PROPOSED KAROSHOEK SOLAR VALLEY DEVELOPMENT

NEAR UPINGTON IN THE NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

AS PART OF AN ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

Produced for:

FG Emvelo (Pty) Ltd

Produced by:

MetroGIS (Pty) Ltd.
PO Box 384, La Montagne, 0184
Tel: (012) 349 2884/5 Fax: (012) 349 2880
E-mail: lourens@metrogis.co.za Web: www.metrogis.co.za

On behalf of:

Savannah Environmental (Pty) Ltd.
PO Box 148, Sunninghill, 2157
Tel: (011) 234 6621 Fax: 086 684 0547
E-mail: alicia@savannahSA.co.za Web: www.savannahSA.com

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1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

MetroGIS (Pty) Ltd, specialists in visual impact assessments and Geographic Information Systems, undertook this visual assessment.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1989.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Karoshoek Solar Valley Development. Neither the author nor MetroGIS will benefit from the outcome of the project decision-making.

1.2. Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time.

1.3. Level of Confidence

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.
- The information available, understanding of the study area and experience of this type of project by the practitioner:

[1] Adapted from Oberholzer (2005).

- 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
- 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
- 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

Table 1: Level of confidence.

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

*The level of confidence for this assessment is determined to be **9** and indicates that the author's confidence in the accuracy of the findings is high:*

- The information available, and understanding of the study area by the practitioner is rated as **3** and
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**.

1.4. Methodology

The study was undertaken using Geographic Information Systems (GIS) technology as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Chief Directorate National Geo-Spatial Information.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The approach utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc;
- The identification of sensitive environments upon which the proposed facility could have a potential impact;
- The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

This report (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed facility, including related infrastructure, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **Determine Potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed WEF and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed WEF facility and related infrastructure indicate the potential visibility.

- **Determine Visual Distance / Observer Proximity to the facility**

  In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the turbines.

  Proximity radii for the proposed development site are created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment.

  The visual distance theory and the observer's proximity to the facility are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed facility.

- **Determine Viewer Incidence / Viewer Perception**

  The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

  It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed WEF and its related infrastructure.

  It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **Determine the Visual Absorption Capacity of the natural vegetation**

  This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The VAC is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernable detail in visual characteristics of both environment and structure decreases.

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **Determine the Visual impact index**

  The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the magnitude of each impact.

- **Determine Impact significance**

  The potential visual impacts identified and described are quantified in their respective geographical locations in order to determine the significance of the anticipated impact. Significance is determined as a function of extent, duration, magnitude and probability.

2. BACKGROUND

FG Emvelo (Pty) Ltd is proposing the establishment of a Solar Valley Development on a site about 30 km east of Upington within the Siyanda District Municipality in the Northern Cape Province. The proposed development will comprise seven projects, each consisting of a potential variety of solar energy generation alternatives.

The proposed sites for the seven projects are all located within the farms identified for the Karoshoek Solar Valley Development and are indicated on the maps that are referenced throughout this report.

The site numbers on the maps correspond with the project descriptions listed below. The maps also indicate a site labelled **Site 1.2**. This site is not part of this assessment, but is earmarked for the Ilanga Solar Thermal Power Plant (parabolic trough technology), which was part of a separate Environmental Impact Assessment process, which has already received environmental authorisation in October 2011. This project would also form part of the Karoshoek Solar Valley Development but is not individually assessed in terms of visual impact in this report.

Table 2: Project components related to the Karoshoek Solar Valley Development.

SITE REF	PROJECT NAME, COMPONENTS AND DESCRIPTION
Site 2 (approx. 240ha)	**Karoshoek CPVPD 1** (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 2 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 3 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
	Karoshoek CPVPD 4 (1 x 25 MW Concentrating photovoltaic or parabolic dish technology project)
Site 1.1 (approx. 480ha)	**Karoshoek LF 1** (1 x 100 MW Linear Fresnel)
Site 1.3 (approx. 469ha)	**Karoshoek PT** (1 x 100 MW Parabolic Trough)
Site 1.4 (approx. 474ha)	**Karoshoek LFT 2** (1 x 100 MW Linear Fresnel or Parabolic Trough)
Site 3 (approx. 484ha)	**Karoshoek Tower 1** (1 x 50MW Tower)
	Karoshoek Tower 2 (1 x 50MW Tower)
Site 4 (approx. 484ha)	**Karoshoek LFTT 1** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)
Site 5 (Approx. 484ha)	**Karoshoek LFTT 2** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)
Grid connection	Electricity distribution line(s) which will connect to an on-site substation / switchyard

A concise description of each solar energy generation technology is as follows:

- **Parabolic Troughs** are curved, mirrored troughs which reflect direct solar radiation onto a glass tube containing a fluid (also called a receiver, absorber, or collector) running the length of the trough, and positioned at the focal point of the reflectors.

- The **Parabolic Dish** combines a parabolic shaped point focus concentrator in the form of a dish that reflects solar radiation onto a receiver mounted at the focal point. These concentrators are mounted with a two-axis tracker to follow the sun. The collected heat is typically utilized directly by a heat engine mounted on the receiver moving with the dish structure.

- **Linear Fresnel** technology is an evolution from the parabolic trough technology; it uses flat glass mirrors in place of parabolically curved mirrors. Parallel lines of mirrors reflect solar energy onto a receiver in which water is vaporized.

- The **Tower** is based on concentrated solar power with an array of heliostats on a central receiver mounted atop a tower more than 200 metres high. The liquid running through the receiver absorbs highly concentrated solar radiation in the receiver and converts it into thermal energy for use in the generation of steam, which runs the turbine and thus generates electricity.

- **Concentrated Photovoltaic** technology is used to generate electricity by converting solar radiation into direct current electricity using semiconductors (i.e. silicon) through the photovoltaic effect. PV technology refers to the use of multiple PV cells which are linked together to form PV panels. The proposed PV panels may have a tracking

functionality which will allow them to follow the movement of the sun during the day.

Figure 1: Images of potential solar energy generation options proposed for the Karoshoek Solar Valley Development.

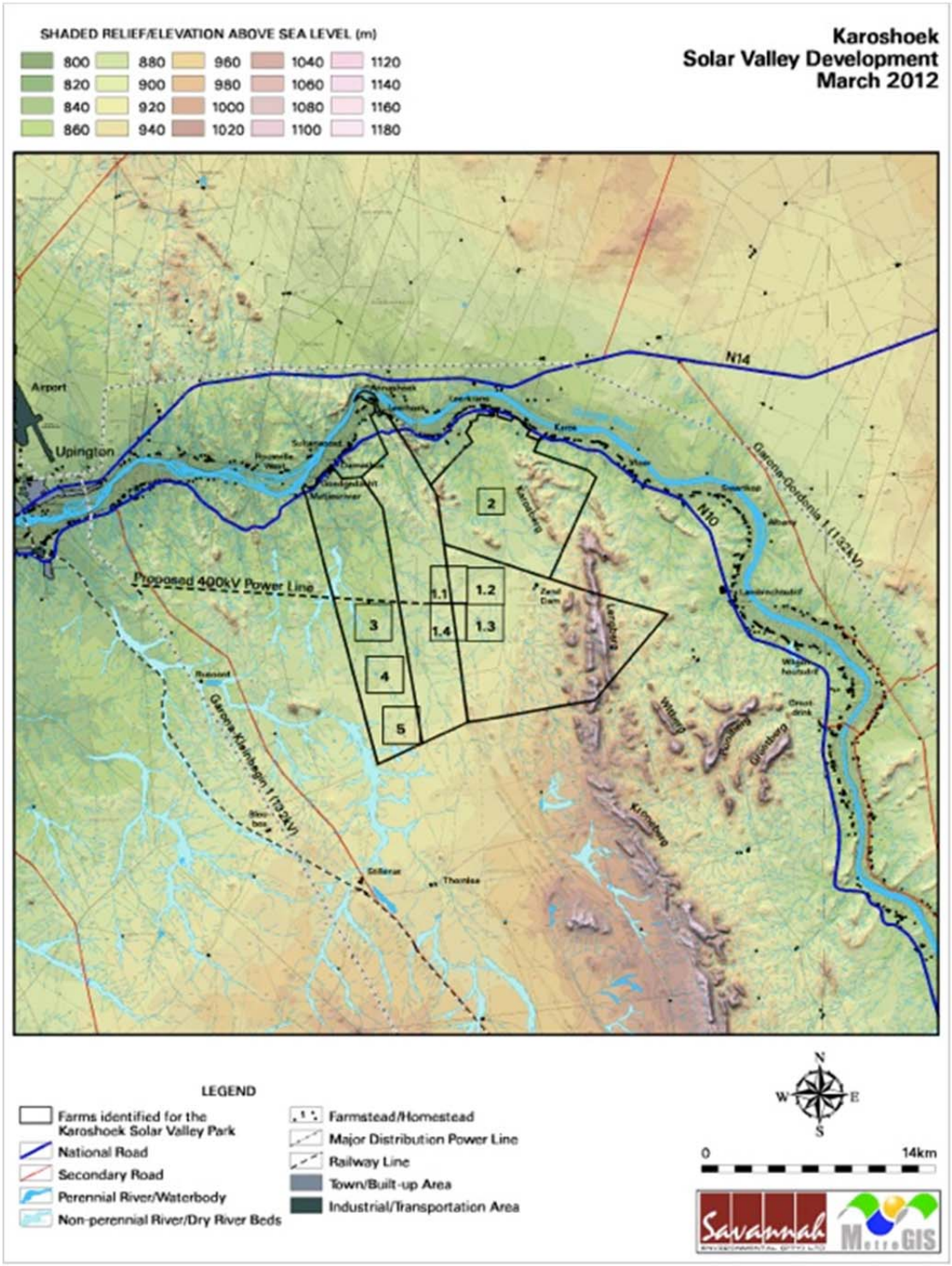
Figure 1 above illustrates some examples of the proposed solar energy generation technology options proposed for the Karoshoek Solar Valley Development. *Please note that these images are indicative only and that there may be variations in the dimensions and designs of the final structures/facilities.*

Detailed designs and construction layouts of the individual project components are not available at present, but it is expected that the proposed infrastructure would encompass the larger part of the surface areas of their respective sites.

Supplementary infrastructure for each of the seven projects is expected to include:

- Overhead power lines connecting to an onsite substation.
- A 400kV power line facilitating the connection between the substation and the national grid. This will connect to the future 400kV line to be constructed in the area (to the west of the site).
- Internal and external access roads.
- Accommodation facilities, storerooms, security and access control structures, etc.

Each proposed plant within the Karoshoek Solar Valley Development will take approximately 2-3 years to construct. The construction of the entire Karoshoek Solar Valley development is expected to take approximately 10-12 years. The lifespan of the facility is typically 30 - 40 years.



Map 1: Locality map indicating the seven solar energy facility (SEF) sites as well as the shaded relief (topography and elevation above sea level).

3. SCOPE OF WORK

The study area for the visual assessment encompasses a geographical area of 1024km² (the extent of the maps displayed below) and includes a minimum 16km buffer zone from the proposed development area.

The broader study area includes the town of Upington and a number of settlements and homesteads, mainly concentrated along the banks of the Orange River. Industrial infrastructure within the study area includes the Upington Airport, several transmission and distribution power lines as well as a number of distribution substations.

The N14 and N10 national roads to the north of the site (to the north and south of the river respectively) and a few secondary roads traverse the study area.

The scope of work for this assessment includes the determination of the potential visual impacts of the proposed facility and associated infrastructure in terms of nature, extent, duration, magnitude, probability, and significance of the construction and operation of the proposed infrastructure.

In this regard, specific issues related to the visual impact were identified during the Scoping phase. These issues include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the national (N14 and N10) and secondary roads within the study area.
- The visibility of the facility to, and visual impact on settlements and homesteads within the study area.
- The potential visual impact of the facility on the visual character and sense of place of the region.
- The potential visual impact of the facility on tourist routes (N10 and N14) and potential tourist activities and destinations (i.e. along the Orange River).
- The potential visual impact of ancillary infrastructure within the facility footprint on observers in close proximity of the facility.
- The potential visual impact of ancillary infrastructure beyond the facility footprint on observers in close proximity of the facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential visual impacts associated with the construction phase.
- Potential cumulative visual impacts, specifically in context of the seven solar energy facilities (SEFs) envisaged for the Karoshoek Solar Valley development, as well as the Project Ilanga SEF (site1.2).
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

4. THE AFFECTED ENVIRONMENT

The proposed site for the construction of the solar development includes the following farms:

- Portion 0 of Karos 959;
- Portion 3 of Annashoek 41;
- Portion 0 of Zandemm 944;
- Portion 2 of Matjiesrivier 41; and

- Portion RE of Matjiesrivier 41[2].

The above farms comprise a total area of about 260km^2, but the actual development will be limited to a total area of about 32km^2 for all seven sites.

Regionally, the Solar Park is located about 30km east of Upington within the Northern Cape Province. Although it is not on the Orange River itself, the site is quite close, lying to the south of the river, just beyond the river valley.

The N10 national road runs along the northern boundary of the site, traversing it for a small portion. A number of secondary roads form links between this road and the N14 north of the river. These are located to the west and east of the site. Refer to **Map 1**.

The study area occurs on land that ranges in elevation from 800m (at the Orange River) to 1180m (at the top of the nearby koppies). The terrain surrounding the farm is predominantly flat with an even slope towards the Orange River valley that forms the most distinct hydrological feature in the region.

Due to this flat topography, the area, particularly south of the river, is characterised by the occurrence of many non-perennial drainage lines and pans.

The dominant topographical unit or terrain type of the region is relatively homogenous and is described pre-dominantly as *lowlands with hills, dune hills* and *irregular or slightly irregular plains*.

Relatively prominent low hills and koppies occur in the south-east of the study area. Some isolated koppies also occur randomly in the north west of the study area. The Orange River meanders from the south east, and then curves toward the west.

The river has, to a large degree, dictated the settlement pattern in this arid region by providing a source of permanent water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district. Cattle and game farming practises also occur at a less intensive degree.

