immediate south.
- The farms on the Blaaukrantz Road
- Industrial estates and sewage works

5.6.2.1 The site itself, the hills to the immediate west
Development would be visible to receptors on the site who will be people directly involved with the installation. Development would be clearly visible to people walking on the hills to the west.

5.6.2.2 Road and rail transport corridors.
Development would be held in view for users of a length of the R48, travelling in each direction, for users of local roads around the show-grounds site, and for users of the rail lines adjacent.

5.6.2.3 The showground site and the residential area both to the immediate south.
Users of the showground site would be at the same level as the site and therefore would be visually aware; residents of existing housing have screening by trees and walls.

5.6.2.4 The farms on the Blaaukrantz Road
There are two farmsteads which are both shielded by topography, and tree planting.

5.6.2.5 Industrial estates, Secure Care Centre, and Sewage Works
The industrial estates are accessed to the west of the northbound R48; the development would be largely screened by railway infrastructure. However the northward extension of these estates and sites would be potentially more visually aware.

5.6.3 Construction Period

5.6.3.1 Large scale of proposed works
The construction access would be off the R48, (within the defined visual envelope). There could be 450 truck deliveries, and/or 900 40-foot container loads. The scale of the haulage is large.

5.6.3.2 Impact on the site and environs:
Construction traffic may start by upgrading the site access, constructing new site roads, excavating for foundations, etc. The works would also involve provision of services, construction of concrete foundations, and installation of all above ground infrastructure.

There will 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 probably via the N10. The route for commercial traffic into De Aar is along Voortrekker Street.

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 further from the residential centres it is deemed to have a lesser 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.

5.6.4.4 *Transmission* line alternatives: preferred route: very low visual intensity. Alternative route: low visual intensity.

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 below 5km to around 3 to 4km.

5.7.3 Extent of Impact of Alternatives

The extent of the impact of the *Alternative* layout is also rated local.
The extent of the impacts of the Option 1 and 2 Technology *Alternatives* is also rated local.
The extent of the impacts of the Technology *Alternatives* is also rated local.
The extent of the impacts of the Transmission line *Alternatives* is also rated local.
The extent of the impact of the *No-Go Alternative* is rated as having no impact

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

Topography: the site is gently undulating.

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

5.8.2 Elements **beyond** the Site which affect Visual Exposure

Topography: the hills to the west offer shielding from that direction but cause the site to be particularly exposed to east bound traffic on the R48 as they descend the hill and face the site. The low railway embankment to the east offers some shielding to receptors beyond it but the rail

carriages would have a more elevated view. The site is somewhat lower in elevation than its immediate surrounds by 2 to 3 metres.

Tree Planting and Built Form: the pylons, buildings, trees and sporadic vegetation on the showground site to the south offers some shielding. The railway infrastructure to the south east offers some shielding.

5.8.3 Conclusion

The visual exposure is rated as 'partly exposed', or medium and medium for the construction period; this is 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 medium to the same degree for the *No-Go Alternative* and for the *layout* and *technology Alternatives.*

5.9 Zones of Visual Influence or Theoretical Visibility

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

- *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*

- The site itself, the hills to the immediate west.
- Road and rail transport corridors.
- The showground site and the residential area both to the immediate south.
- The farmsteads on the Blaaukrantz Road
- Industrial Estates and Sewage Works

The zones of visual influence, viewsheds, are recorded in Figures 5.1 and 5.2 and from them it can be seen that significant areas could be visually affected. The degree is adjudged to be moderate as the development will be low to the ground and partially shielded.

5.9.1 The site itself, the hills to the immediate west

There are no receptors on the site itself apart from people working with the grazing animals. The ridge shaped line of low hills to the immediate west of the site rise to between 1320 to 1350m asl, and extend from the N10 south of De Aar past the site and up to De Poort on the Blaaukrantz Road. De Aar has been laid out to derive some shelter from this ridge and it will screen the development site successfully from receptors to the west. There does not appear to be any evidence of habitation on these hills, but there may be some recreational use for walkers.

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

5.9.2 The showground site and the residential area both to the immediate south

Potential receptors on the showground site will be people working in the offices there and maintenance operatives for the Eskom infrastructure.

The northern edge of the De Aar residential area lies further to the south and on the opposite side of the R48. It is at a similar elevation and between 1 and 1.5km away. These houses benefit from screening by walls, garden trees, and also by the clutter on the showground site.

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 moderate-high as the distance and shielding is less effective.

5.9.3 The farmsteads on the Blaaukrantz Road

This is a gravel road on the west side of the ridge, from the R48 north to Blaaukrantz farm, via De Poort farmstead. The stretch of road between the R48 and De Poort is shielded from the development site by the ridge, as is the farmstead.

The road then goes through an open landscape till Blaaukrantz farmstead is reached, on the north side of the Brak River. This farmstead would also be shielded from the Option 1 *Preferred* layout because of subtle changes in local topography, the intervening land rises shallowly and then falls away again towards the site. The Option 1 *Alternative* development site would be closer but is similarly screened. Option 2 *Preferred* would have a similar impact but Option 2 *Alternative* layout would be well within the zone of visual influence.

The zone of visual influence for Option 1 is assessed as low due to shielding.
The zone of visual influence for Option 2 is assessed as moderate due to less shielding.

5.9.4 Industrial Estates, Secure Care Centre, and Sewage works

The Industrial sites lie close to the site, within 1km, to the east, between the railway line and the R48. It is an area of mainly single storey industrial units divided by short roads, and parking. These sites would be screened from the Option 1 development by railway infrastructure; the more northerly of the sites would have a potentially more open view. However the low embankment supporting the rail line offers some shielding. Option 2 would be more visually evident.

To the north of these sites a single storey residential Secure Care centre has been established, whose boundary extends to the rail line. This is a residential centre for young offenders, and people living and working there would be visually aware of the Option 1 development; the *Alternative* layout would impact to a greater degree because of its greater footprint. Option 2 would be more visually evident.

The sewage works, is a single storey place of employment further north along the R48 where a view of the *Alternative* layout would be obtained. The view of Option 1 would be partially shielded by the railway embankment. Option 2 would be more visually evident.

The zone of visual influence for Option 1 is assessed as moderate due to shielding
The zone of visual influence for Option 2 is assessed as moderate-high due to less shielding

5.9.5 Road and Transport corridors.

5.9.5.1 R48 from the N10 to the under-bridge, in De Aar north

Travelling eastwards, traffic leaves the N10 to use the R48 to access the north part of De Aar, then, via an under-bridge under the railway lines, proceeds to Philipstown and Petrusville. At 2km from the N10, the road rises over the ridge of hills discussed in earlier paragraphs, and immediately a wide view of the development site is obtained. The road then reduces in elevation till the site level is reached, but simultaneously moves away to skirt the edge of the showground site. Thereafter, users have no view of the site.

Therefore, for a distance of about 200m, about 8 seconds if travelling at 100km/hour, drivers would have a high level view of the site. This view will include the 10MW PVF referred to in paragraph 4.6 which may be constructed in about 2 years time.

Road users travelling west on this road will drive along the showground site, looking towards the site, and just as they start to ascend the ridge they would be able to look to their right and be visually aware of both PVF developments. The view will be brief, for about 400m.

There are two picnic sites on this stretch of road, there is shielding by trees.

The *Preferred Alternative* would be closer to the road and therefore be slightly more visible.

The zone of visual influence for Option 1 is assessed as low due to brevity of view and shielding.
The zone of visual influence for Option 2 is assessed as moderate due to brevity of view but little shielding.

5.9.5.2 R48 from the under-bridge out past the industrial estates towards Philipstown.

Drivers travelling north or south would not have a view of the Option 1 development site as it would be shielded by the industrial sites. After the Secure Care centre is passed the site is still shielded by the rail embankment. The Option 2 development of either the *Preferred* or the *Alternative* layout would be visible to drivers looking to the side; the top portions of the panel modules would be seen.

The zone of visual influence for Option 1 is assessed as low due to shielding.
The zone of visual influence for Option 2 is assessed as moderate-low due to less shielding.

5.9.5.3 N10 travellers driving north-west towards Britstown, or south-east towards Hanover.

Would theoretically receive a glimpsed view of the Option 1 *Preferred Alternative* but this would be too brief to be measureable because of shielding by intervening topography.
Drivers could look to the side and obtain a view of Option 2 for a distance of 1.5km, or about 1 minute.

The zone of visual influence for Option 1 is assessed as low due to brevity of view and shielding.
The zone of visual influence for Option 2 is assessed as low due to brevity of view and shielding.

5.9.5.4 Rail users

This rail line north from De Aar to Kimberley is a passenger service, running the Shozoloza Meyl and the Premier Classe up to twice a week in each direction. Option 1: northbound or southbound passengers could hold the site in view for about 8 minutes over 8km if travelling at 60km/hr. The Rail line west to Britstown and Prieska is a freight service. Option 2: the view would be held for a similar time but more of the layout would be visible.

The zone of visual influence is assessed as moderate.

5.9.6 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 would use the roads described above. The location of lay-down areas may be visible locally.

5.9.7 Comparison with other Layouts

The visibility of the N*o-Go Alternative* is low. The *Alternative* layout has a greater footprint, and is rated slightly greater in visibility than the *Preferred*.

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

The visibility of the *Technology alternatives* (foundations) are all rated visible to a similar degree; of the mounting options, concentrated dual axis tracking would be most visible, due to movement and possible occasional sunlight bounce off the panels. Transmission line alternative route is rated as more visible than the preferred route.

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 on the northern edge of town where views are quite long. There are vertical elements in the local landscape, such as electricity pylons, railway infrastructure and the adjacent ridge, so the site is contained. Most of the land surrounding the site is developed. The electricity, and railway, infrastructure introduces some industrial character to the locality, reinforced by the industrial estate nearby.

Therefore the visual absorption capacity for Options 1 is rated medium, (the area could absorb this development to a degree) and it would not look out of place in this landscape. Option 2

would be rated medium-low to immediate receptors but medium to receptors more than 1km away.

Visual absorption capacity is rated more positively for the *Preferred Alternative* than for the *Alternative layout*, due to the lesser footprint. The visual absorption capacity does not vary for the other Technology *Alternatives.*

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 is peri-urban, with on-site agriculture, and industrial character from Eskom and Transnet infrastructure. It is open, flat, used for grazing and vegetated by low shrubs and grasses, and in a landscape where views are quite long. Its compatibility with surrounding landscape does not vary throughout its physical extent.

This development proposes to change the use of these peri-urban lands to that of a Photovoltaic Energy Facility, which is an industrial land use. The power lines component of the proposed development will fit in because in proximity to the development site is the existing sub-station and the industrial sites. 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 that the *Preferred* is more compatible in scale. The Technology and Transmission lines *Alternatives* are equally compatible as all relate to the industrialisation of the landscape.

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 close to a residential community, rail infrastructure, transportation corridors, and power lines. The locality has always had mixed uses though with an industrial component from the power lines and the industrial estate.

The local site 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 adjudged 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 would be users of transport corridors, the show-grounds site, the Secure Care home, the Sewage works and possibly, the hill adjacent. 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 Comparison of Alternatives

Layouts: Comparing the magnitude of the visual impact of the *Preferred* and the *Alternative layouts* indicates that as the *Preferred* is less in extent that the *Alternative*, its visual intensity is rated lower.