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open spaces and very little development. The scarcity of water and other natural resources has dictated the settlement patterns of this region.

Tourism is not well developed within the study area, but some destinations exist along the river and in Upington.

The population distribution is primarily concentrated in and around small towns along the Orange River. Farming homesteads dot the countryside at irregular intervals.

The study area has a rural character with little development outside of Upington. Exceptions occur where power lines traverse the study area. These include the Garona-Gordonia 1 132kV line to the north east of the site and the Garona-Kleinbegin 1 132kV line to the west of the site.

[2] No development is proposed on RE Portion of Matjiesrivier 41 at this stage, but the farm portion is included in the project scope as it is envisaged for future development

Vegetation cover in this semi-desert region is primarily *shrubland, thicket, and bushland* with isolated pockets of *grassland*, and *agricultural fields* occurring along the Orange River. Refer to **Map 2.** There are no formally protected areas within the study area.[3]

The photographs below show the area identified for the proposed Solar Valley Development and give an indication of the visual quality of the receiving environment.

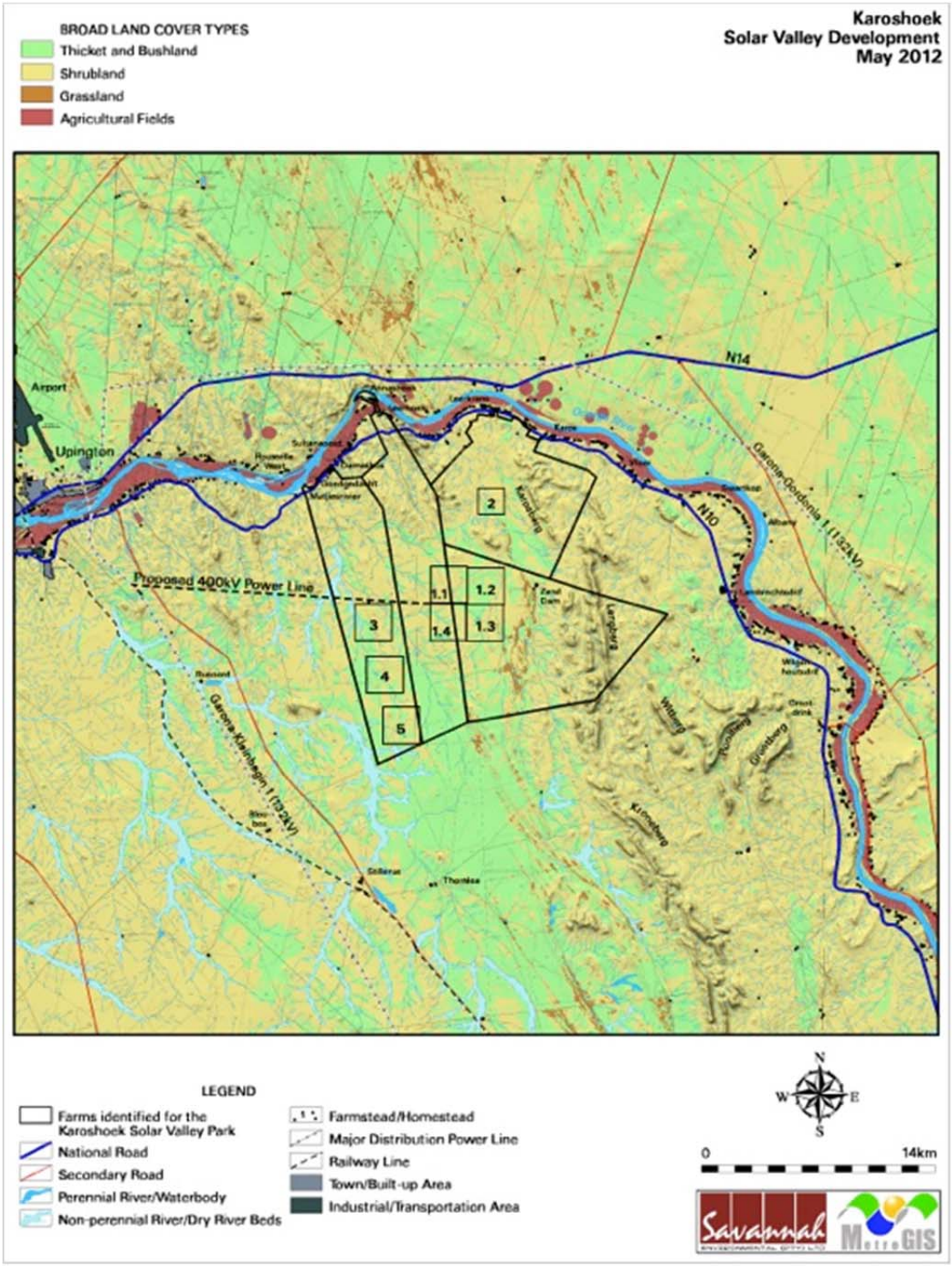
Figure 2: Typical natural vegetation cover of the area north of the proposed site.

[3] Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

Figure 3: Agricultural land to the north of the proposed solar development (i.e. land between the N14 and the Orange River, east of Upington).

Figure 4: Typical homestead in the area south of the proposed development.

Figure 5: Photograph showing the dominantly flat topography of the region.



Map 2: Broad land cover types of the study area.

5. RESULTS

5.1 Potential visual exposure

The results of the visibility analyses for the proposed solar energy facilities are shown on **Maps 3-9** (for each of the proposed development sites individually) and on **Map 10** for the potential cumulative visual exposure of all the Karoshoek Solar Valley Developments collectively.

The analyses were undertaken from positions within each of the development sites at varying heights above ground level. These heights, or offsets, reflect the potential maximum height of the solar energy structures intended for each site. Where there are a number of different technologies planned for one site, the larger (in terms of vertical dimensions) heights were utilised for the viewshed. This was done in order to cater for a worst case scenario when assessing the visual impacts.

An additional and separate viewshed has been generated for the overhead power line, set at 20m above average ground level, and is displayed on **Map 10**.

Site 1.1: Karoshoek LF 1 (1 x 100 MW Linear Fresnel)

The colour shading on the viewshed analysis indicates areas from which the proposed facility would be visible. Visibility is calculated at 12m above ground level (a.g.l. (i.e. the approximate maximum height of the structures associated with this solar technology)).

It is clear from the analysis that this site would be visually exposed to a large area, but that the visually exposed areas are quite contained to the extent of the Karoshoek Solar Valley Development site itself, and to the immediate west and south west.

Other areas of potential (longer distance) visual exposure lie further afield, north of the Orange River and within the low hills in the north west (also beyond the Orange River). The former are very flat visually exposed areas, but the latter low hills offer some visual protection for areas lying further to the north west.

The low hills within and to the east of the site also shield the region further east from potential visual exposure. The west facing slopes of these hills will, however, be visually exposed.

The Orange River valley is, for the most part, shielded from potential visual exposure by virtue of its depressed location within the topography. The exception is a zone on the northern bank of the river, north west of the site. Refer to **Map 3**.

Site 1.3: Karoshoek PT (1 x 100 MW Parabolic Trough)

This site, located immediately south east of Site 1.1, has a very similar viewshed pattern (see above), albeit slightly less exposed. Visibility was calculated at 12m above ground level (i.e. the approximate maximum height of the structures associated with this solar technology). Refer to **Map 4**.

Site 1.4: Karoshoek LFT 2 (1 x 100 MW Linear Fresnel or Parabolic Trough)

Located immediately south of Site 1.1, and also featuring structure heights of about 12m a.g.l., this site's viewshed virtually mimics the aforementioned pattern of visual exposure. See above. Refer to **Map 5**.

Site 2: **Karoshoek CPVPD 1, 2, 3,** and **4** (4 x 25 MW Concentrating photovoltaic or parabolic dish technology)

This site is the most northerly situated of all the proposed development sites. It is therefore located closest to the N10 national road (4km at the closest) and the Orange River. It is also the site with the most limited visual exposure due to its location in a valley where it is flanked by hills towards the east, west and south.

The depressed nature of the Orange River valley to the north makes it unlikely that the facility would be visible from the N10 national road or from the river itself. Exposure further north, at distances from 6-8km from the facility, may be experienced by observers travelling along the N14 national road and residents of homesteads located between this road and the river.

Visibility was calculated at 15m above ground level (i.e. the approximate height of the CPV or parabolic dish technology). Refer to **Map 6**.

Site 3: **Karoshoek Tower 1** and **2** (2 x 50MW Towers)

The height of the towers (approximately 200m a.g.l.) is immediately evident in the increased areas of visual exposure displayed on Maps 7, 8 and 9.

Notwithstanding the height of these towers, the exposure is still relatively constrained due to topographical factors, such as the *Langberg* and *Kroneberg* mountains ranges to the east of the sites and the hilly topography in the far north west. The core areas of largely uninterrupted exposure are expected to occur within an 8km radius of the towers and heliostats, extending in all directions. Further afield (i.e. up to 16km), areas of potential visual exposure extend to the north, beyond the Orange River and to the south west.

The towers may be visible from sebctions of the N10 national road. This will occur at distances predominantly exceeding 8km from the most northern tower.

A number of homesteads located in the area are also likely to be exposed. These include *Matjiesrivier, Goedgedaan, Damaskus, Sultanaoord and Rouxville West*. Residents of *Stillerus, Bloubos* and *Thornlea*, located south of the solar valley development, and *Rusoord* (west of the towers) may also be visually exposed to the project infrastructure.

The section of secondary road, traversing south west of the solar valley development, is expected to be visually exposed for relatively long stretches. Refer to **Map 7**.

Site 4: **Karoshoek LFTT 1** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)

The proposed technologies for Site 4, located just south of Site 3, includes a tower option. The viewshed analysis was therefore calculated at 200m above ground level, in order to allow for the worst-case scenario, in the event that this technology is preferred.

The visual exposure is very similar to the previous tower's exposure (see **Site 3** above), with only a few local topographical features (i.e. the hill located west of the towers) influencing the viewshed. This is due to the relative close location of the tower sites to each other and due to the tall structure heights.

In the event that another technology is preferred (i.e. Linear Fresnel or Parabolic Trough) the visual exposure will be greatly reduced, due to the limited height of these structures. Refer to **Map 8**.

Site 5: **Karoshoek LFTT 2** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)

The technologies proposed for Site 5 is similar to that of Sites 3 and 4. The visual exposure is a virtual copy of the viewsheds undertaken for the other tower sites with only a few local differences (see above). Once again if the preferred technology is Linear Fresnel or Parabolic Troughs, the exposure will be reduced. Refer to **Map 9**.

Grid connection: 400kV overhead power line

The viewshed analysis for this power line indicates a very limited area of visual influence. Visibility was calculated at 35m above ground level for a distance (radius) of 2km from the alignment (the expected sphere of visual influence for this type of infrastructure).

There are very few sensitive visual receptors within this zone of exposure, with the possible exception of the secondary road traversing near the Garona-Kleinbegin 1 (132kV) power line. Refer to **Map 10**.

Potential cumulative visual exposure

The potential cumulative visual exposure of all the proposed infrastructure for the Karoshoek Solar Valley Development is indicated on **Map 10**.

Here the potential visibility of any number of project structures are indicated as an index, with the yellow colour showing areas where only one site's structures may be visible, up to red, where structures from all seven sites may be visible.

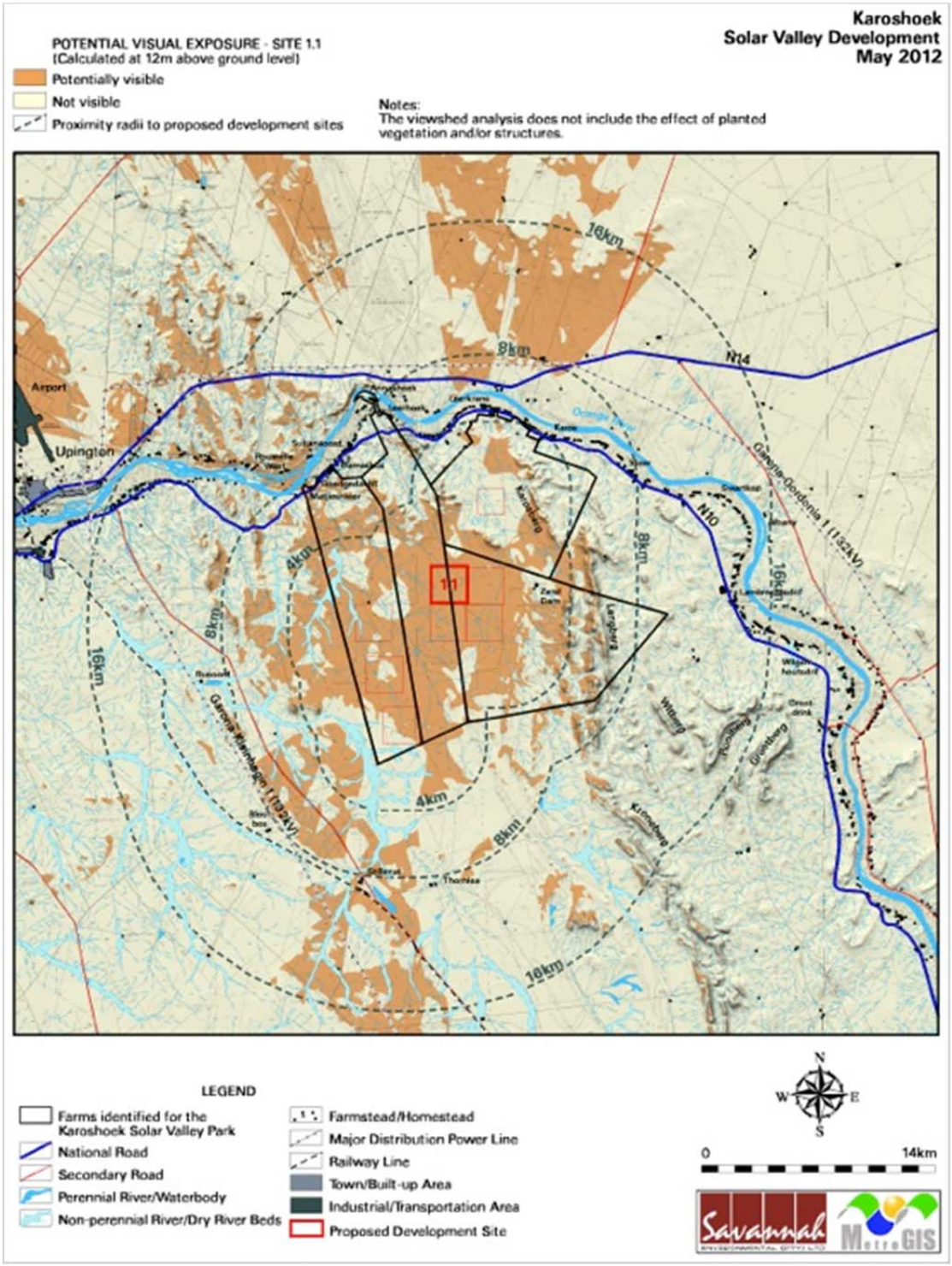
It is clear that the areas of highest cumulative exposure (more than three projects may be visible) are greatly limited to the Karoshoek development itself and to areas located to the immediate east of the development (i.e. the western faces of the Langberg), to the west and to the far north of the study area.

Areas of high potential cumulative visual exposure occur to the west and south west of the proposed development (near *Stillerus* and along the section of secondary road).

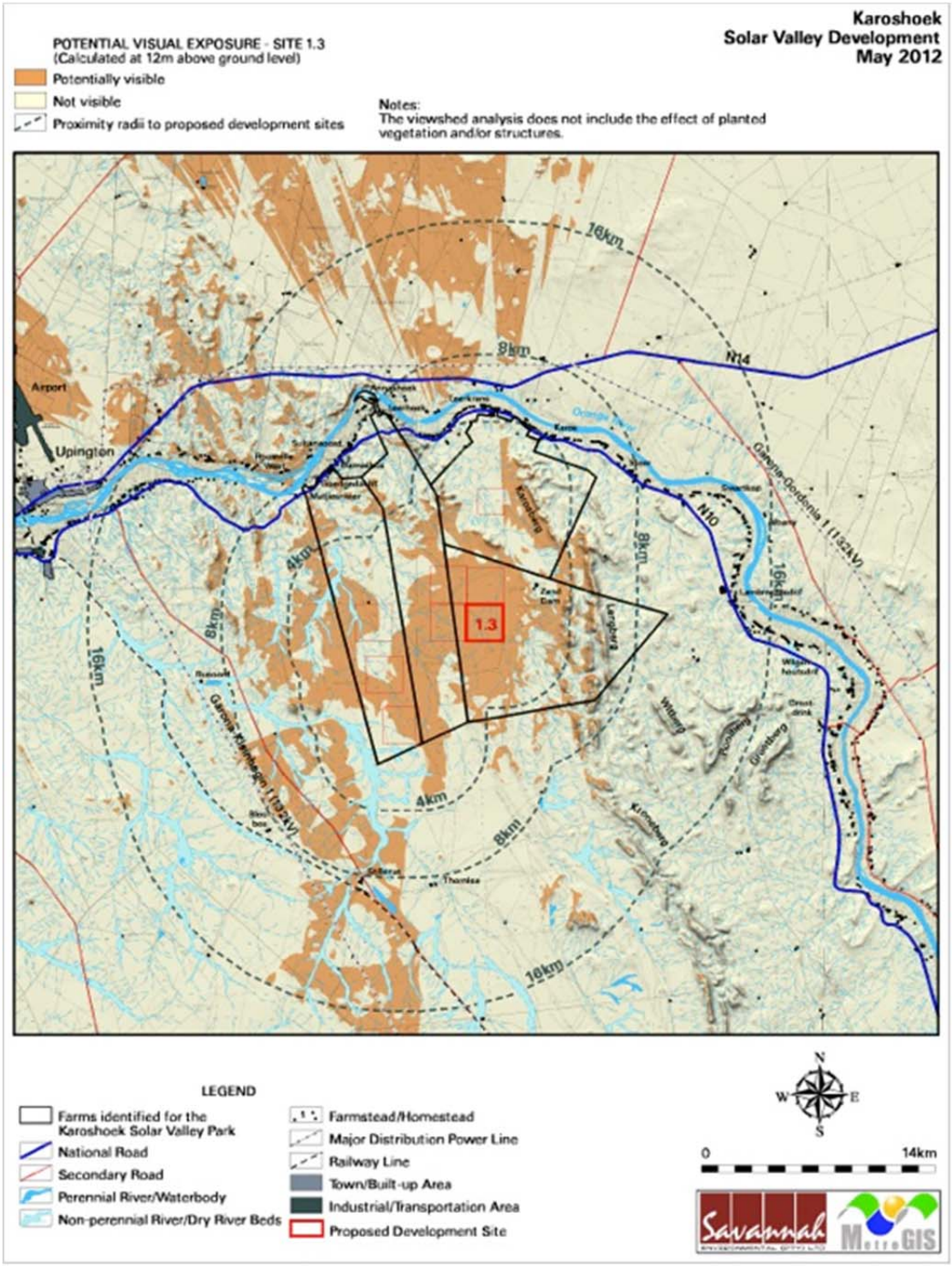
Additional areas of higher potential cumulative visual exposure are located further north, beyond the Orange River and the N14 national road.

The areas likely to have a clear view of all the Karoshoek Solar Valley Developments (i.e. all project sites and infrastructure) will be the elevated terrain along the west facing slopes of the *Langberg*, and the east facing slopes of the hills in the west.

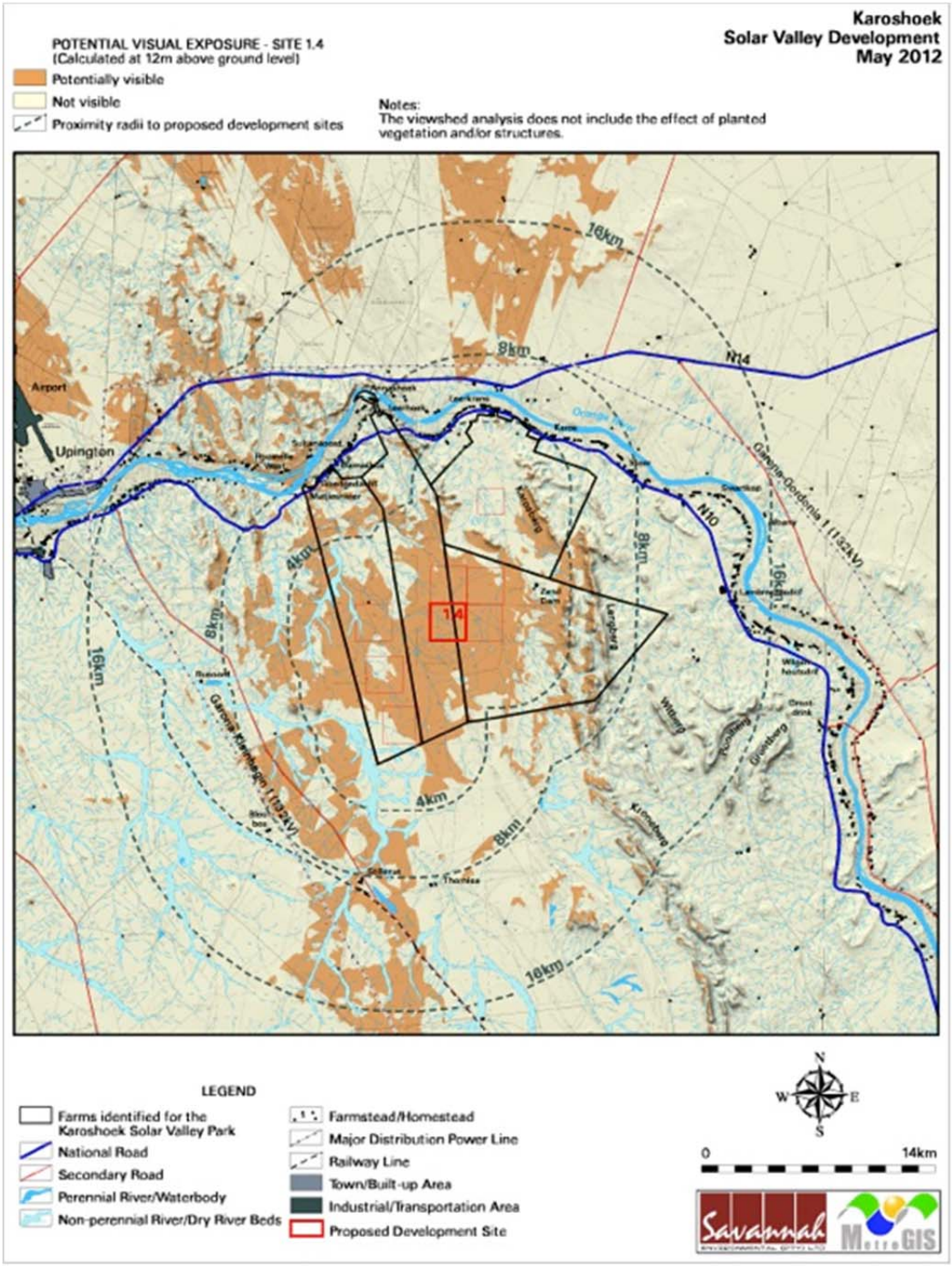
Elevated areas to the north, beyond the Orange River may also have a view of the entire development, but at a greater distance, which would reduce the visibility of the smaller infrastructure somewhat.



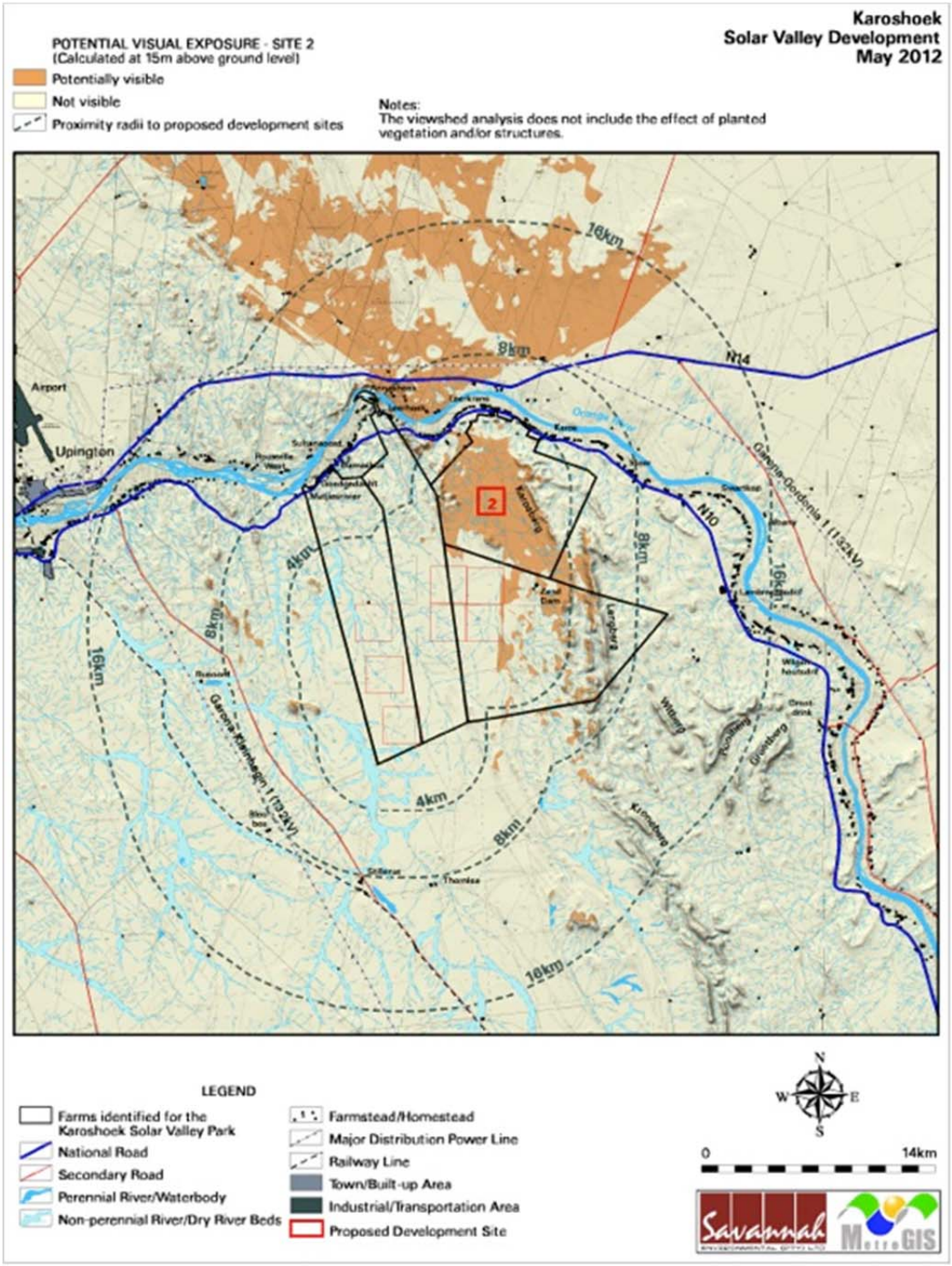
Map 3: Potential visual exposure: **Site 1.1: Karoshoek LF 1** (1 x 100 MW Linear Fresnel).