Activities: 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 alternatives: 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.
Transmission lines: the *Preferred* line is rated lower in visual intensity than the *Alternative*.

5.12.6 Conclusion

The Intensity, or Magnitude, is summarised from the foregoing as moderate. 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, (permanent/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 beyond 20 years. New infrastructure could be erected on the site and on the same foundations, or the site could be de-commissioned. The duration is judged to be long term.

The duration of the *No-Go alternative* cannot be known at this time but may not be permanent 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 (para 5.7, local)
- the length of time over which it may be experienced, (para 5.13, long term)
- and the intensity of the impact, (para 5.12, moderate).

and the significance ratings in 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 moderate 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 *No-Go Alternative* will have a low significance, as the status quo will not alter.
The significance rating for the *Preferred* Layout is moderate.

The significance rating for the *Alternative* Layout is moderate-high, due to its scale and distance from receptors.
The significance rating for the Option 1Technology is moderate.
The significance rating for the Option 2 Technology is moderate-high.
The significance rating for the Transmission line *Alternatives* is moderate.

5.15 Potential Cumulative Visual Impacts.

Looks at the accretion of similar developments over time

5.15.1 This development

This is the second application made by the proponent in respect of this locality. The first application was for the land to the immediate south-east of this site, (i.e. a small area defined by the R48, the railway and this development). It is not known if the proponent, or any other body, would consider further phases on this site to the north; that would depend upon factors outside of the scope of this study.

If the ground is not developed, and the *No Go Alternative* obtains, 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 cumulative impact of the proposed PVFs and WEFs are brought together in Section 8.

5.16 Viewpoints 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.

Fig 5.8 PV2 Site landscape, appears flat with grasses

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 5.9 The nearest residential area to PV2 as seen from the R48. The houses would face onto the development but would be shielded by perimeter walls and planting.

Fig 5.10. View from the R48 and travelling east just past the ridge where a view of the site is obtained. The PV2 development would be held in view for some minutes; PV1 would be beyond PV2 and glimpsed only. The ridge in the distance and to the right of centre is the site of a proposed WEF on the Eastern Plateau but the distance is too great for turbines to be seen.

Fig 5.11. View from the Sewage Works which are accessed off the R48. This is a place of work and the development site would be seen, albeit there is some screening from the railway embankment in the near distance. The Sewage Works would be closer to the *Alternative* Layout. The ridge to the west of the site can be seen in the far distance.

Fig 5.12. View of the development site from the R48 2km north of the Secure Care Home. Drivers travelling south and looking east would be aware of the proposed development. The land between the road and the site is quite open.

Table 5.2 Table of Visual Significance of Impacts

Visual Significance of Impacts associated with the Construction and Operation of PV2 Paarde Valley PV Installation, De Aar.

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 and drainage	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 they 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

	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
	2 OPERATIONAL PHASE										
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
2.3	Site buildings, and perimeter fence	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Carry out repairs promptly and keep tidy	Low
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
	3 COMPARISON OF ALTERNATIVES										
3.1	Activity: PVF_The visual impact of the installation during its lifetime	Local and surrounds	Long-term	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Local consultations, mitigation measures, EMP	Medium
3.2	Activity: No Go Retention of status quo	Local and surrounds	Long term	Medium	Probable	Status quo	Unsure	Reversible	Neutral	N/a	N/a
3.3	Preferred Layout	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Local consultations, mitigation, EMP	Medium
3.4	Alternative Layout	Local and surrounds	Long-term	Medium-high	Definite	Negative	Certain	Irreversible	Moderate-high	Local consultations, mitigation, EMP	Medium-high
3.5	Option 1 technology	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Local consultations, mitigation, EMP	Medium
3.6	Option 2 technology	Local and surrounds	Long-term	Medium-high	Definite	Negative	Certain	Irreversible	Moderate-high	Local consultations, mitigation, EMP	Medium-high
3.7	Foundation Alternatives in order of least visibility first: Thrusted structures Concrete Piles Isolated bases Continuous bases	Local and surrounds	Long-term	Low	Definite	Negative	Certain	Irreversible	Low	n/a	Low
3.8	Tracking options in order of least visibility first: Fixed axis Single axis Dual axis	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	None	Medium

6.0 PV3 BADENHORST DAM FARM VISUAL IMPACT ASSESSMENT

6.1. 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.

6.1.1 Information from the Proponent

Final design has not yet been undertaken but the proponent is expecting the maximum height of the tracking arrays to be below 4.5m. 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. At that height a distance of 5km has been taken as the maximum distance of visual significance.

6.2 View Catchment Areas

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

- The site itself, the agricultural lands to the north and east
- Suburbs, (townships) of De Aar.
- Road and rail transport corridors.
- Local farmsteads

The viewshed envelope is therefore defined partly by views from existing places of habitation and employment, and by topography; views of the proposed development will be obtained from residential areas, and transport corridors.

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

Viewshed images:
Figure 6.1: Option 1 (technology) *Preferred* layout
Figure 6.2: Option 1 (technology) *Alternative* layout
Figure 6.3: Option 2 (technology) *Preferred* layout
Figure 6.4: Option 2 (technology) *Alternative* layout

6.3 Viewsheds

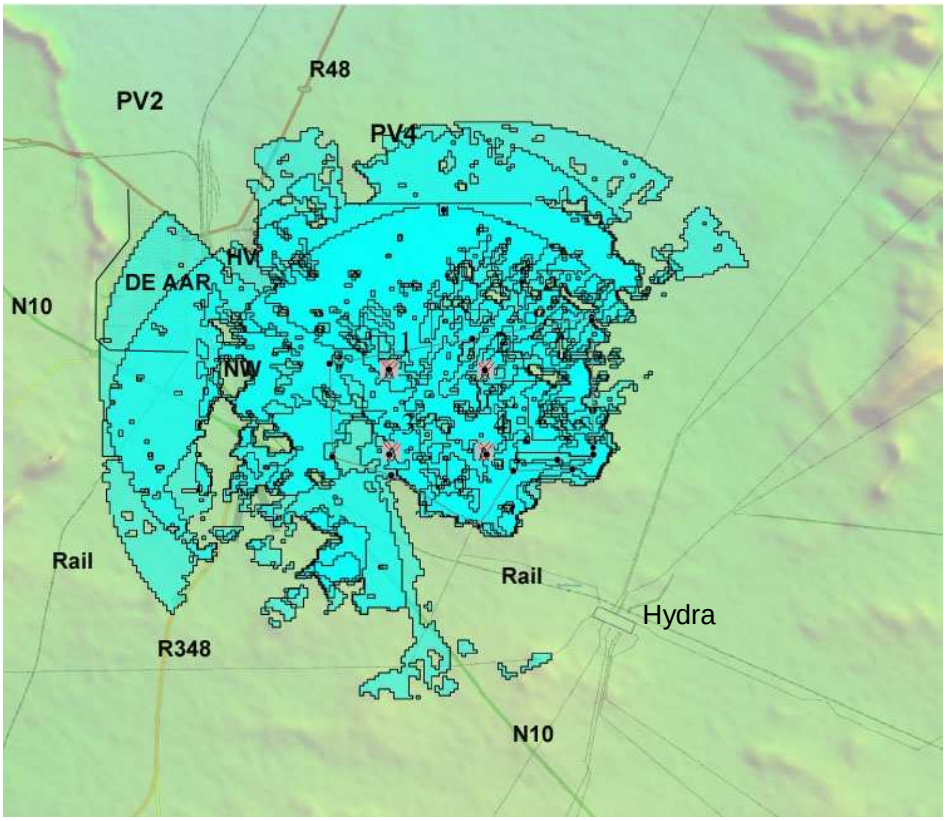

Fig 6.1: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Preferred* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, (HV: Happy Valley, NW: Nonzwakazi), transport corridors

Areas which appear to be affected:

- The development site
- Suburbs of Happy Valley and Nonzwakazi
- R48
- N10 and Rail line
- Local farmsteads

When tested on site it was noted that the trees, roads and housing broke up the view from De Aar to the extent that the development would not be visible.

Description:

- The site environs would be affected.
- Happy Valley, east side, and the recreation area, would see the site; extensive areas of Nonzwakazi would see the site, including the cemetery.
- De Aar, when tested on site, these receptors would not be visually aware.
- Southbound traffic on the R48, for a short distance, and traffic using the over-bridge south of the town.
- N10, northbound traffic would be more visually aware than southbound; the drivers would have to look to their side. The freight rail line.
- Local farmsteads both north and south of the site.

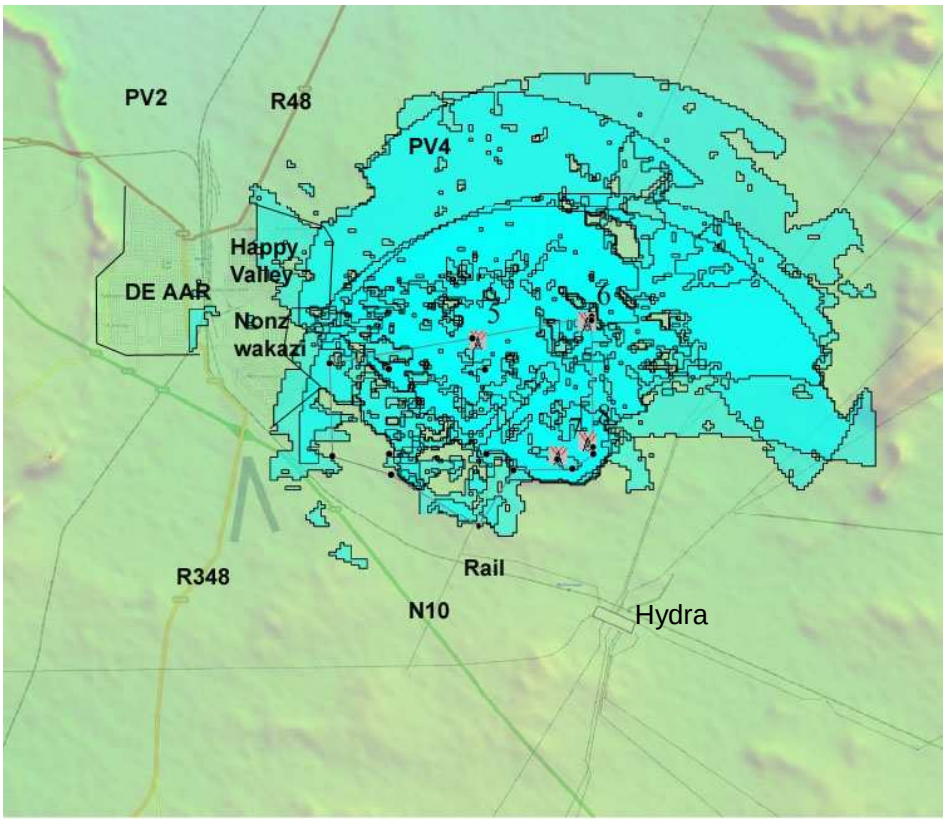

Fig 6.2: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Alternative* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- East side of Suburbs of Happy Valley and Nonzwakazi
- Local farmsteads

Description:

- The site environs would be affected.
- Happy Valley, east side, and the recreation area, would see the site; the east side of Nonzwakazi would see the site, including the cemetery
- Local farmsteads both north and south of the site

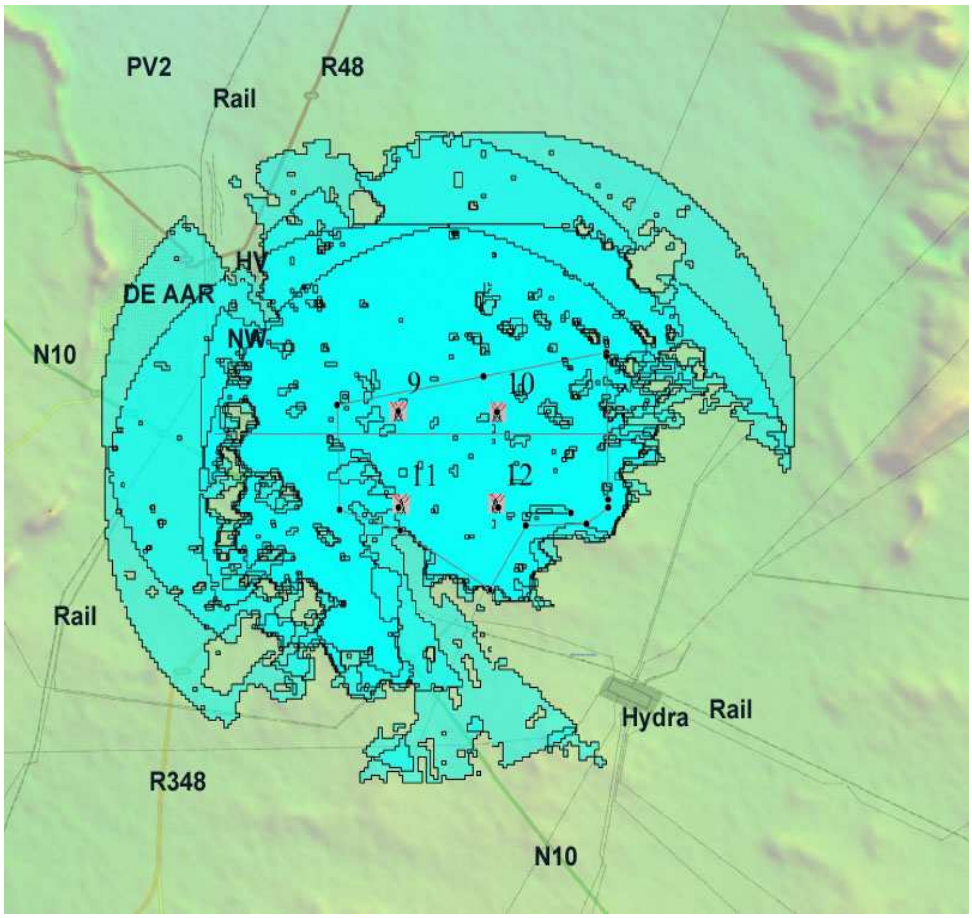

Fig 6.3: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Preferred* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, (HV: Happy Valley, NW: Nonzwakazi), transport corridors

Areas which appear to be affected:

- The development site
- Suburbs of Happy Valley and Nonzwakazi
- R48
- N10 and Rail line
- Local farmsteads

When tested on site it was noted that the trees, roads and housing broke up the view from De Aar to the extent that the development would not be visible.

Description:

- The site environs would be affected.
- Happy Valley, east side, and the recreation area, would see the site; extensive areas of Nonzwakazi would see the site, including the cemetery.
- De Aar, when tested on site, these receptors would not be visually aware.
- Southbound traffic on the R48, for a short distance, and traffic using the over-bridge south of the town.
- N10, northbound traffic would be more visually aware than southbound; the drivers would have to look to their side. The freight rail line.
- Local farmsteads both north and south of the site.

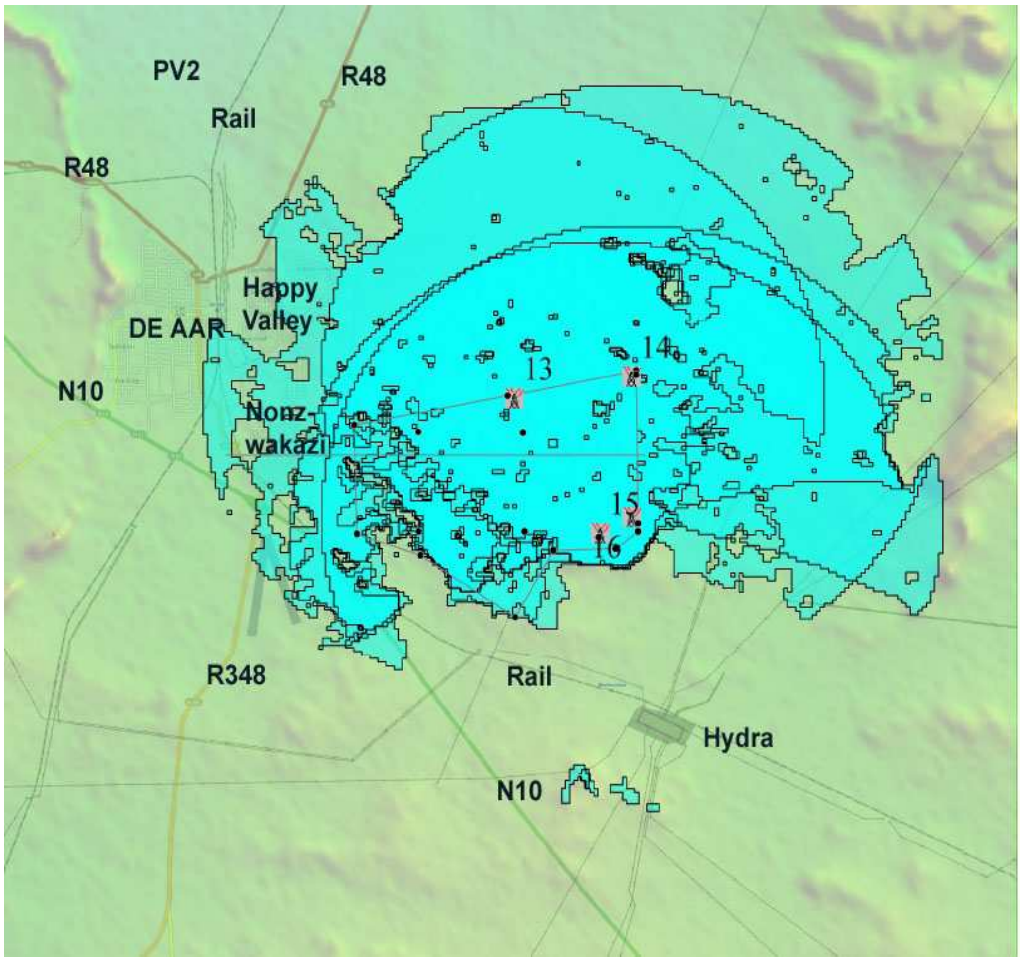

Fig 6.4: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Alternative* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- Suburbs of Happy Valley and Nonzwakazi
- Local farmsteads

Description:

- The site environs would be affected.
- Much of Happy Valley, and the recreation area, would see the site; much of Nonzwakazi would see the site, including the cemetery
- Local farmsteads both north and south of the site

6.3.1 Extent of actual photo-voltaic visibility 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, (location of the points illustrated in Fig 6.3). This figure expresses the area of land visually affected by that portion of

the proposal as a percentage of the overall sampled area which would be 100%; 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 are also given. The rankings are for purposes of comparison only.

Table 6.1 Actual visibility as a percentage of potential visibility

PV point	Height in m asl	Percent visible Option 1	Percent visible Option 2	Analysis
PV point 1 Preferred	1 261	65.2%	79.2%	Most visible
PV point 2 Preferred	1 262	43.2%	67.8%	Moderate
PV point 3 Preferred	1 274	52.2%	73.6%	Moderate
PV point 4 Preferred	1 282	41.2%	57.0%	Least visible
PV point 5 Alternative	1 256	44.4%	69.7%	Moderate
PV point 6 Alternative	1 251	63.4%	80.6%	Most visible
PV point 7 Alternative	1 291	40.7%	50.6%	Least visible
PV point 8 Alternative	1 292	46.9%	57.6%	Moderate

This shows that the section of the installation that has the greatest visibility, (though not necessarily to the most receptors) is the portion of the *Preferred* Layout closest to Nonzwakazi and the portion of the *Alternative* on the north-east side; this affects some habitation centres. The remainder of the installation has a moderate visual impact in terms of potential area affected.

6.3.2 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. For Option 2, up to 80% of the surrounding areas could be affected visually due to the increased infrastructure height.

Option 1: mean visibility is 50.0% of the sampled areas are visually impacted upon.
Option 2: mean visibility is 67.0% of the sampled areas are visually impacted upon.
The greater extent of the Option 2 visual envelope can be attributed to the increased infrastructure height.

6.4 Cross Sections

To assist in the understanding of the viewshed, a cross section has been drawn through the site west-east. The cross section is at a scale of 1:4 horizontal to vertical. It shows the relationship between the site and its environs.

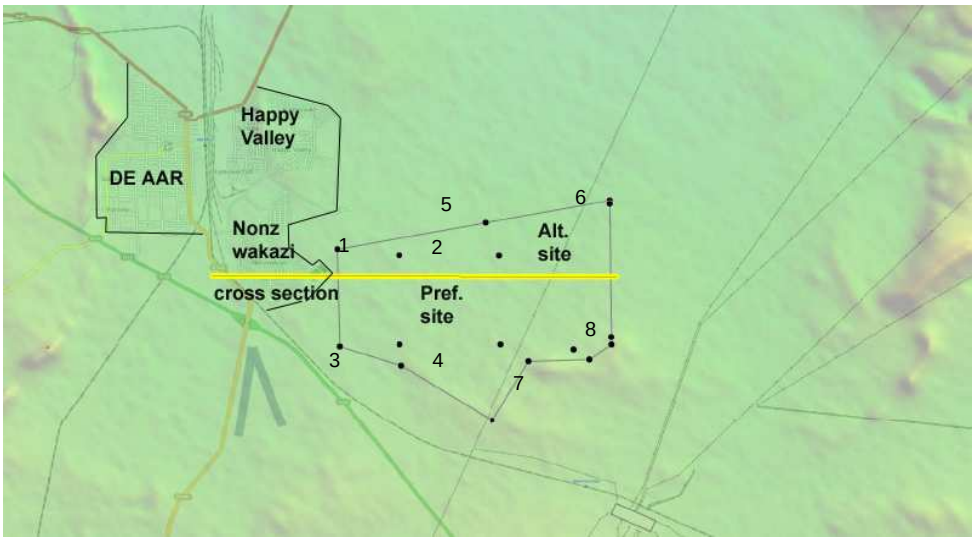

Fig 6.5: Location of sampled points of the proposed installation, and location of cross section.