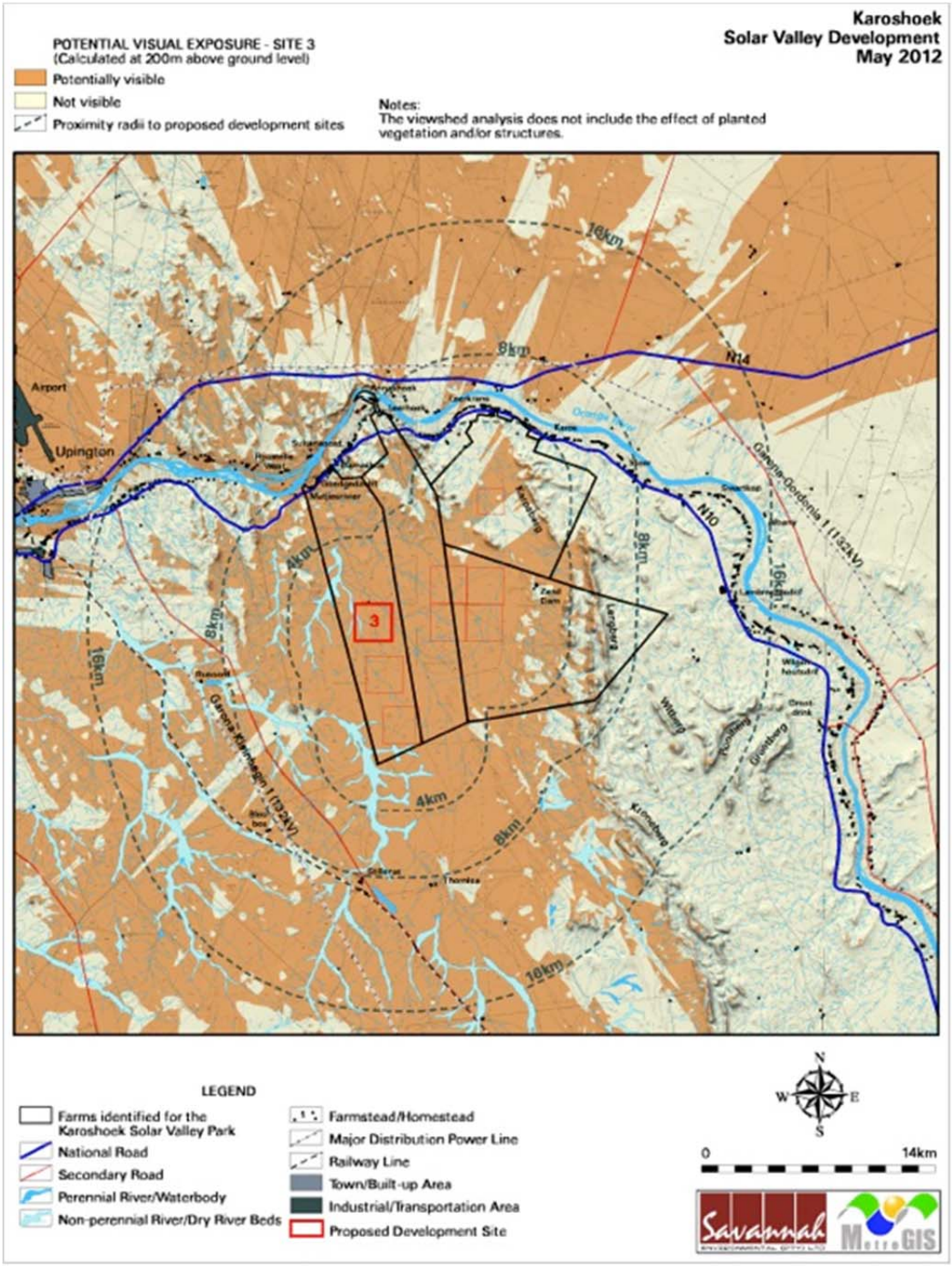
Map 4: Potential visual exposure: **Site 1.3: Karoshoek PT** (1 x 100 MW Parabolic Trough)



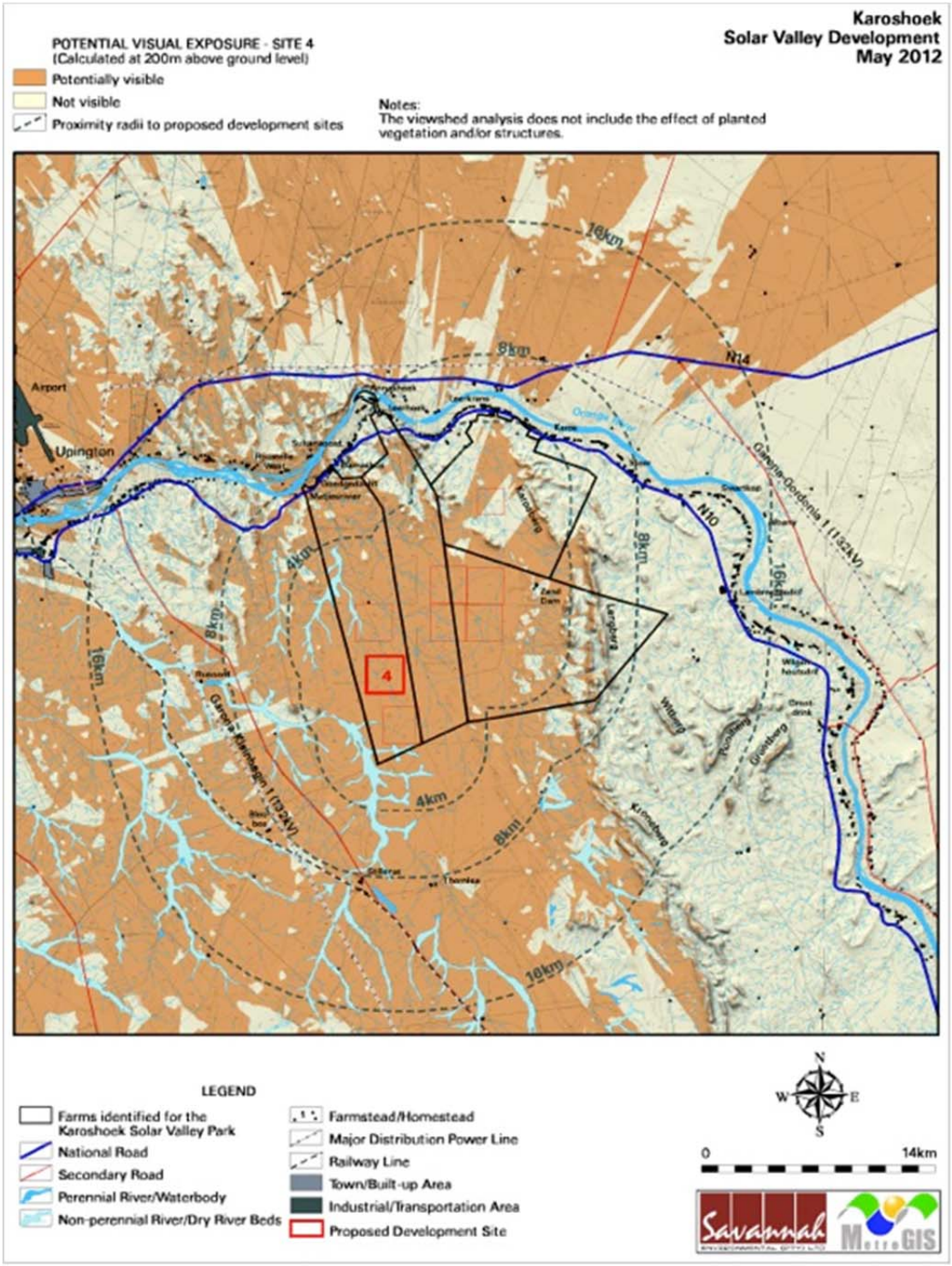
Map 5: Potential visual exposure: **Site 1.4: Karoshoek LFT 2** (1 x 100 MW Linear Fresnel or Parabolic Trough)



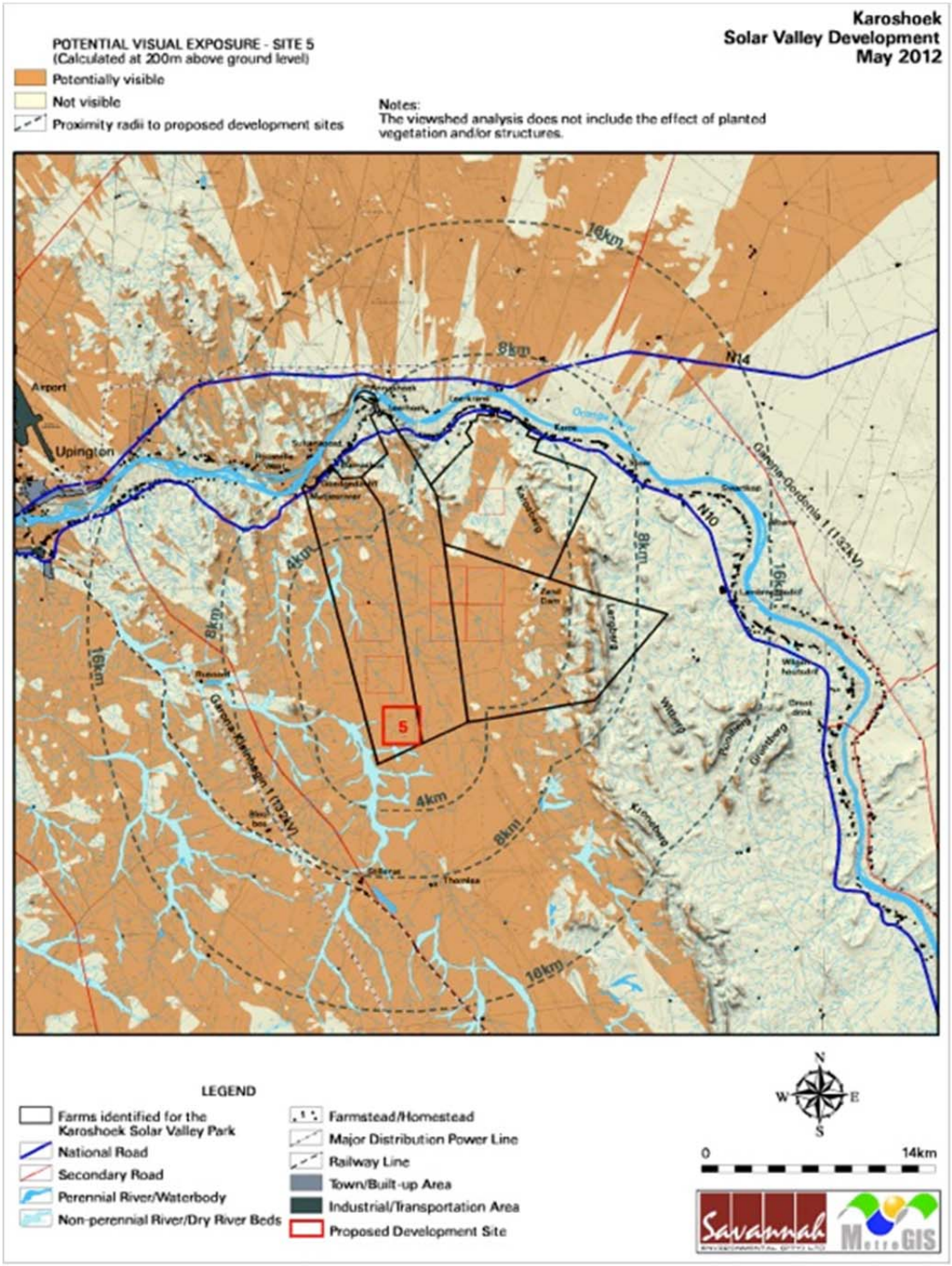
Map 6: Potential visual exposure: **Site 2: Karoshoek CPVPD 1, 2, 3,** and **4** (4 x 25 MW Concentrating photovoltaic or parabolic dish technology each)



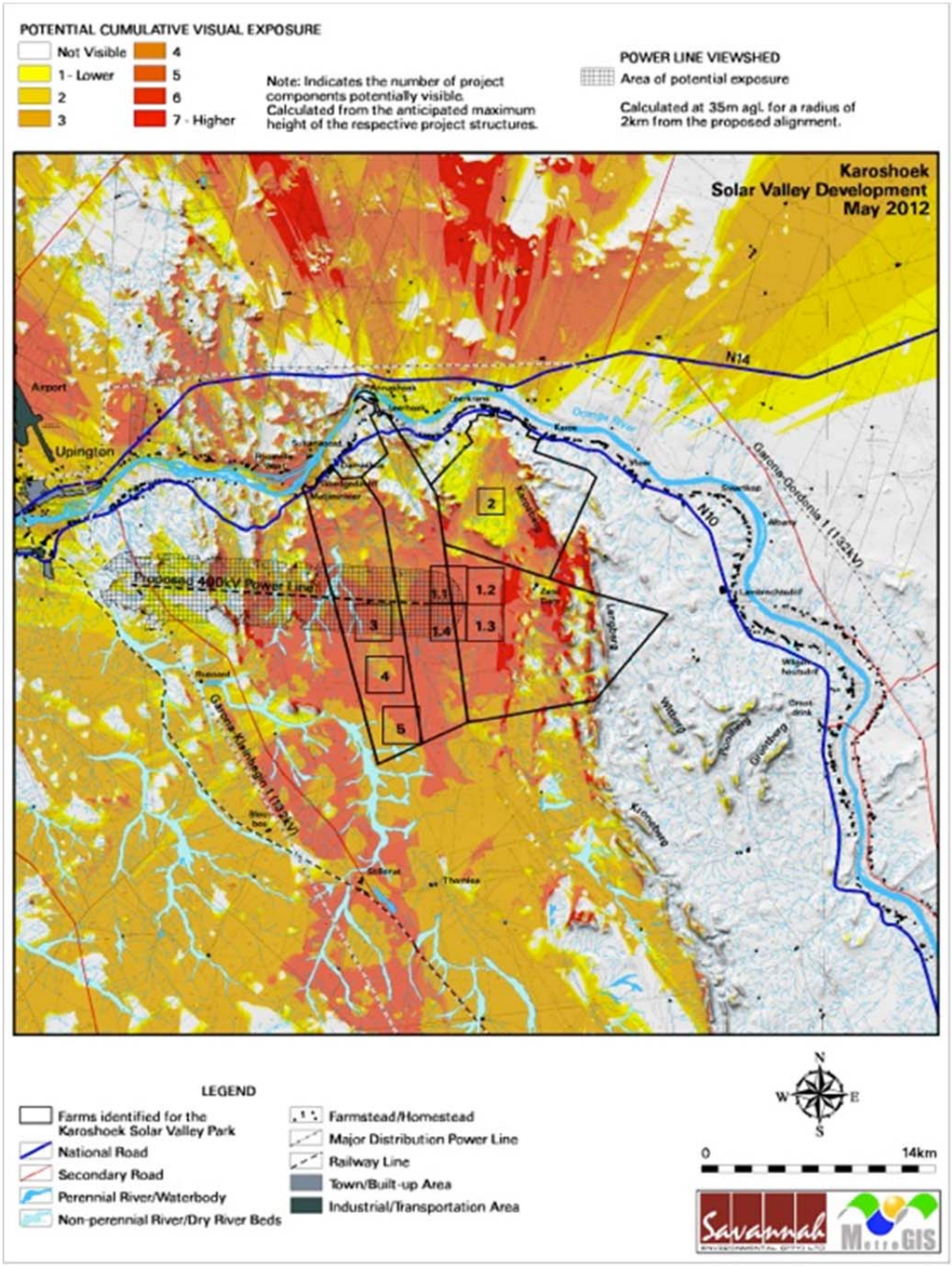
Map 7: Potential visual exposure: **Site 3: Karoshoek Tower 1** and **2** (2 x 50MW Towers)



Map 8: Potential visual exposure: **Site 4: Karoshoek LFTT 1** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)



Map 9: Potential visual exposure: **Site 5: Karoshoek LFTT 2** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)



Map 10: Potential cumulative visual exposure including 400kV overhead power line viewshed.

5.2 Visual distance / observer proximity

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure). MetroGIS developed this methodology in the absence of any known and/or acceptable standards for South African solar energy facilities.

The proximity radii (calculated from the boundary lines of the collective development sites) are shown on **Map 11** and are as follows:

- 0 - 4 km - Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 4 - 8 km - Medium distance views where the facility would be easily and comfortably visible and constitute a high visual prominence.
- 8 - 16 km - Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 16 km - Long distance view where the facility would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the facility.

5.3. Viewer incidence / viewer perception

Refer to **Map 11**. Viewer incidence is calculated to be the highest along the national roads (i.e. the N10 and N14) as well as the secondary roads within the study area. Commuters and tourists using these roads could be negatively impacted upon by visual exposure to the Karoshoek Solar Valley Developments and ancillary infrastructure (i.e. specifically the power lines).

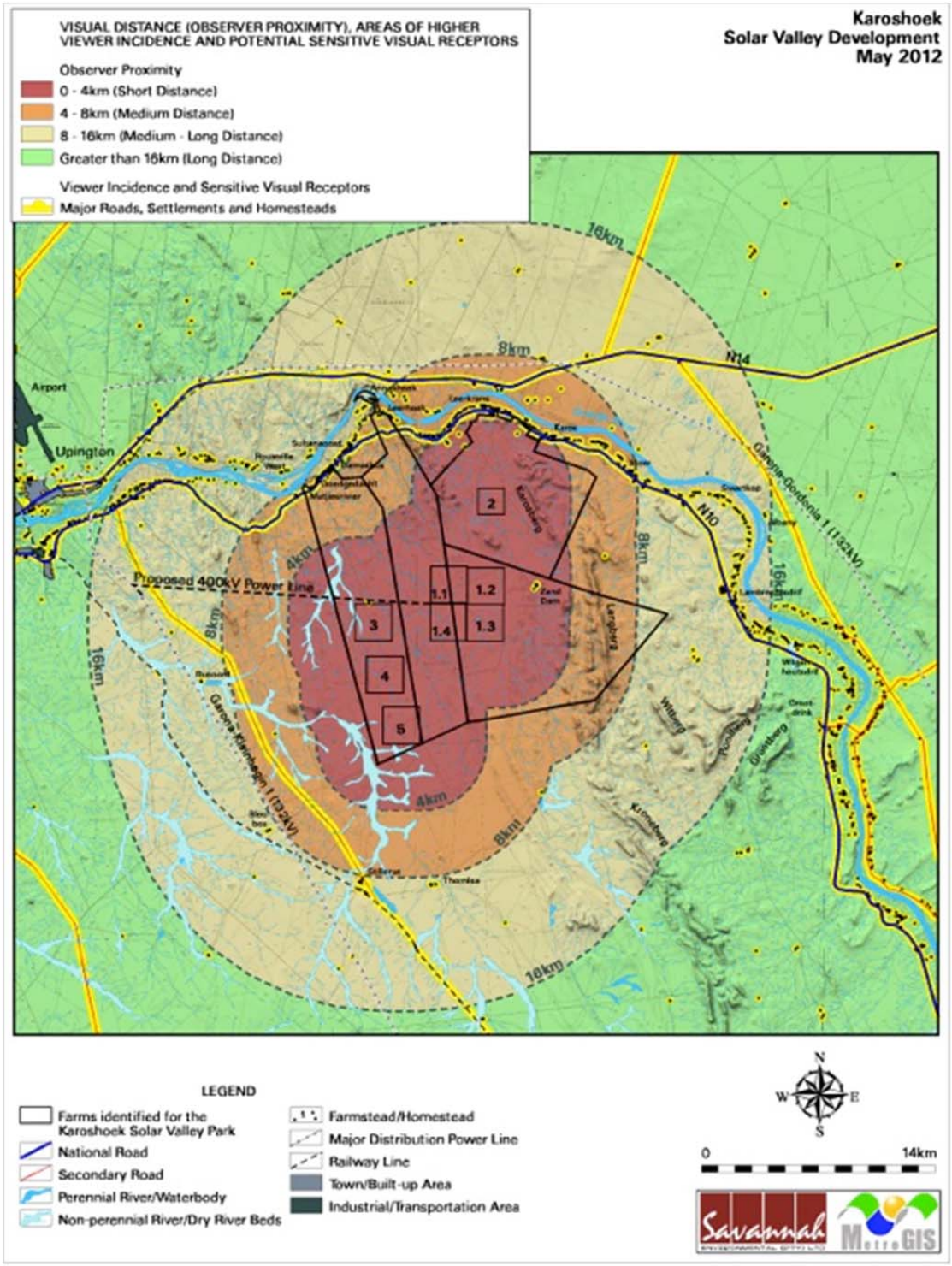
Tourists travelling through the area are seen as possible sensitive visual receptors upon which the construction of the proposed facility could have a negative visual impact.

Other than along the above roads, viewer incidence within a 16km radius of the proposed solar developments is concentrated in the significant number of homesteads and settlements along the Orange River.

The severity of the visual impact on the above receptors decreases with increased distance from the collective facility. It should in fact be noted that many of the receptors above occur more than 8km from the proposed facility.

The remaining areas beyond 16km consist predominantly of vacant natural land (grazing) and very sparsely scattered homesteads.

The highest concentration of potential observers is in Upington, which lies more than 20km from the site. Receptors within this urban context are not, however, considered to be sensitive to potential visual impact due to the high visual absorption capacity of the urban environment. In addition, it is not considered likely that the proposed infrastructure will be visible from this distance.



Map 11: Observer proximity to the proposed development sites and areas of high viewer incidence.

5.4. Visual absorption capacity

The vegetation present in the study area surrounding the facility (predominantly *Shrubland)* is expected to have a low Visual Absorption Capacity (refer to figures 3, 4 and 5 in this respect.). Where *Thicket and Bushland* occurs, the VAC may be somewhat higher (refer to figure 1). However, these areas have not been mapped, and a low to negligible VAC is assumed for these areas. The Visual Impact Index therefore simulates a worst case scenario.

Visual absorption capacity is expected to be high within the built up area of Upington and surrounds. The presence of buildings, infrastructure and urban clutter absorb the potential visual impact presented by the proposed facility to some extent, rendering the visual impact less noticeable within this context.

Visual absorption capacity will therefore only be taken into account within the built up area of Upington.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Solar Valley Developments are displayed on **Maps 12 - 19**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index for each of the individual sites, and cumulatively for all the sites. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence, and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index map (Map 11) represents the anticipated cumulative visual impact of the primary solar energy technologies and ancillary infrastructure located within the development footprints of all the sites. The map does not, however, illustrate the anticipated visual impact of the proposed off-site power line.

The map indicates a core area of potentially **moderate** visual impact within a 4km radius of the proposed Solar Valley Developments. No infrastructure or settlements, other than the houses/structures (e.g. *Zand Dam*) located on the farms earmarked for the development, lie within this area.

The following is of relevance:

Site 1.1: **Karoshoek LF 1** (1 x 100 MW Linear Fresnel)

Areas of **medium** to **low** visual impact, and even very low visual impact occur within 4km of the proposed facility. No sensitive visual receptors are lcoated within this zone.

A stretch of secondary road to the south west of the site will be exposed to potentially **low** visual impact. Remaining visual impacts, where these occur beyond the 4km radius are expected to be **very low** to **negligible**. Refer to **Map 12**.

Site 1.3: **Karoshoek PT** (1 x 100 MW Parabolic Trough)

Visual impacts for this site are very similar to those described above for site 1.1. refer to **Map 13**.

Site 1.4: **Karoshoek LFT 2** (1 x 100 MW Linear Fresnel or Parabolic Trough)

Visual impacts for this site are very similar to those described above for sites 1.1. and 1.3. refer to **Map 14**.

Site 2: **Karoshoek CPVPD 1, 2, 3,** and **4** (4 x 25 MW Concentrating photovoltaic or parabolic dish technology)

Areas of **medium** to **low** visual impact occur within a 4km of the proposed facility.

Sensitive visual receptors include a few homesteads to the north west (incuding *Annashoek* and *Leerhoek* north of the River) and *Zand Dam* to the south east. Only the latter is located within 4km of the proposed facility.

The other homesteads are located between the 4km and 8km radius. Additional sensitive receptors located at this distance include users of a short stretch of the N14 north of the river. These sensitive visual receptors are likely to be exposed to potentially **high** visual impact. Refer to **Map 15**.

Site 3: **Karoshoek Tower 1** and **2** (2 x 50MW Towers)

Areas of **medium** to **low** visual impact, and even very low visual impact occur within 4km of the proposed facility. No sensitive visual receptors are lcoated within this zone.

Between 4km and 8km, potential visual impacts are expected to be **low** to **very low**. Sensitive visual receptors occurring at this distance include users of short stretches of the N10 in the north, and of the secondary road in the south west. These receptors are likely to be exposed to potentially **high** visual impact.

Between 8km and 16km from the proposed facility, visual impacts are **very low**. Sensitive visual receptors (i.e. users of roads and residents of homesteads) are likely to be exposed to potentially **low** visual impact.

Remaining visual impacts beyond the 16km radius are expected to be **very low** to **negligible**. Refer to **Map 16**.

Site 4: **Karoshoek LFTT 1** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)

Visual impacts for this site are very similar to those described above for site 3. The difference lies in that sensitive visual receptors located between the 4km and 8km radius are limited to users of the secondary road in the south west. No potential visual impacts is anticipated for the N10. Refer to **Map 17**.

Site 5: **Karoshoek LFTT 2** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)

Visual impacts for this site are very similar to those described above for site 4. Refer to **Map 18**.

Grid connection: 400kV overhead power line

The proposed overhead power line is not expected to greatly influence the outcome of the visual impact index. The only area of potential visual impact occurs where this line crosses the secondary road before linking with the Garona-Kleinbegin 1 power line. The impact, for this power line is expected to be negligible, when viewed within the context of the greater Karoshoek Solar Valley Development.

Cumulative visual impact index

Potentially **moderate** visual impacts are likely to occur within 4km of the proposed Solar Valley Development. Sensitive visual receptors within this zone include a few homesteads in the north, along the Orange River, and *Zand Dam* in the east. These receptors are likely to experience potentially **high** visual impact.

Between 4km and 8km from the proposed development, potential visual impacts are expected to be **low**. Within this zone (4-8km) there are three distinct areas where the viewer incidence is higher and potential sensitive visual receptors may be visually influenced by the solar developments.