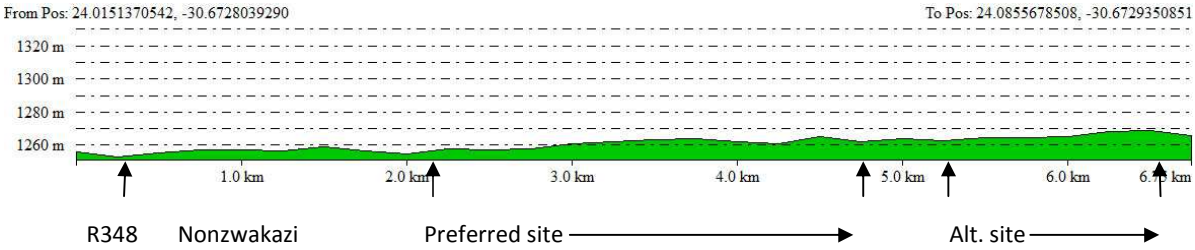

Fig 6.6: Cross section west-east. The site is on gently rising ground, increased visibility with elevation

6.5 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.

6.5.1 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 upland.

6.5.2 Site Layout Alternatives

Preferred and Alternative layouts are designed to generate 100MW in an area of 225ha; *Preferred* on the centre of the site, *Alternative* to the east.

6.5.3 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

6.5.3.1 Fixed axis photovoltaic

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

6.5.3.2 Single axis tracking

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 equal to that of the passage of the sun across the earth's surface. It would be akin to watching a shadow move. Due to the extent of the development there would be awareness of panels facing in a certain direction in the morning and in another direction in the afternoon, but it is not likely that the panels will be seen to move.

The foregoing describes the cumulative effect but many installations re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will 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 may be seen to glint with reflected sunlight intermittently.

6.5.3.3 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 cumulative pace, of the passage of the sun. The overall visual impact is however expected to be greater as the complex movements provide 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. Many installations would re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will re-orient. The panels may 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

The visual implications of concrete bases whether isolated or continuous are minimal when the installation is viewed as a whole which is what is being assessed in this study

The visual implications of option (lll): less impact due to apparently lighter structure, and this would be slightly more apparent with option (IV)

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

6.5.4 There are transmission line alternatives to assess, a short route to existing Eskom infrastructure. A longer route to Hydra.

6.6 Visibility of the Proposed Development

6.6.1 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 better clutter? *The site is in an area of little visual clutter; more clutter will ensue.*

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 quite 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 offers little visual composition opportunities.*

6.6.2The localities from which the development will be seen are:

- The development site
- Suburbs of Happy Valley and Nonzwakazi

- R48
- N10 and Rail line
- Local farmsteads

6.6.2.1 The development site
Development would be visible to receptors on the site who will be people directly involved with the installation.

6.6.2.2 Suburbs of Happy Valley and Nonzwakazi

Development will be held in view for residents of the east side of Happy Valley and the recreation area adjacent. Also for residents of most of Nonzwakazi, and visitors to the cemetery.

6.6.2.3 The R48.
Southbound traffic will have a glimpsed view of the north of the site for 1km. The development will be visible to users of the over-bridge over the N10.

6.6.2.4 The N10 and Rail line
Northbound traffic on the N10 will have a view, 2 to 3km away of the development

6.6.2.5 Local Farmsteads
There are farmsteads to the north and the south of the site that will be visually aware of the development.

6.6.3 Construction Period

6.6.3.1 Large scale of proposed works
The construction access will be off a farm road, off the N10, (within the defined visual envelope). There could be 450 truck deliveries, and/or 900 40-foot container loads; the scale of the haulage is large.

6 .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 will involve excavations, provision of services, construction of concrete foundations, and installation of all above ground infrastructure.

There will 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.

6.6.3.3 Impact beyond the site
Road haulage probably via the N10. PV3 can be accessed without affecting residential and commercial centres of De Aar.

6.6.4 Comparison with other layouts

6.6.4.1 *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.

6.6.4.2 *Layout Alternatives:* As the *Alternative* is further from the residential centres it is deemed to have a lesser visual impact than the *Preferred*.

6.6.4.3 *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.

6.6.4.4 *Transmission* line alternatives: preferred route: very low visual intensity. Alternative route: low visual intensity.

6.7 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*
- *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*

6.7.1 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.

6.7.2 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 below 5km to around 3 to 4km.

6.7.3 Extent of Impact of Alternatives

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.
The extent of the impact of the *Alternative* layout, Option 2 is rated at local.

The extent of the impacts of the Technology *Alternatives* are also rated local.
The extent of the impacts of the Transmission line *Alternatives* is also rated local.
The extent of the impact of the *No-Go Alternative* is rated as having no impact

6.8 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:

6.8.1Elements **on** the Site which affect Visual Exposure

Topography: the site is gently undulating.

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

6.8.2 Elements **beyond** the Site which affect Visual Exposure

Topography: the site is overlooked by Nonzwakazi and is visible to adjacent farmsteads..

Tree Planting and Built Form: the built up area of De Aar would not be visually impacted upon, due to shielding by urban infrastructure.

6.8.3 Conclusion

The visual exposure is rated as 'partly exposed', or medium and also medium for the construction period, 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 medium to the same degree for the *No-Go Alternative* and for the other *Alternatives* being assessed.

6.9 Zones of Visual Influence or Theoretical Visibility

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

- *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*

- The development site
- Suburbs of Happy Valley and Nonzwakazi
- R48
- N10 and Rail line
- Local farmsteads

The zones of visual influence, viewsheds, are recorded in Figures 6.1 to 6.4 and from them it can be seen that significant areas will be visually affected. Option 1: the degree is judged to be moderate as the development will be low to the ground and partially shielded. Option 2: the degree is judged to be moderate-high as the development will be over 15m high but there is some shielding.

6.9.1 The development site, Options 1 and 2

There are no receptors on the site itself apart from people working on the land. There is slightly higher ground to the south of the site which limits the visual impact in that direction.

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

6.9.2 Happy Valley and Nonzwakazi

Option 2 would be more visually evident than Option 1. These are extensive and high density residential townships; Nonzwakazi has commercial areas as well. Houses are small and many are close together and receptors would be visually aware of the development. The access road into the township would provide a view of the development to east bound travellers as the road crosses over the rail line.

The fencing, buildings, sub-station and roads would not be expected to form the focus of the view because the scale of the development is large and that is what would be seen. The new transmission line(s) would be noticeable as they would lie closer to the sensitive receptors.

The *Preferred* would have a greater impact than the *Alternative* layout due to proximity

The zone of visual influence is assessed as moderate-high due to proximity.

6.9.3 The R48, Options 1 and 2

Southbound travellers would have a view of the *Preferred* site, but not the *Alternative*, for about half a minute as they approach De Aar. Other stretches of this road are shielded by built form. The over-bridge over the N10 will offer a view of the development for north bound travellers.

The zone of visual influence is assessed as moderate, the site will be seen, but for short periods.

6.9.4 N10 and Rail line

Option 1: Travellers approaching De Aar and heading north to Britstown would be within 2 to 3km of the development and if they looked to their side they would partially see it; over a distance of 4.5km for about 3 minutes. The installation would be seen from the south so the panels would not be clearly seen. The impact upon travellers in the opposite direction would be very brief, before the site was behind them.

Option 2: Travellers approaching De Aar and heading north to Britstown would be within 2 to 3km of the development and if they looked to their side they would partially see it; over a distance of 6.5km for over 4 minutes. The installation would be seen from the south so the panels would not be clearly seen. The impact upon travellers in the opposite direction would be less, about 3km, for 2.5 minutes, before the site was behind them.

The N10 would be crossed twice by new power lines for this and the other developments being assessed in this study; this will have a negative impact but on a small scale as the local landscape has many power lines.

The rail line is a freight line and the development would not be visible to many receptors.

The *Preferred* would have a greater impact than the *Alternative* layout due to proximity

The zone of visual influence is assessed as low for Option 1 and low-moderate for Option 2.

6.9.5 Local Farmsteads.

The farm Badenhorst Dam is 2km to the south of the site; as the panels would generally face to the north, their view would be of infrastructure only.

There are a number of farms accessed off the farm road to the north of the site; all would have a clear view of the development within 1km, and especially of the panels.

Both alternatives being assessed would have a similar impact.

The zone of visual influence is assessed as high due to proximity.

6.9.6 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 would use the N10. The location of lay-down areas may be visible locally.

6.9.7 Comparison with other Layouts

The visibility of the N*o-Go Alternative* is low. The *Alternative* layout is situated further from the main group of receptors; therefore it is rated lesser in visibility than the *Preferred*. Option 1 would have a lesser zone of visual influence than Option 2 due to the height of the infrastructure.

The visibility of the *Technology alternatives* (foundations) are all rated similarly visible; of the mounting options, concentrated dual axis tracking would be most visible, due to movement. Transmission line alternative route is rated as more visible than the preferred route.

6.10 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 medium. The site is an open, fairly flat area on the eastern edge of town where views are long. The proposed electricity infrastructure would not look out of place in this locality.

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

Visual absorption capacity rating does not vary with the layout alternatives. Visual absorption capacity is rated slightly more positively for the *Option 1* than for the *Option 2*, due to the lesser height. 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.

6.11 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 is of rural grazing land vegetated by low shrubs and grasses, and in a landscape where views are quite long. Its compatibility with surrounding landscape does not vary throughout its physical extent.

This development proposes to change the use of this site 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 the existing sub-station and the industrial sites. 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.

The layout, Technology and Transmission line *Alternatives* are equally compatible. The *No-Go Alternative* will be seen as a part of the surrounding landscape as the status quo will not change.

6.12 Intensity or Magnitude, of Visual Impact

This refers to the degree to which the visual nature of the landscape will be altered.

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

6.12.1 Local Site Landscape

The area which forms the development site is close to a residential community, transportation corridors, power lines. 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 adjudged to be moderate. The impact will be noticeable but there is local context.

6.12.2 Between 1 km and 3 km
The visual receptors will be receptors in the residential and commercial areas, and users of transport corridors. The magnitude of the visual impact will remain moderate for Option 1 and moderate-high for Option 2.

6.12.3 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 moderate-low for Option 1 and moderate for Option 2

6.12.4 Construction Period

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

6.12.5 Comparison of Alternatives

Layouts: The intensity of the visual impact would be reduced for the layout *Alternative* as it is further away from the residential centre and the transmission line would go straight to Hydra.

Activities: 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 Technologies:. 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. Transmission lines: the *Preferred* line is rated lower in visual intensity than the *Alternative*.

6.12.6 Conclusion
The Intensity, or Magnitude, is summarised from the foregoing as moderate.

6.13 Duration of the Visual Impact

The duration of the impact upon its surroundings, from one year, (temporary) up to beyond 15 years, (permanent/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 beyond 20 years. New infrastructure could be erected on the site and on the same foundations, or the site could be de-commissioned. The duration is judged to be long term.

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

6.14 The Significance of the Visual Impact

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

- the extent of the impact (para 6.7, local)
- the length of time over which it may be experienced, (para 6.13, long term)
- and the intensity of the impact, (para 6.12, moderate).

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 moderate 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. 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 *No-Go Alternative* will have a low significance, as the status quo will not alter.
The significance rating for the *Preferred* Layout is moderate.
The significance rating for the *Alternative* Layout is moderate-low. The significance rating is reduced because the development would be further away from affected receptors due to the installation fewer affected receptors.

The significance rating for the Option 1 Technology, Transmission lines *Alternatives* is moderate. The significance rating for the Option 2 Technology, Transmission lines *Alternatives* is moderate but would appear more significant due to height and mass of structures.

6.15 Potential Cumulative Visual Impacts.

Looks at the accretion of similar developments over time

6.15.1 This development

It is not known if the proponent, or any other body, would consider further phases on this site; that would depend upon factors outside of the scope of this study. If the ground is not developed, and the *No Go Alternative* obtains, there may or may not be cumulative impacts; the site appears stable in its land uses at this time.

6.15.2 Other Alternative Energy Projects in the Locality

The cumulative impact of the proposed PVFs and WEFs are brought together in Section 8.

6.16 Viewpoints 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 6.7. View from a farmstead on the north-west corner of the site looking to the south east and south; the land is open and undulating. The Preferred layout would be about 1.5km away.

Fig 6.8 View along the north-south gravel road to the east of the townships along which the new transmission line servitude will run. A school can be seen on the right of the image

Fig 6.9. View from the west of the Cemetery at Nonzwakazi and looking east over the development site; the Preferred layout would be about 1.5km away from the viewer and from the nearest residential areas.

Fig 6.10. View from the N10, about 1.5km away from the Preferred layout, and looking north-east at the site. The view for drivers travelling south would be open but not clear as they would be looking to the side and there is clutter in the landscape.

Table 6.2:Table of Visual Significance of Impacts

Visual Significance of Impacts associated with the Construction and Operation of PV3 Badenhorst Dam Farm PV Installation, De Aar.

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 they 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

	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
2.3	Site buildings, and perimeter fence	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Carry out repairs promptly and keep tidy	Low
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
	3.0 COMPARISON OF ALTERNATIVES										
3.1	Activity: PVF_The visual impact of the installation	Local and surrounds	Long-term	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Local consultations, mitigation measures, EMP	Medium
3.2	Activity: No Go Retention of status quo	Local and surrounds	Long term	Medium	Probable	Status quo	Unsure	Reversible	Neutral	N/a	N/a
3.3	Preferred Layout	Local and surrounds	Long-term	Medium-high	Definite	Negative	Certain	Irreversible	Moderate	Local consultations, mitigation, EMP	Medium
3.4	Alternative Layout	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate -low	Local consultations, mitigation, EMP	Medium-low
3.5	Option 1 technology	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate -low	Local consultations, mitigation, EMP	Medium-low
3.6	Option 2 technology	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate - high	Local consultations, mitigation, EMP	Medium
3.7	Foundation Alternatives in order of least visibility first: Thrusted structures Concrete Piles Isolated bases Continuous bases	Local and surrounds	Long-term	Low	Definite	Negative	Certain	Irreversible	Low	n/a	Low
3.8	Tracking options in order of least visibility first: Fixed axis, Single axis Dual axis	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	None	Medium

7.0 PV4 ANNEX DU PLESSIS VISUAL IMPACT ASSESSMENT

7.1. 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.

7.1.1 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. The image, (Figure 2.3), 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. At that height a distance of 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

7.2 View Catchment Areas

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

- The development site, similar lands and farmsteads to the north, east, and south and the proposed PV3 site.
- Happy Valley and Nonzwakazi to the east of De Aar.

The viewshed envelope is therefore defined partly by views from existing places where people live and work, and by topography; views of the proposed development will be obtained from surrounding areas.

The degree of visual influence within the View Catchment Area is adjudged 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

7.3 Viewsheds

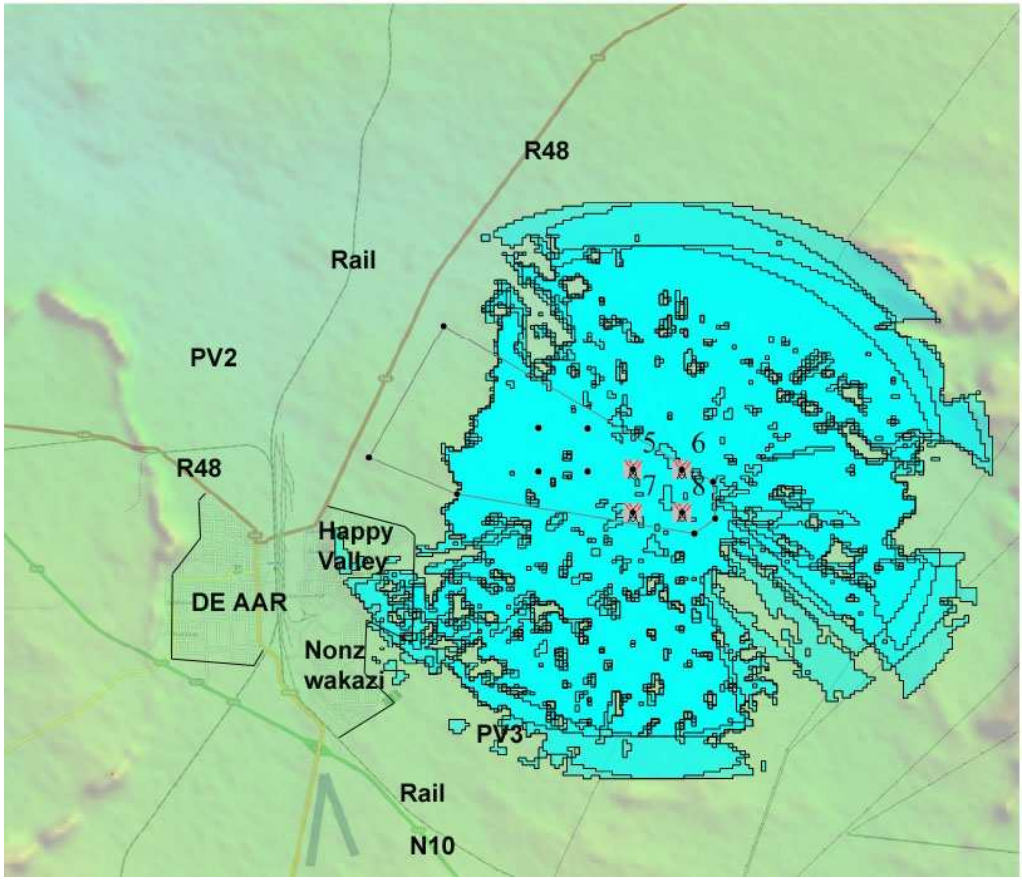

Fig 7.1: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Preferred* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north east and south
- Farmsteads

Description:

- The site environs would be affected.
- A portion of the east edges of Nonzwakzi and Happy Valley would be affected.
- Receptors are those working on the lands around the development site.
- There are a few farmsteads within the catchment area.

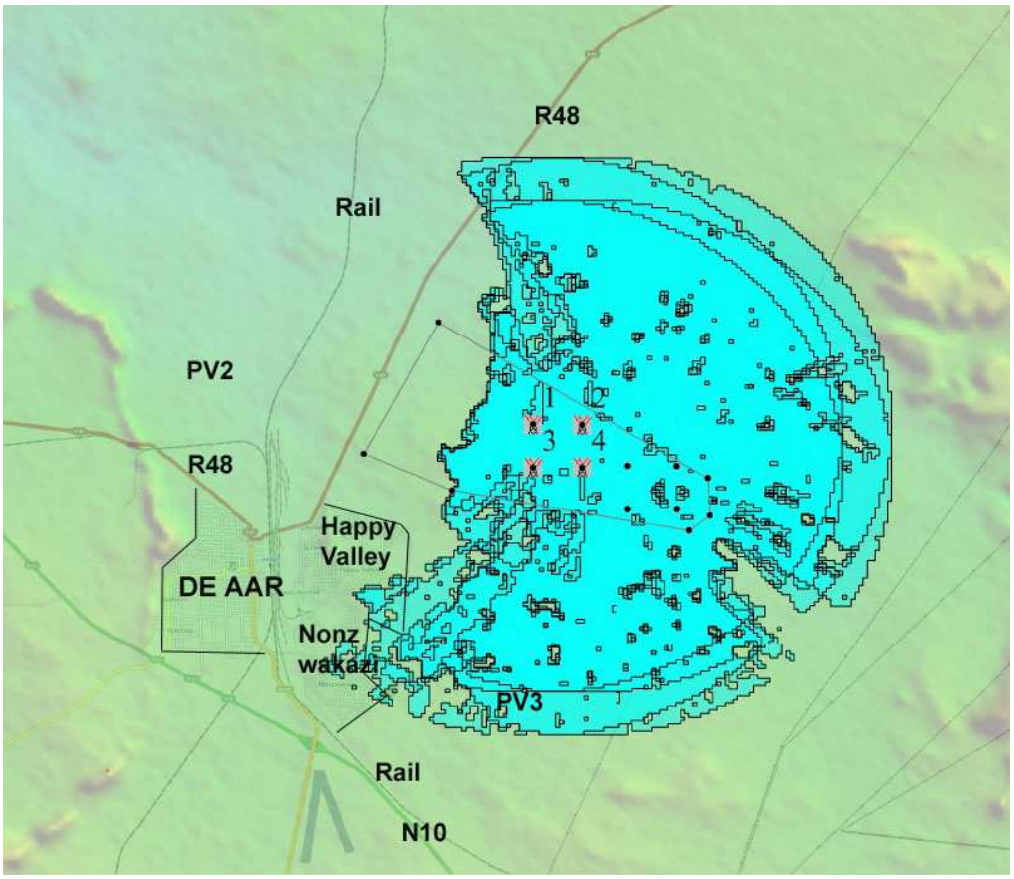

Fig 7.2: **Option 1** Visual envelope calculated at a radius of 5km from the proposed *Alternative* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north, east, and south
- Farmsteads
- R48

Description:

- The site environs would be affected.
- The east edge of Nonzwakzi would be affected and to a lesser degree, a small portion of the east edge of Happy Valley
- Lands around the development site, the receptors would be those working on the land.
- There are a few farmsteads within the catchment area.
- Southbound traffic on the R48 would have a view of the site for a short period.