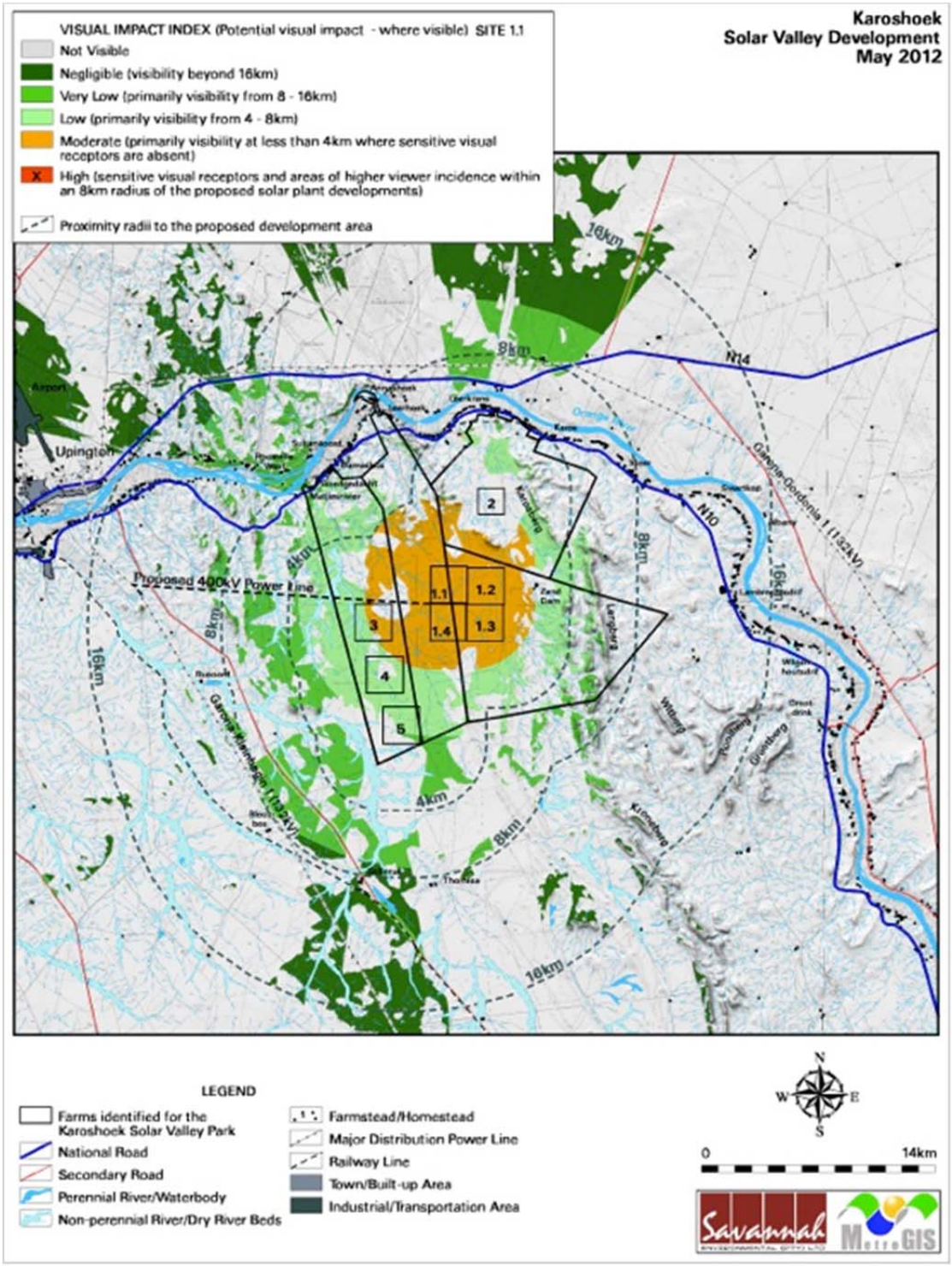
The first of these includes the section of secondary road between *Stillerus* and *Rusoord*, located south west of the Solar Valley development. The visual impact index indicates **high** potential impacts from where a number of solar developments may be visible.

A similar scenario occurs to the north west of the Karoshoek Solar Valley Development along the N10 national road, near *Damaskus, Goedgedacht* and *Matjiesrivier*. Observations of the project infrastructure from this area may also have a **high** visual impact.

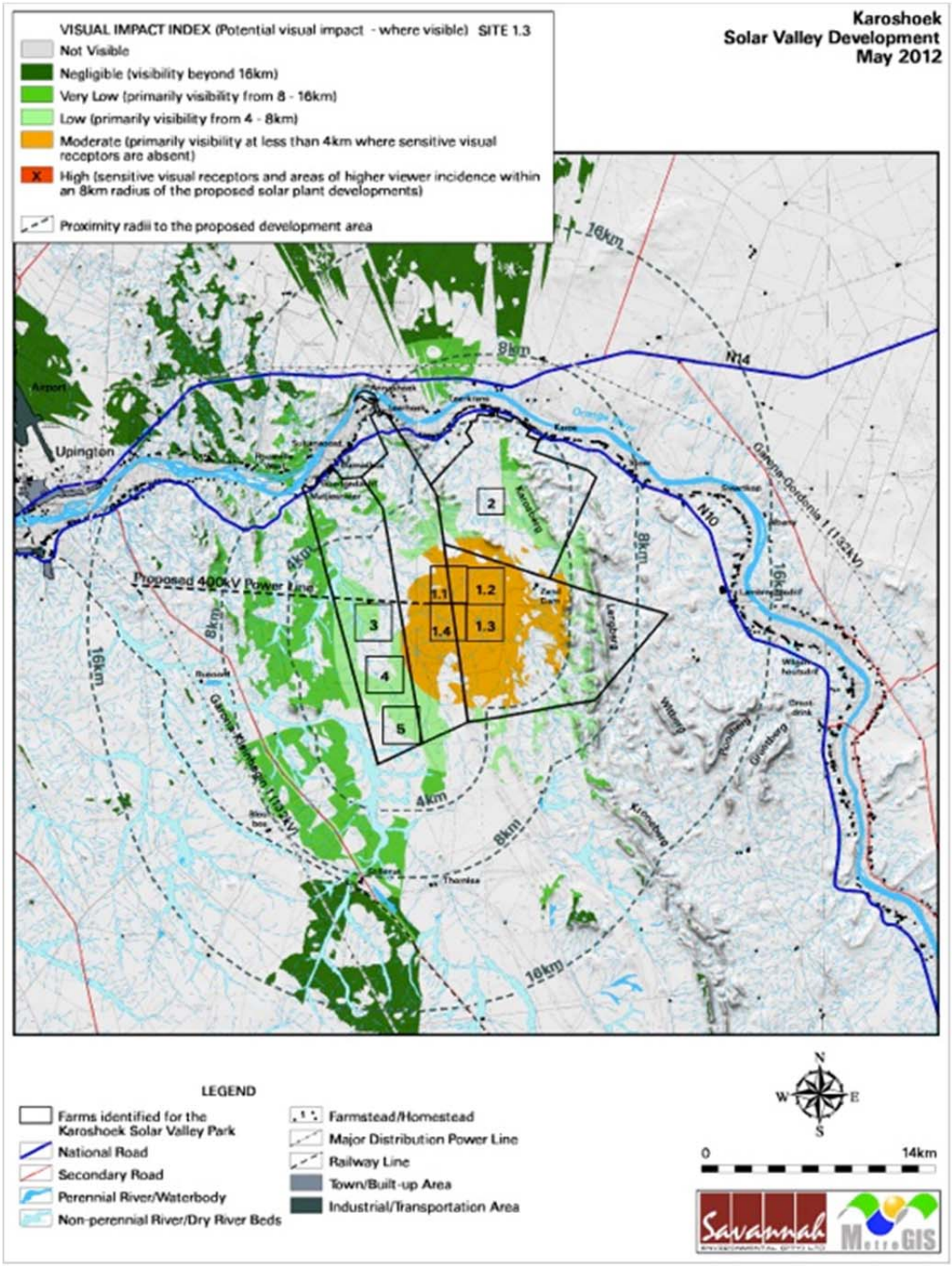
The area located north of Site 2 (including sections of the N14 national road, *Annashoek* and *Leerhoek*) may also experience **high** visual impacts. It should be noted though, that it is primarily the infrastructure developed on Site 2 that would be visible and that the other six development sites would be located at distances exceeding 10km and is therefore not expected to have a cumulative influence.

The zone between a radius of 8-16km, where the project infrastructure is visible, is generally expected to experience a **very low** visual impact, mainly due to the absence of sensitive visual receptors. Where observers do occur within this zone, the impact is expected to be **low**, due to the great distance between the observer and the object.

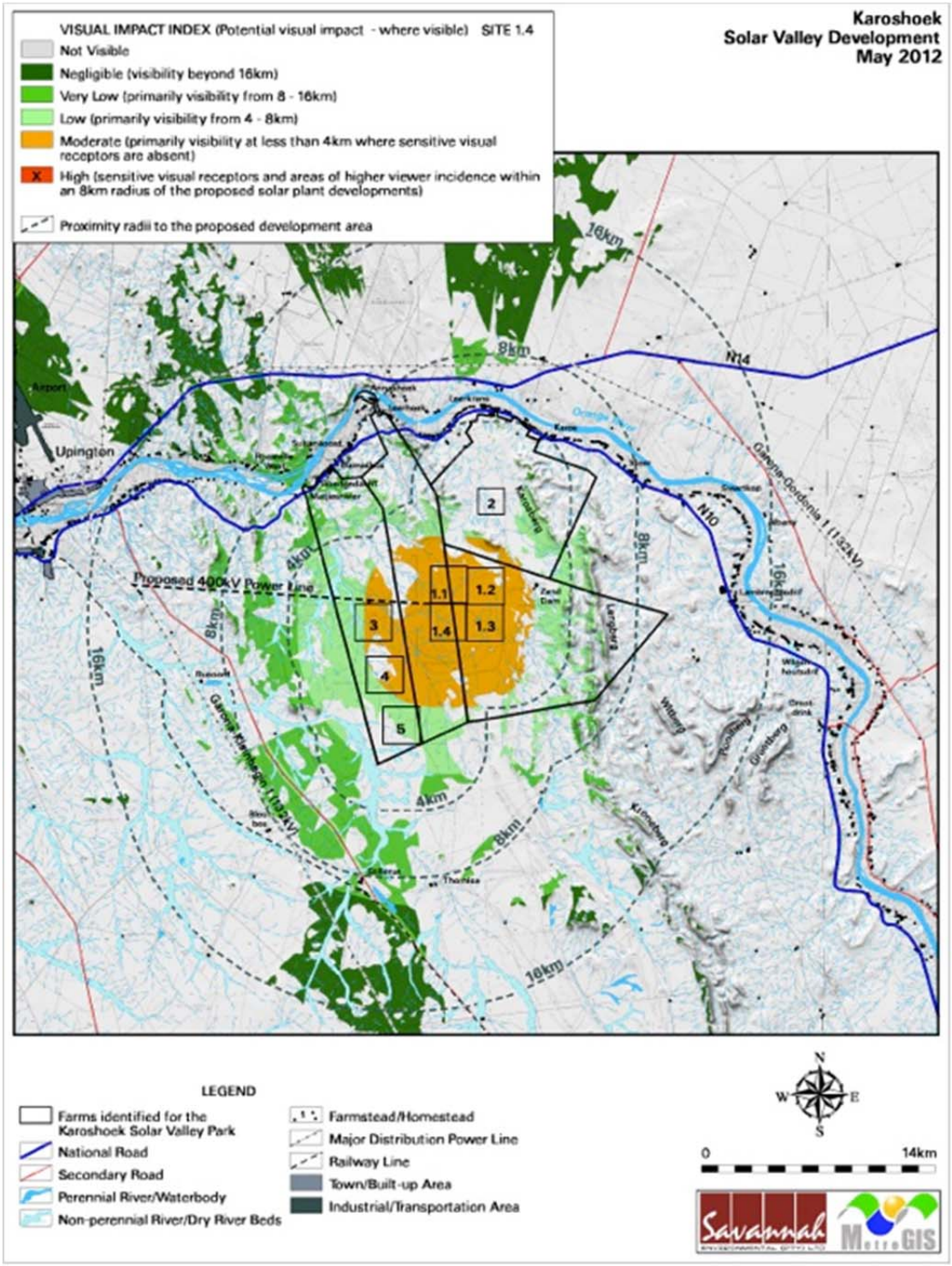
Visual impact beyond 16km, including the eastern outskirts of Upington, is likely to be **negligible**.



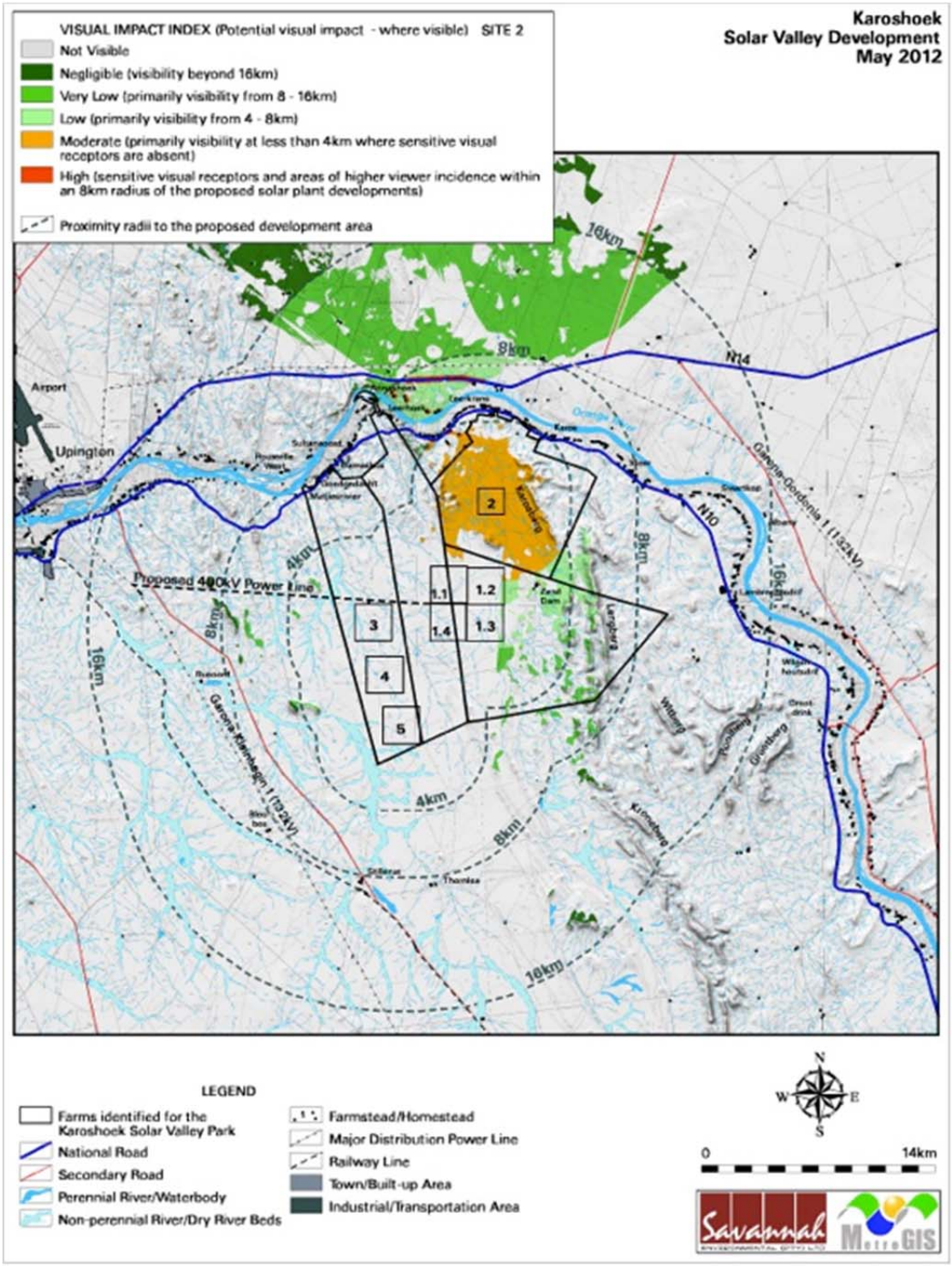
Map 12: Visual impact index: **Site 1.1: Karoshoek LF 1** (1 x 100 MW Linear Fresnel).