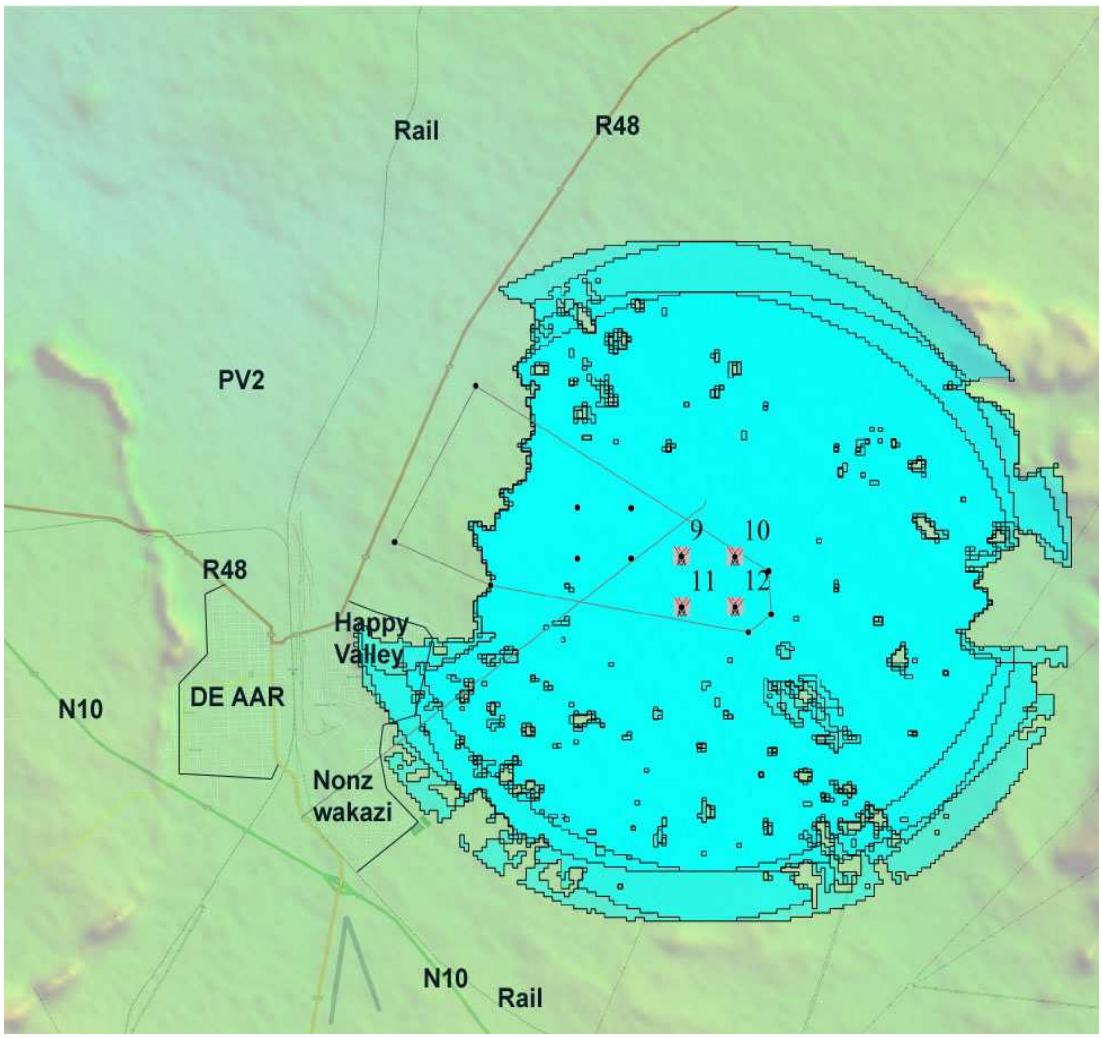

Fig 7.3: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Preferred* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north east and south
- Farmsteads

Description:

- The site environs would be affected.
- A portion of the east edges of Nonzwakzi and Happy Valley would be affected.
- Receptors are those working on the lands around the development site.
- There are a few farmsteads within the catchment area.

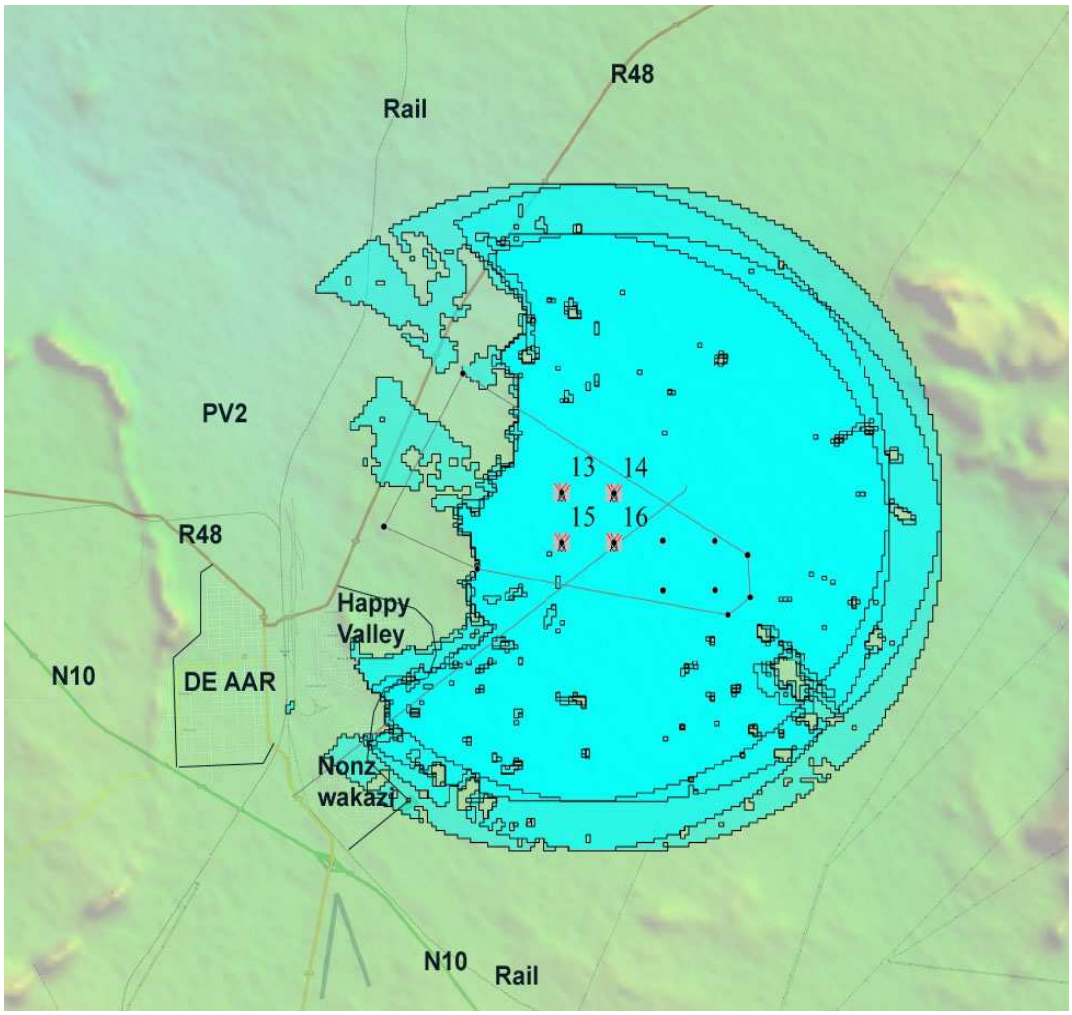

Fig 7.4: **Option 2** Visual envelope calculated at a radius of 5km from the proposed *Alternative* layout, using 4 of its perimeter points; and showing the locations of De Aar and suburbs, transport corridors

Areas which appear to be affected:

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north, east, and south
- Farmsteads
- R48

Description:

- The site environs would be affected.
- The east edge of Nonzwakzi would be affected and to a lesser degree, a small portion of the east edge of Happy Valley
- Lands around the development site, the receptors would be those working on the land.
- There are a few farmsteads within the catchment area.
- Southbound traffic on the R48 would have a view of the site for a short period.

7.3.1 Extent of actual photo-voltaic visibility against potential visibility

Metadata extracted from the terrain analysis software gave the following data for the representative sample of the photo-voltaic layout assessed. This figure expresses the area of land visually affected by that portion of the proposal as a percentage of the overall sampled area, which would be 100%; 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 turbine also plays a part in the extent of its visibility, heights in metres are also given. The rankings are for purposes of comparison only.

Table 7.1 Actual visibility as a percentage of potential visibility

PV point	**Height in m asl**	**Percent visible Option 1**	**Percent visible Option 2**	**Analysis**
PV point 1 Alternative	1 242	59.4%	72.8%	Least visible
PV point 2 Alternative	1 234	61.0%	74.2%	Least visible
PV point 3 Alternative	1 243	61.8%	68.7%	Least visible
PV point 4 Alternative	1 238	64.1%	75.7%	Least visible
PV point 5 Preferred	1 236	71.0%	82.3%	Most visible
PV point 6 Preferred	1 234	71.6%	84.8%	Most visible
PV point 7 Preferred	1 239	67.9%	83.1%	Most visible
PV point 8 Preferred	1 236	68.0%	86.7%	Most visible

This shows that the installation that has the greatest visibility, (though not necessarily to the most receptors) is the *Preferred* Layout; the topography ensures that the impact can be experienced for over two thirds of the potential area. The *Alternative* layout has a lesser visual impact in terms of potential area affected, (but to more receptors).

7.3.2 General Conclusions

An over-view of the visual envelopes for Option 1 indicates that they are, statistically, within a similar band of visibility, but there are few receptors in the majority of lands impacted upon. For Option 2 up to 86% of the surrounding areas could be affected visually due to the increased infrastructure height.

Option 1: mean visibility is 65.6% of the sampled areas are visually impacted upon.
Option 2: mean visibility is 78.5% of the sampled areas are visually impacted upon.
The greater extent of the Option 2 visual envelope (19.6% more visible) can be attributed to the increased infrastructure height.

7.4 Cross Sections

To assist in the understanding of the viewshed, a cross section has been drawn through the site, south-west: north-east. The cross section is at a scale of 1:4 horizontal to vertical. It shows the relationship between the site and its environs.

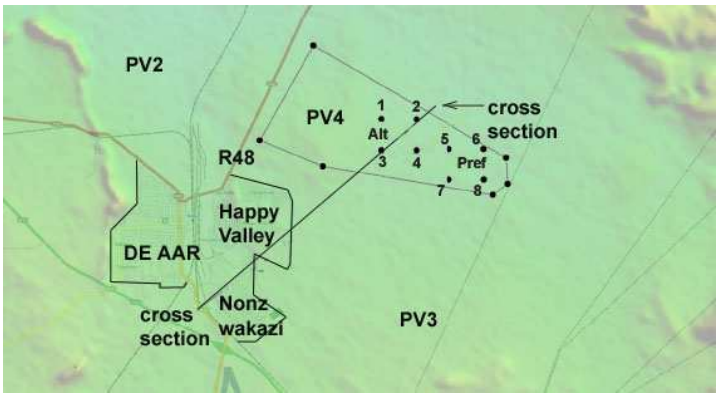

Fig 7.5: Location of sampled points of the proposed installation, and location of cross section.

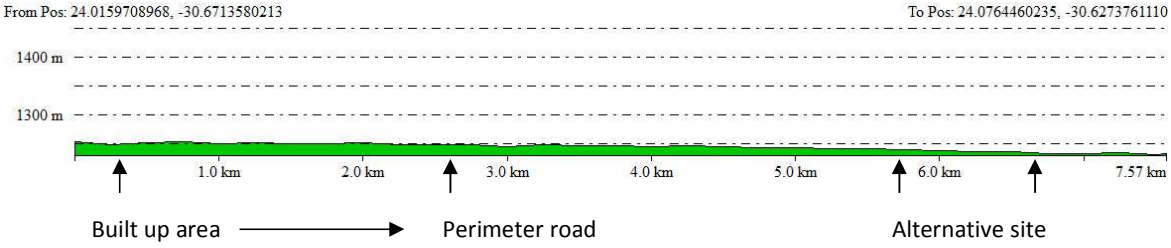

Fig 7.6: Cross section south-west:north-east. The site is lower in elevation than the built up areas so the visual impact is mainly experienced by receptors on the edge of these areas.