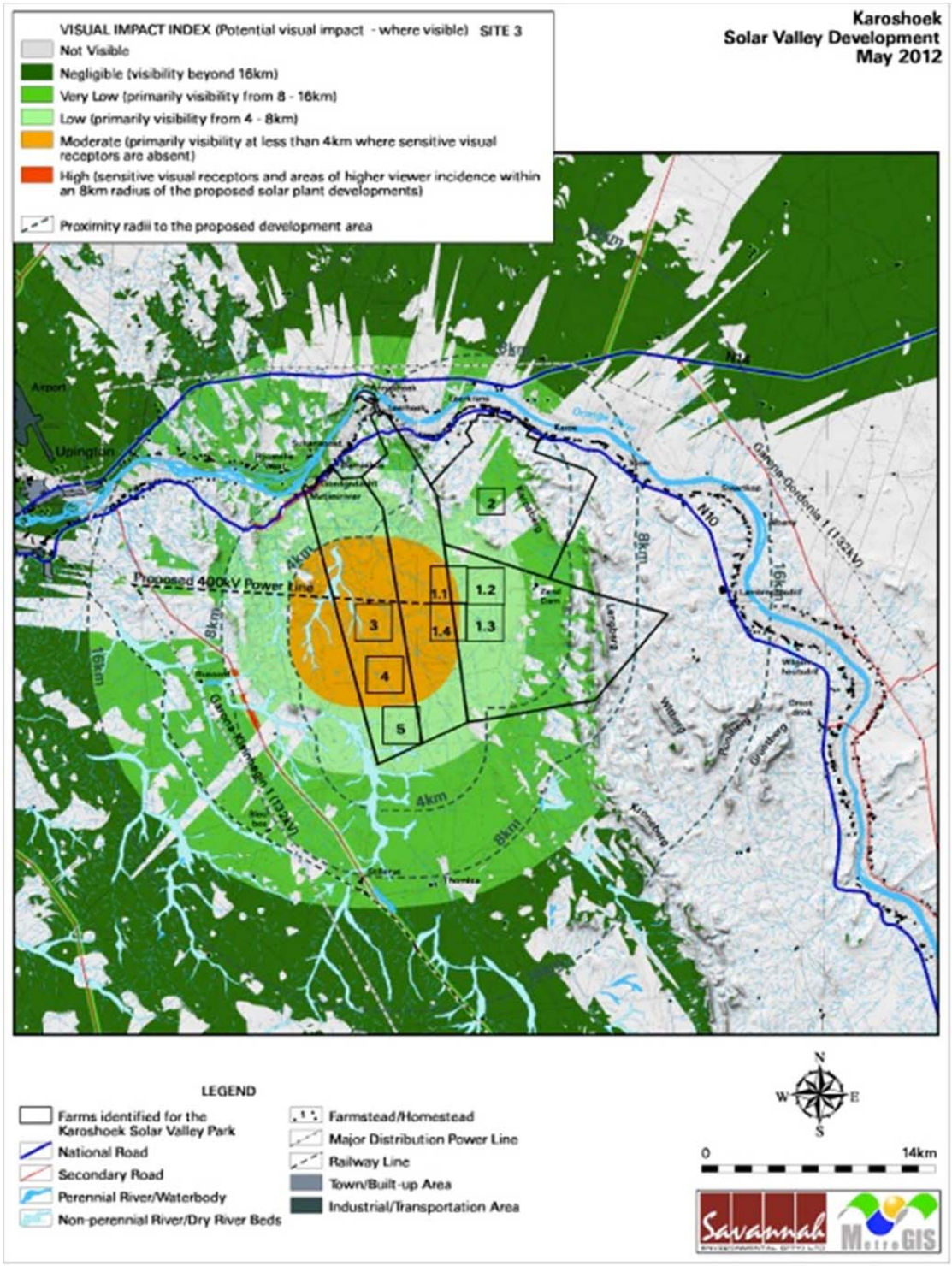
Map 13 Visual impact index: **Site 1.3: Karoshoek PT** (1 x 100 MW Parabolic Trough)



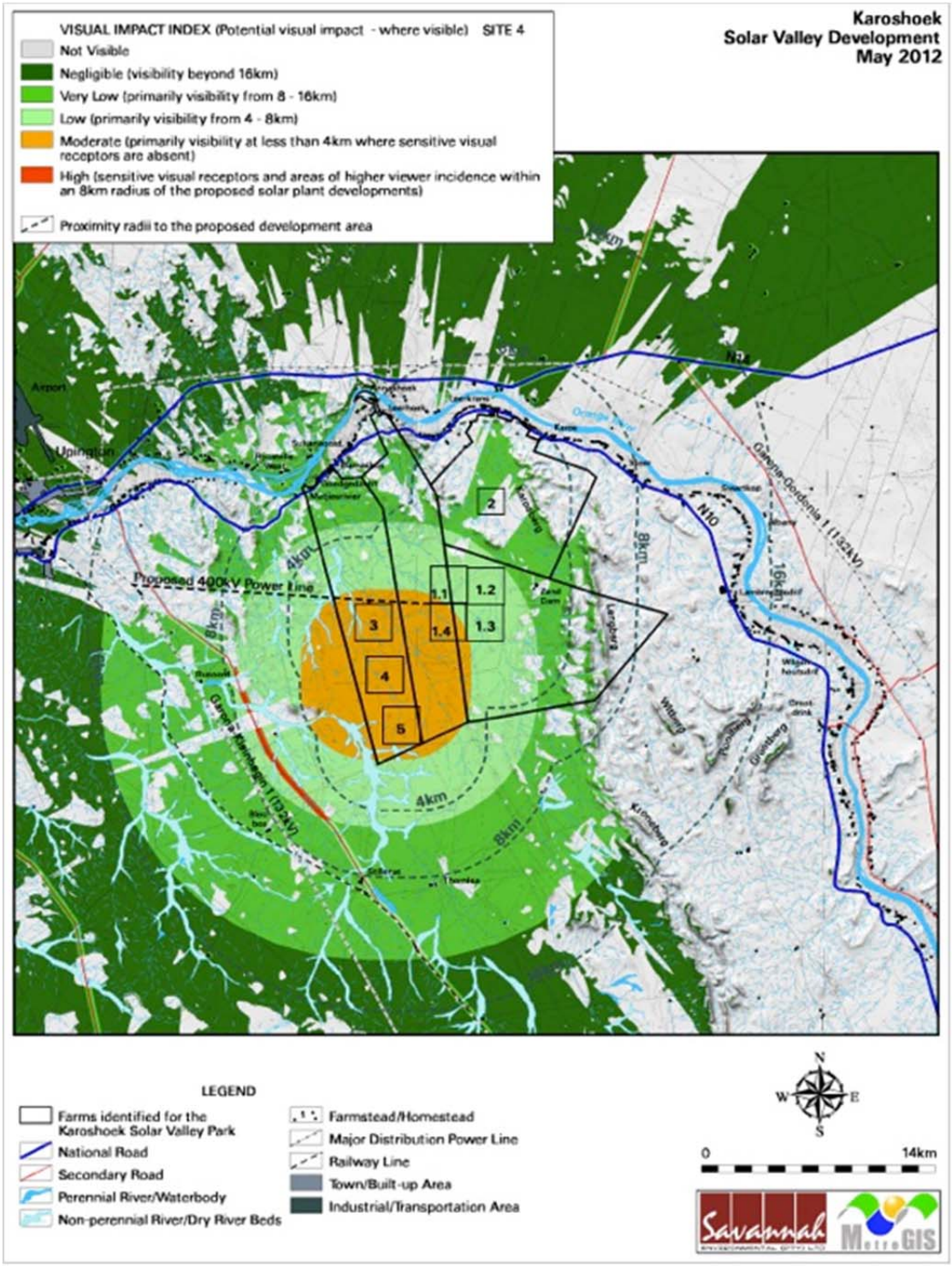
Map 14: Visual impact index: **Site 1.4: Karoshoek LFT 2** (1 x 100 MW Linear Fresnel or Parabolic Trough)



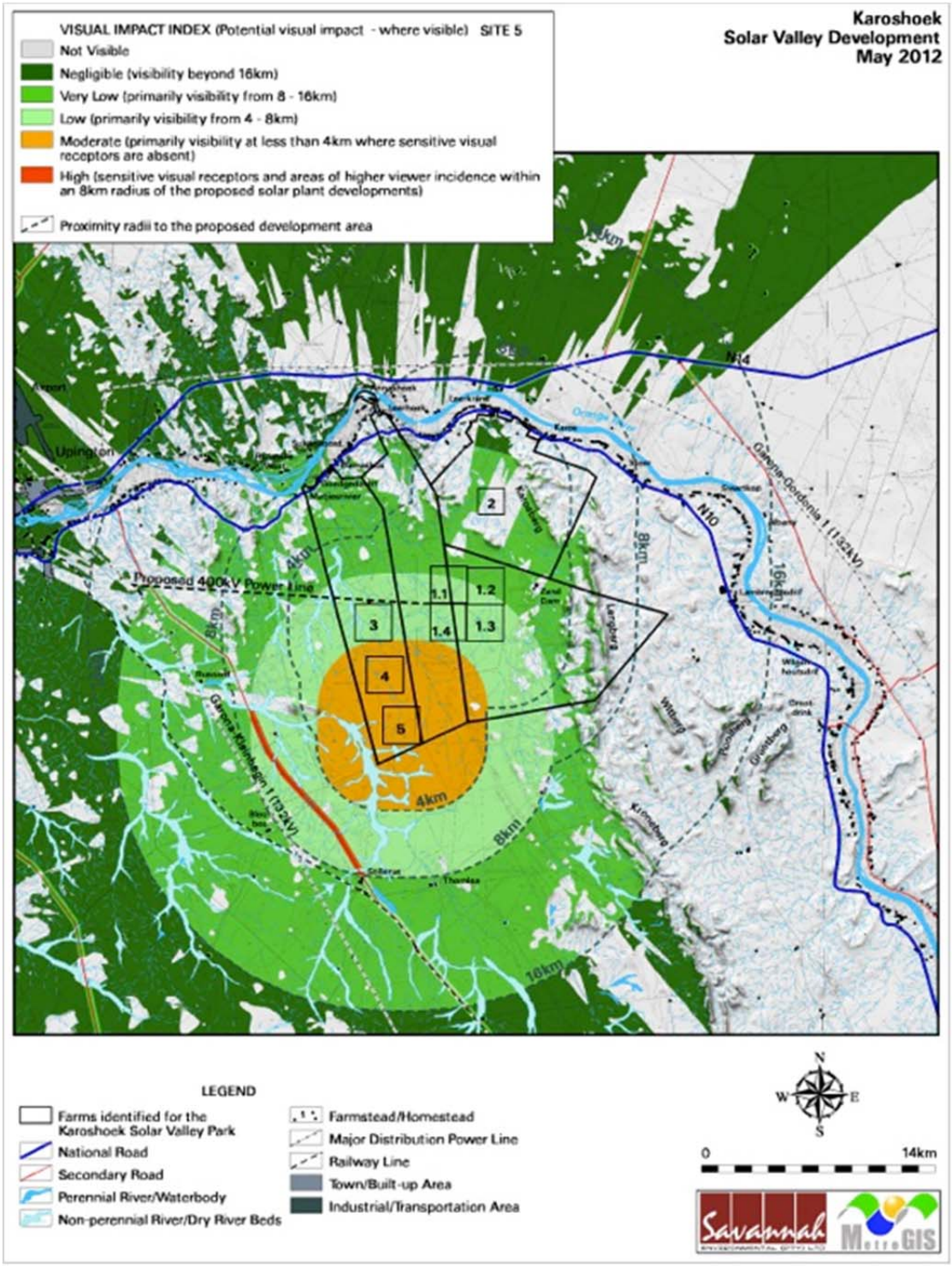
Map 15: Visual impact index: **Site 2: Karoshoek CPVPD 1, 2, 3,** and **4** (4 x 25 MW Concentrating photovoltaic or parabolic dish technology each)