7.5 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.

7.5.1 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.

7.5.2 Site Layout Alternatives

Preferred layout is designed to generate 19MW in an area of 64ha, east part of site. The site for the *Alternative layout* is to the west of the preferred site, with the same specification.

7.5.3 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

7.5.3.1 Fixed axis photovoltaic

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

7.5.3.2 Single axis tracking

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 equal to that of the passage of the sun across the earth's surface. It would be akin to watching a shadow move. Due to the extent of the development there would be awareness of panels facing in a certain direction in the morning and in another direction in the afternoon, but it is not likely that the panels will be seen to move.

The foregoing describes the cumulative effect but many installations re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will re-orient.

7.5.3.3 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 cumulative pace, of the passage of the sun. The overall visual impact is however expected to be greater as the complex movements provide 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. Many installations would re-orient at fixed and regular times, such as every hour, or two hours. Therefore, at each pre-determined time the whole array will re-orient.

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

The visual implications of concrete bases whether isolated or continuous are minimal when the installation is viewed as a whole which is what is being assessed in this study

The visual implications of option (lll): less impact due to apparently lighter structure, and this would be slightly more apparent with option (lV)

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

7.5.4 There are transmission line alternatives to assess, a short route to existing Eskom infrastructure. Longer routes to De Aar substation.

7.6 Visibility of the Proposed Development

7.6.1 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 little visual clutter; more clutter will ensue.*

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 quite 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 offers no visual composition opportunities.*

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

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north, east, and south
- Farmsteads
- R48

7.6.2.1 The development site
Development would be visible to receptors on the site who will be people directly involved with the installation.

7.6.2.2 Nonzwakazi and Happy Valley.

While the terrain analysis software indicates that the east edges of these developments would be visually impacted upon, site appraisal indicated that the impact would be intermittent.

7.6.2.3 Lands to the north, east, and south
Would be at a similar elevation but receptors are few in number.

7.6.2.4 Farmsteads
There is a farm to the north of the site, Plessisdam farm, and several on the road to the south of the site.

7.6.2.5 R48
Impacted upon briefly for south bound traffic, by the *Alternative* layout.

7.6.3 Construction Period

7.6.3.1 Large scale of proposed works
The construction access would either be off the existing perimeter road around Happy Valley, or off the farm road to the south of the site. The farm road connects with the perimeter road, and thence with the R48. There could be 450 truck deliveries, and/or 900 40-foot container loads; the scale of the haulage is large.

7.6.3.2 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 will 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.

7.6.3.3 Impact beyond the site
Road haulage probably via the N10. The route for commercial traffic between the R48 and the N10 is along Voortrekker Street.

7.6.4 Comparison with other layouts

7.6.4.1 *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.

7.6.4.2 *Layout Alternatives:* As the *Preferred* is further from the residential centres it is deemed to have a lesser visual impact than the *Alternative*.

7.6.4.3 *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.

7.6.4.4 *Transmission* line alternatives: preferred route: very low visual intensity. Alternative routes: low visual intensity.

7.7 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*
- *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*

7.7.1 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.

7.7.2 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 below 5km to around 3 to 4km.

7.7.3 Extent of Impact of Alternatives

The extent of the impact of the *Alternative* layout is also rated local.
The extent of the impacts of the Technology *Alternatives* including Options 1 and 2 are also rated local.
The extent of the impacts of the Transmission line *Alternatives* is also rated local.
The extent of the impact of the *No-Go Alternative* is rated as having no impact

7.8 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:

7.8.1Elements **on** the Site which affect Visual Exposure

Topography: the site is mainly shielded from the R48 by higher ground.

Tree Planting and Built form: there is none on the site, which provides shielding.

7.8.2 Elements **beyond** the Site which affect Visual Exposure

Topography: the site is slightly visible to the east edges of Happy Valley and Nonzwakazi and is visible to adjacent farmsteads.

Tree Planting and Built Form: the built up area of De Aar would not be visually impacted upon, due to shielding by urban infrastructure.

7.8.3 Conclusion

The visual exposure is rated as low, and low for the construction period, 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 low for the *No-Go Alternative* and for the other *Alternatives* being assessed.

7.9 Zones of Visual Influence or Theoretical Visibility

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

- *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*

- The development site
- Nonzwakazi and Happy Valley
- Lands to the north, east, and south
- Farmsteads
- R48

The zones of visual influence, viewsheds, are recorded in Figures 7.1 to 7.4 and from them it can be seen that few significant areas would be visually affected. The degree is judged to be low as the development would be partially shielded.

7.9.1 The development site

There are no receptors on the site itself apart from people working on the land and people who would be working with the installation.

The zone of visual influence is therefore assessed as high; the development would influence the view, but to very few receptors. This applies to Options 1 and 2.

7.9.2 Nonzwakazi and Happy Valley

While the terrain analysis software indicates that the east edges of these developments would be visually impacted upon, site appraisal indicated that the impact would be intermittent, and restricted to the edges of these residential areas. In addition, the panels will face north and therefore only the support structures will be visible, and to a limited degree.

The zone of visual influence is assessed as low due to distance and shielding. This applies to Options 1 and 2.

7.9.3 Lands to the north, east, and south

Would be at a similar elevation but receptors are few in number and restricted to people working the land.

The zone of visual influence is assessed as low . This applies to Options 1 and 2.

7.9.4 Farmsteads

Plessisdam farm to immediate north of the site would be impacted upon to a degree judged to be moderate. The farms along the farm road to the south of the site would be between 2 and 3km away and would see the support structures only. Their road may be used by construction traffic, which would have a greater impact.

The zone of visual influence is assessed as moderate. This applies to Options 1 and 2.

7.9.5 R48.

South bound traffic would be visually aware of the north edge of the preferred layout for a short time, about half a minute, travelling at 80km/h. The junction with the perimeter road around Happy Valley could be very busy for the duration of the construction period.

The zone of visual influence is assessed as low due to shielding and distance. This applies to Options 1 and 2.

7.9.6 The Construction Phase

During this phase the roads selected for the transport of the construction materials and the infrastructure components will be visually impacted upon. The zone of visual influence would not vary from the foregoing, as construction traffic would use the roads described above. The location of lay-down areas may be visible locally.

7.9.7 Comparison with other Layouts

The visibility of the N*o-Go Alternative* is low. Option 1: The *Alternative* layout affects receptors to a similar degree as the *Preferred*. Option 2: The *Alternative* layout affects receptors to a similar degree as the *Preferred* but over a slightly greater area. The visibility of the *Technology alternatives* (foundations) are all rated similarly visible; of the mounting options, concentrated

dual axis tracking would be most visible, due to movement. Transmission line alternative routes are rated as more visible than the preferred route.

7.10 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 visual absorption capacity is rated medium, (the area can absorb this development but it will look somewhat out of place in this landscape).

The *Preferred* layout is slightly further away from most receptors; the surrounding area would be slightly more able to absorb the development.

Visual absorption capacity is rated equally for Options 1 and 2 and the Option 1 *Technology Alternatives*.

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

7.11 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 is rural and its compatibility with surrounding landscape does not vary throughout its physical extent.

This development proposes to change the use of these lands to that of a Photovoltaic Energy Facility, which is a semi-industrial land use. This development will change the character of the locality.

This development is judged to have a moderately appropriate capacity for compatibility with the surrounding landscape; the development can blend in with care, due to the zone of visual influence being generally rated as low.

The Layout, Technology, Transmission line *Alternatives* are rated moderately appropriate.

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

7.12 Intensity or Magnitude, of Visual Impact

This refers to the degree to which the visual nature of the landscape will be altered.

- *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*

7.12.1 Local Site Landscape

The area which forms the development site is not close to, or clearly seen by, sensitive receptors. The visual nature of the local landscape will be altered by the introduction of this infrastructure

The magnitude of the visual impact is adjudged to be moderate low. The impact will be noticeable but to few receptors.

7.12.2Between 1 km and 3 km

The visual receptors will be residents of farmsteads and the edges of the two suburbs. The magnitude of the visual impact will remain moderate.

7.12.3Beyond 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.

7.12.4 Construction Period

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

7.12.5 Comparison of Alternatives

Comparing the intensity of the visual impact of the *Preferred* and the *Alternative layouts* indicates that the *Preferred* has a reduced intensity. The intensity of the visual impact of the *No-Go Alternative* will be low because no changes to the landscape are currently anticipated.

Option 1 Technology Alternatives
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 may

reduce with habituation. Transmission lines: the *Preferred* line is rated lower in visual intensity than the *Alternative* lines.

7.12.6 Conclusion
The alternative with the least intensity or magnitude of visual impact is the *Preferred* layout with Option 1 and no tracking; the greater intensity will be from the *Alternative* layout, with Option 2. The Intensity, or Magnitude, is summarised from the foregoing as moderate.

7.13 Duration of the Visual Impact

The duration of the impact upon its surroundings, from one year, (temporary) up to beyond 15 years, (permanent/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 beyond 20 years. New infrastructure could be erected on the site and on the same foundations, or the site could be decommissioned. The duration is judged to be long term.

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

7.14 The Significance of the Visual Impact

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

- *the extent of the impact (para 7.7, local)*
- *the length of time over which it may be experienced, (para 7.13, long term)*
- *and the intensity of the impact, (para 7.12 moderate).*

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 moderate 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. 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 *No-Go Alternative* will have a low significance, as the status quo will not alter.
The significance rating for the *Preferred* Layout is moderate-low.
The significance rating for the *Alternative* Layout is moderate. The significance rating for Options 1 and 2, the Option 1 Technology *Alternatives*, Transmission lines *Alternatives* is moderate.

7.15 Potential Cumulative Visual Impacts.

Looks at the accretion of similar developments over time

7.15.1 This development

It is not known if the proponent, or any other body, would consider further phases on this site, (but not all the site is occupied by either of these layouts); that would depend upon factors outside of the scope of this study.

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

7.15.2 Other Alternative Energy Projects in the Locality

The cumulative impact of the proposed PVFs and WEFs are brought together in Section 8.

7.16 Viewpoints 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 7.7. View from the R48 looking across the PV4 development site from about 2km north of Secure Care. The site appears to rise gently and then roll over a gentle ridge and it is this feature which offers shielding to the proposed development to the degree that receptors would not be visually aware.

Fig 7.8 The road that skirts Happy Valley to the north of Kareenville and which the Proponent proposes to use to access the PV4 site. The road is wide and tarred for part of its length; there is housing on one side, which would be about 3.0 to 3.5km from the *Preferred* site.

Fig 7.9 View of the site from the area of the recreation ground and Grasbult farmstead. There will be some view of the proposed Preferred layout from both the recreation ground, (recently extended), and this farmstead, (which has screening trees). The viewer is about 3.5km from the *Preferred* and about 2km from the *Alternative* layout, (which would not be clearly visible from this point).

Table 7.2:Table of Visual Significance of Impacts

Visual Significance of Impacts associated with the Construction and Operation of PV4 Annex Du Plessis Farm PV Installation, De Aar.

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 they 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
1.9	Completion of all site works and fencing	Local and surrounds	Construction period	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Site management, avoidance of litter, etc	Low

	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
	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 site management practices	Low
2.2	Site buildings, and perimeter fence	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Carry out repairs promptly and keep tidy	Low
2.3	The impact of the development on receptors	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Mitigation measures	Medium
	3 COMPARISON OF ALTERNATIVES										
3.1	Activity: PVF_The visual impact of the installation	Local and surrounds	Long-term	Medium	Definite	Neutral	Certain	Irreversible	Moderate	Mitigation measures	Medium
3.2	Activity: No Go Retention of status quo	Local and surrounds	Long term	Medium	Probable	Status quo	Unsure	Reversible	Neutral	N/a	N/a
3.3	Preferred Layout	Local and surrounds	Long-term	Medium-low	Definite	Negative	Certain	Irreversible	Moderate -low	Mitigation measures	Medium-low
3.4	Alternative Layout	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Mitigation measures	Medium
3.5	Option 1 technology	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate - low	Mitigation measures	Medium
3.6	Option 2 technology	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	Mitigation measures	Medium
3.7	Foundation Alternatives in order of least visibility first: Thrusted structures Concrete Piles Isolated bases Continuous bases	Local and surrounds	Long-term	Low	Definite	Negative	Certain	Irreversible	Low	n/a	Low
3.8	Tracking options in order of least visibility first: Fixed axis, Single axis Dual axis	Local and surrounds	Long-term	Medium	Definite	Negative	Certain	Irreversible	Moderate	None	Medium
3.9	Power line route: Preferred direct to Eskom infrastructure	Local and surrounds	Long-term	Low	Definite	Negative	Certain	Irreversible	Very Low	None	Very Low
3.10	Power line routes, 1, 2, 3: Alternative. Routes to De Aar	Local and surrounds	Long-term	Low	Definite	Negative	Certain	Irreversible	Low	None	Low

8.0 COMPARISON OF SITES

8.1 Other Alternative Energy Projects in the Locality

The visual impact of the three proposed PVF developments discussed in this study must also be assessed in the context of the other renewable energy projects within the De Aar area that are in various stages of assessment/approval. If any or all of these PVF developments were to proceed it or they would be experienced in the context of other similar developments.

8.2 WEF Projects

De Aar has become a centre of interest for alternative energy developments. A WEF project is approved for south of the town, on the Kasamberge/Maanhaarberge plateau and the Swartkoppies ridge. This 100MW WEF would include 67 turbines, those nearest De Aar would be on Swartkoppies, about 7km from the town; those on the plateau would be about 15km away. The development would be shielded by the built form of the town and therefore the visual impact upon De Aar would be limited; there would be a visual impact experienced by users of the N10 travelling in either direction.

A WEF project is being assessed for two sites on the Eastern Plateau, about 23km away from De Aar to the north east and east. The site lies between the towns of De Aar and Philipstown, in similar rural uplands. The North project would provide for 145 turbines distributed over the plateau and adjacent hills and there would be 105 turbines in the South Project. Cumulatively the250 turbines would have a lesser impact on the N10 and fringes of De Aara greater impact on local receptors.

8.3 PVF Projects

8.3.1 A summary of the three sites assessed in this study:

PV2, Paarde Valley to generate approximately 75-150 MW on an area of 225 ha to 450 ha to the immediate north of De Aar, in a landscape setting of mixed industrial, rural and residential fringe.

PV3, Badenhorst Dam farm to generate approximately 75 MW on an area of 225 ha to the immediate east of De Aar in a landscape setting of residential fringe and rural.

PV4 Annex du Plessis Farm to generate approximately 19 MW on an area of 64ha to the immediate north-east of De Aar in a landscape setting of residential fringe and rural.

These three sites are all within a few kilometres of the centre of the built up area of De Aar, but receptors there are shielded by built form and tree planting. Receptors who could experience these sites are those living and/or working on the residential fringe and those being able to see the site or sites from transport corridors.

8.3.2 Two Additional PVFs

A PVF project has received approval for a site adjacent to the proposed Paarde Valley site assessed in this study. This is a small development and would evacuate its power locally to De Aar sub-station. A PVF project is being considered for a site south of De Aar.

8.4 De Aar

De Aar is a visually contained town in that it is bound on its western edge by a line of very low hills; its residential character changes abruptly north of the R48 to industrial; the town is bound to the south by the N10. There will be new transmission lines, sub stations and new access roads associated with the new developments. The construction periods may not run concurrently with consequent increased visual impact on local roads.

8.5 The Scale of the Local Landscape

The local landscape may therefore change in character from one of residential, industrial and agricultural fringe, to one of solar arrays. The local landscapes are all extensive enough to provide a setting for these developments as expressed in previous sections.

8.6 The scale of the Cumulative Impact

Consideration must be given to local residents in De Aar, the people who work there, people who live locally on the farmsteads, and people who drive through the area. To what degree would the proliferation of these developments visually impact upon these receptors and how would they be experienced.

Cumulative impacts would be generated by new transmission lines, sub stations and new access roads associated with the new developments. The construction periods may not run concurrently with consequent increased visual impact on local roads. The construction periods could also have an increased impact due to longer timeframes, road access junctions will be more impacted-upon and lay-down areas may be more visible.

Should all the proposed PVFs be constructed, De Aar will have a more industrial, (security fenced), and a more contemporary, (hi-tech developments), appearance. Once operational, these facilities would probably not promote noticeable additional traffic movements but they may begin to influence the character of the town

In a very populated area, with complex landscape patterns, the number of proposed developments could result in a high visual impact. In this context, the long views, exposed sites, roads with little traffic, small to medium sized towns, all combine to rate this cumulative impact as *medium*.

The local landscape character of rural-urban fringe would be changed and made more industrial, but the scale of the landscape can absorb these currently assessed developments, and this cumulative impact is assessed as *medium* for both *magnitude* and *significance*.

9.0 RECOMMENDED MITIGATION MEASURES: ALL SITES

9.1Construction phase:

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

9.1.1 Location of construction access

PV2: Construction access is intended to be off the existing R48 by means of a new road. In this location there is already a crossing over the rail line.

PV3: access would be off the N10, which is deemed visually acceptable

PV4: access would be off the road around Happy Valley which is deemed visually acceptable.

All sites: 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.

9.1.2 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.

9.1.3 Visibility 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)). 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.

9.1.4 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.

9.2 Infrastructure

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

9.2.1 New roads within the site

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

9.2.2 Concrete footings

The need to provide concrete footings for all the support structures will result in inevitable scarring of the existing land cover. 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.

9.3 Visibility of Buildings and Ancillary infrastructure

These developments will require the installation of a number of small buildings, a local sub-station and small security office. 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.

It is also advised that any visual impact would be reduced by being able to site them in settings which read to receptors as logical. It is acknowledged that there will be a technology rationale employed in these decisions, but the buildings and the sub-station should be grouped together and any security building should be close to the site entrance.

Buildings should as far as possible, be clad and roofed in materials that will blend in with the local landscape. It is hoped that sensitivity will be employed to ensure that they will not be clearly visible to receptors.

9.4 Visibility of Transmission pylons

PV2: The proposed overhead line from the site into De Aar sub-station would run in parallel with an existing line on a similar servitude. The second proposed 132kV transmission line would cross the industrial estates and the R48 and be routed in a new servitude on the east edge of Happy Valley and Nonzwakazi.

PV3: It is proposed that the power generated would either be evacuated by new 132kV lines direct to existing Eskom infrastructure, or by running in the same new servitude described above.

PV4: It is proposed that the power generated would either be evacuated by new 132kV lines direct to existing Eskom infrastructure, or to De Aar substation.

This will have a visual impact for residents; the additional transmission lines will contribute to the proliferation of transmission lines locally, established due to the significance of Hydra sub-station.

9.5 Layout

The most significant view of the proposed developments would be obtained from receptors to the north as it is they who would see the arrays of panels. In all of these developments there are fewer receptors from that direction. No changes to the layouts under assessment in the report are proposed.

The most important aspect of the visibility of the layouts 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.

10.0 CONCLUSIONS AND RECOMMENDATIONS: ALL SITES

10.1 Issues

10.1.1 The Developments

There would be an extensive array of photovoltaic panel modules, 2 to 4.0m high in the case of Option 1 and a fewer number of larger, 15.4m high panel modules erected on the proposed development sites, to the north and east of De Aar, close to transport corridors, residential areas and industrial sites. Also planned for each site are security fencing, roads, single storey buildings, and a sub- station. New transmission lines are needed; one to the De Aar sub-station close by, and the remainder to Hydra.

The developments vary in extent from 19MW in the north east (PV4) to 75MW in the east (PV3) and the north (PV2) of the town.

10.1.2 Visual Statement: Layouts

None of the developments is rated high for visual impact, although they would change the character of the local landscape from agricultural and rural to semi-industrial. The site to the north of the town, (PV2), is most able to fit in with the local landscape due to compatible adjacent uses. The other two sites lie beyond the built up area in rural locations; of these the north east site, (PV4), is assessed lowest for overall visual impact.

The remaining site in the east is visually exposed to residential areas and there is strong intervisibility between PV3 and PV4. The impacts of PV3 could be mitigated by giving preference to the *Alternate* layout as it would impact fewer sensitive receptors.

It is significant that receptors viewing PV2 and PV4 would do so, in the main, from the south, where the support structures would be seen and not the panels. PV3 would be seen, in the main, from the side.

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.

10.1.3 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 very unusual within the context of De Aar.

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

10.1.4 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.

10.1.5 Visual impact Rating:

The study concluded that the overall visual impact of the proposed developments would be moderate, due to the scale of the development, the numbers and types of receptors directly affected, and the shielding by built form. It was noted that the semi-industrial nature of a PVF was compatible with the industrial uses locally and the transmission lines. A number of mitigation measures was proposed which could moderate that visual impact.

10.1.6 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 De Aar area that are in various stages of approval.

The local landscape, in the outskirts of De Aar, may therefore change in character from one which is residential, commercial and industrial to one where there are isolated high-tech developments, i.e. wind turbines and solar arrays. The most visually significant developments, the WEFs, are 15 to 20km from the built-up area. The solar arrays will be closer to De Aar, but:

- the scale of the landscape is sufficient to provide a setting for these developments, including the smaller number of large scale panel modules in Option 2.
- one site is already partly industrialised, the other sites are more remote.
- the PVFs that are partially inter-visible are of a similar scale
- the fourth PVF, (PV1), is much smaller in scale

The local landscape character is changed; the *cumulative* impact is assessed as *medium* for both *magnitude and significance*.

10.2 Recommendations

PV2: *Preferred* Layout, its access road, and the transmission line to De Aar substation.
PV3: *Alternative* Layout, Option 1 or 2, its access road and the transmission line direct to Eskom infrastructure.
PV4: *Preferred* Layout, preferred access road, and the transmission line direct to Eskom infrastructure.

These could proceed provided that mitigation measures are undertaken relating to the:

Construction Phase:	Timing and location of traffic movements Disposal of surplus materials Location of lay-down areas
Operational Phase: Infrastructure:	Use of non-reflective materials and receding colours Height, location, finishes of building(s)

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 has been drawn up by the EAP, its ratings and criteria are adopted in this report

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 0.2 Definition 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
See Annexure D

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.