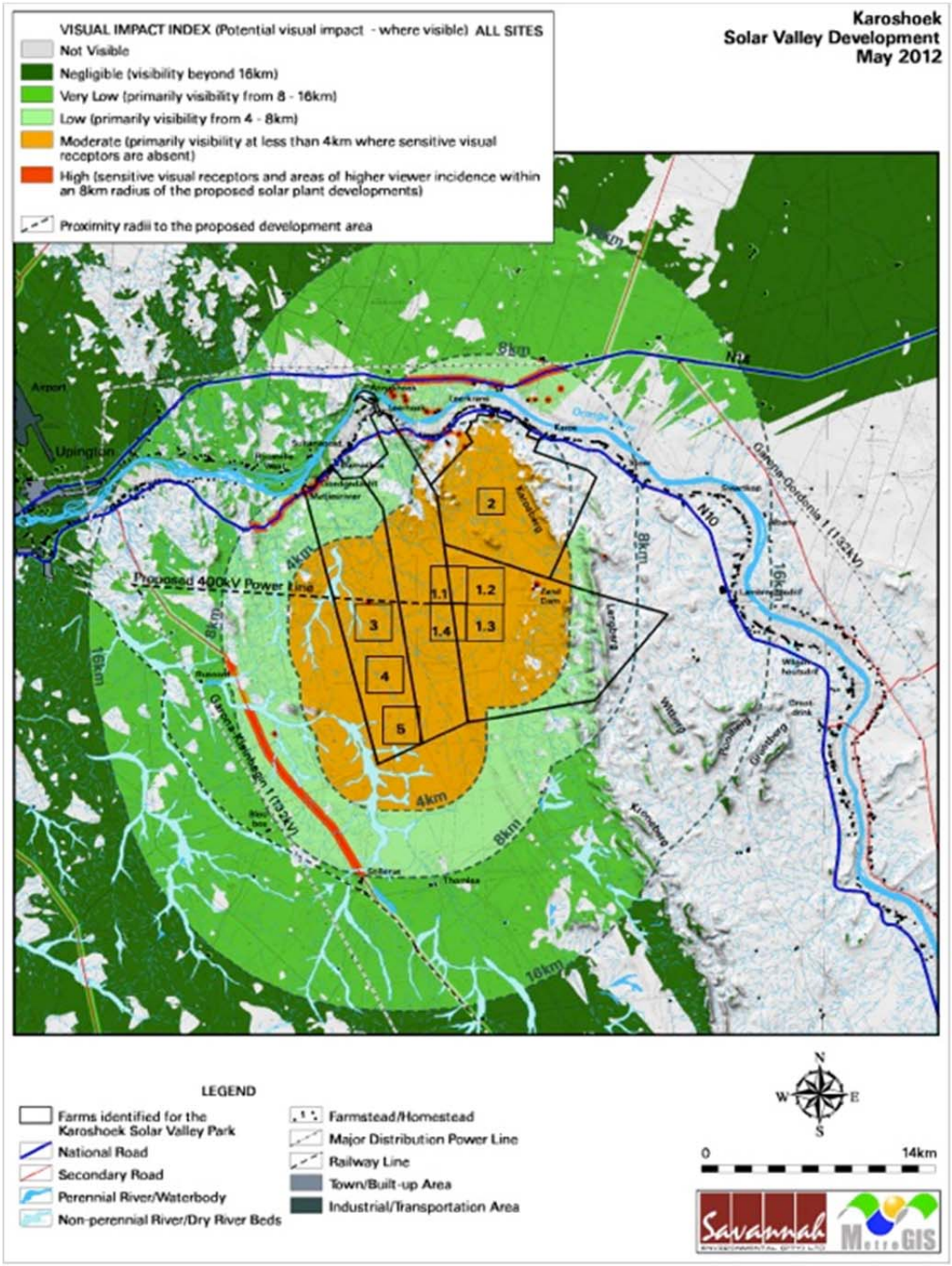
Map 16: Visual impact index: **Site 3: Karoshoek Tower 1** and **2** (2 x 50MW Towers)



Map 17: Visual impact index: **Site 4: Karoshoek LFTT 1** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)



Map 18: Visual impact index: **Site 5: Karoshoek LFTT 2** (1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)



Map 19: Cumulative visual impact index of the proposed Karoshoek Solar Valley Development.

5.6 Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 2: SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads near the proposed solar facility) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1).
- **Duration** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10). This value is informed by the Visual Impact Index Map. Where more than one value is applicable, then the higher of these will be used in order to simulate a worst case scenario.
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

5.7 Visual impact assessment: primary impacts

5.7.1 The solar energy generation structures

Potential visual impact on sesnsitive visual receptors users of national and secondary roads in close proximity to the proposed Karoshoek Solar Valley Development

The overall (cumulative) potential visual impact on users of the national road (i.e. the N10 and N14) and the secondary roads in close proximity (i.e. within 4-8km) to the proposed solar energy facility is expected to be of **high** significance, and may be mitigated to **moderate**.

*Please note that this result is extracted from the table below, where the value indicated as **high** (magnitude) on the **visual impact index** was inserted and further evaluated in terms of extent, duration and probability.*

The table below illustrates this impact assessment.

Table 3: Impact table summarising the significance of visual impacts on users of national and secondary roads in close proximity to the proposed Solar Valley Development.

Nature of Impact: Potential visual impact on users of roads in close proximity to the proposed Solar Valley development.		
	Without Mitigation	***After Mitigation***
SITE 1.1: Karoshoek LF 1 *(1 x 100 MW Linear Fresnel)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 1.3: Karoshoek PT *(1 x 100 MW Parabolic Trough)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 1.4: Karoshoek LFT 2 *(1 x 100 MW Linear Fresnel or Parabolic Trough)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 2: Karoshoek CPVPD 1, 2, 3, *and* ***4*** *(4 x 25 MW Concentrating photovoltaic or parabolic dish technology)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
SITE 3: Karoshoek Tower 1 *and* ***2*** *(2 x 50MW Towers)*		

Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
SITE 4: Karoshoek LFTT 1 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
SITE 5: Karoshoek LFTT 2 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
CUMULATIVE		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
ALL SITES		
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	

Mitigation:

Planning:

- The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented.
- Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
- Retain and maintain natural vegetation in all areas outside of the development footprint.
- Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

- Rehabilitation of all construction areas.
- Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

- Maintain the general appearance of the facility as a whole.
- Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

- Remove infrastructure and roads not required for the post-decommissioning use of the site.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts: The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.
Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Potential visual impact on residents of settlements and homesteads in close proximity to the Karoshoek Solar Valley Development

The overall potential visual impact on residents of homesteads in close proximity (i.e. within 4-8km) of the proposed solar energy facilities is expected to be of **moderate** significance both before and after mitigation. The affected homesteads lies mainly to the north and north west of the proposed solar park.

The table below illustrates this impact assessment.

Table 4: Impact table summarising the significance of visual impacts on residents of settlements and homesteads in close proximity to the proposed solar energy facilities.

Nature of Impact: Potential visual impact on residents of settlements and homesteads in close proximity to the proposed solar energy facilities.		
	Without Mitigation	***After Mitigation***
SITE 1.1: Karoshoek LF 1 *(1 x 100 MW Linear Fresnel)*		
Extent	Nil **(0)**	Nil **(0)**
Duration	Nil **(0)**	Nil **(0)**
Magnitude	Nil **(0)**	Nil **(0)**
Probability	Nil **(0)**	Nil **(0)**
Significance	Nil **(0)**	Nil **(0)**
Status (positive or negative)	N/A	N/A
SITE 1.3: Karoshoek PT *(1 x 100 MW Parabolic Trough)*		
Extent	Nil **(0)**	Nil **(0)**
Duration	Nil **(0)**	Nil **(0)**
Magnitude	Nil **(0)**	Nil **(0)**
Probability	Nil **(0)**	Nil **(0)**
Significance	Nil **(0)**	Nil **(0)**
Status (positive or negative)	N/A	N/A
SITE 1.4: Karoshoek LFT 2 *(1 x 100 MW Linear Fresnel or Parabolic Trough)*		
Extent	Nil **(0)**	Nil **(0)**
Duration	Nil **(0)**	Nil **(0)**
Magnitude	Nil **(0)**	Nil **(0)**
Probability	Nil **(0)**	Nil **(0)**
Significance	Nil **(0)**	Nil **(0)**
Status (positive or negative)	N/A	N/A
SITE 2: Karoshoek CPVPD 1, 2, 3, *and* ***4*** *(4 x 25 MW Concentrating photovoltaic or parabolic dish technology)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable**(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 3: Karoshoek Tower 1 *and* ***2*** *(2 x 50MW Towers)*		
Extent	Local **(4)**	Local **(4)**

Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable**(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 4: Karoshoek LFTT 1 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable**(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 5: Karoshoek LFTT 2 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable**(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
CUMULATIVE		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable**(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
ALL SITES		
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	

Mitigation:

Planning:

- The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented.
- Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
- Retain and maintain natural vegetation in all areas outside of the development footprint.
- Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

- Rehabilitation of all construction areas.
- Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

- Maintain the general appearance of the facility as a whole.
- Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

- Remove infrastructure and roads not required for the post-decommissioning use of the site.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts: The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.
Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Potential visual impact on sensitive visual receptors within the region.

The overall potential visual impact on users of roads and residents of homesteads within the greater region (i.e. beyond 8km of the proposed solar energy facilities) is expected to be of **moderate** significance, and may be mitigated to **low**.

The table below illustrates this impact assessment.

Table 5: Impact table summarising the significance of visual impacts on sensitive visual receptors within the region.

Nature of Impact: Potential visual impact on sensitive visual receptors within the region.		
	Without Mitigation	***After Mitigation***
SITE 1.1: Karoshoek LF 1 *(1 x 100 MW Linear Fresnel)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 1.3: Karoshoek PT *(1 x 100 MW Parabolic Trough)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 1.4: Karoshoek LFT 2 *(1 x 100 MW Linear Fresnel or Parabolic Trough)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 2: Karoshoek CPVPD 1, 2, 3, *and* ***4*** *(4 x 25 MW Concentrating photovoltaic or parabolic dish technology)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 3: Karoshoek Tower 1 *and* ***2*** *(2 x 50MW Towers)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**

Status (positive or negative)	Negative	Negative
SITE 4: Karoshoek LFTT 1 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**
Status (positive or negative)	Negative	Negative
SITE 5: Karoshoek LFTT 2 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**
Status (positive or negative)	Negative	Negative
CUMULATIVE		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**
Status (positive or negative)	Negative	Negative
ALL SITES		
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	

Mitigation:

Planning:

- The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented.
- Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.
- Retain and maintain natural vegetation in all areas outside of the development footprint.
- Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.

Construction:

- Rehabilitation of all construction areas.
- Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings.

Operations:

- Maintain the general appearance of the facility as a whole.
- Maintenance of roads to avoid erosion and suppress dust.

Decommissioning:

- Remove infrastructure and roads not required for the post-decommissioning use of the site.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

5.7.2 Ancillary infrastructure

Potential visual impact of ancillary infrastructure within the Karoshoek Solar Valley Development.

Ancillary infrastructure to be located within the solar energy facility footprints includes the internal access roads; storerooms, accommodation, waste storage facilities etc.

Although no dedicated viewshed has been generated for the infrastructure, it is expected that the area of potential visual impact will lie within that of the primary solar energy facility structures. The visual impact is expected to be of **low** significance, both before and after mitigation, as it is expected to be absorbed entirely by the visual impact of the primary infrastructure.

The table below illustrates this impact assessment.

Table 6: Impact table summarising the significance of visual impacts of on site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed solar energy facilities.

Nature of Impact: Potential visual impact of on site ancillary infrastructure on sensitive visual receptors in close proximity to the proposed solar energy facilities.		
	Without Mitigation	***After Mitigation***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable**(2)**	V Improbable**(1)**
Significance	Low **(28)**	Low **(14)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	
Mitigation: Planning: ➢ Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site. ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. Construction: ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Remove infrastructure and roads not required for the post-decommissioning use of the site.		

➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.
Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

Potential visual impact of ancillary infrastructure beyond the Karoshoek Solar Valley Development on sensitive visual receptors.

The potential visual impact of the 400kV overhead power line is expected to be of **low** significance. It is expected that this infrastructure will be visually absorbed by the primary solar energy generation infrastructure. No mitigation is possible.

The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of visual impacts of the offsite power line on sensitive visual receptors within the region.

Nature of Impact: Potential visual impact of the offsite power line on sensitive visual receptors within the region.		
	Without Mitigation	***After Mitigation***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Improbable**(2)**	N/a
Significance	Low **(26)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	
Mitigation: <u>Construction:</u> ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings. <u>Operations:</u> ➢ Maintain the general appearance of the facility as a whole. ➢ Maintenance of roads to avoid erosion and suppress dust. <u>Decommissioning:</u> ➢ Remove infrastructure and roads not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.		
Cumulative impacts: The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.		
Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.		

5.7.3. Lighting

Potential visual impact of lighting at night on sensitive visual receptors.

The area surrounding the proposed solar valley development has a relatively low incidence of populated places. Therefore light trespass and glare from the security and after-hours operational and security lighting will have some significance for residents in the area.

In addition, the potential lighting impact known as sky glow will be of relevance. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The solar valley development may contribute to the effect of sky glow in an otherwise dark environment.

Mitigation of this impact entails the pro-active design, planning and specification lighting for the each of the solar energy facilities by a lighting engineer. The correct specification and placement of lighting and light fixtures will go far to contain rather than spread the light.

The table overleaf illustrates the overall (cumulative) assessment of this anticipated impact, which is likely to be of **moderate** significance both before and after mitigation.

Table 8: Impact table summarising the significance of visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed solar energy facilities.

Nature of Impact: Potential visual impact of lighting on sensitive visual receptors in close proximity to the solar energy facilities.		
	Without Mitigation	***After Mitigation***
SITE 1.1: Karoshoek LF 1 *(1 x 100 MW Linear Fresnel)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 1.3: Karoshoek PT *(1 x 100 MW Parabolic Trough)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 1.4: Karoshoek LFT 2 *(1 x 100 MW Linear Fresnel or Parabolic Trough)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
SITE 2: Karoshoek CPVPD 1, 2, 3, *and* ***4*** *(4 x 25 MW Concentrating photovoltaic or parabolic dish technology)*		

Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 3: Karoshoek Tower 1 *and* ***2*** *(2 x 50MW Towers)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 4: Karoshoek LFTT 1 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
SITE 5: Karoshoek LFTT 2 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
CUMULATIVE		
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Moderate **(32)**
Status (positive or negative)	Negative	Negative
ALL SITES		
Reversibility	Recoverable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated during operational phase?	Yes	

Mitigation:

Planning & operation:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
- Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Cumulative impacts:

The construction of the solar energy facilities will increase the cumulative lighting impacts within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.

Residual impacts: None. The visual impact will be removed after decommissioning. Failing this, the visual impact will remain.

5.7.4. Construction

Potential visual impact of construction activities on sensitive visual receptors.

The construction phase of the Karoshoek Solar Valley Development may exceed 10 years should all the proposed solar generation facilities be constructed.

During the construction period, there will be a noticeable increase in heavy vehicles utilising the N10 to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

In this environment, dust from construction work is also likely to represent a significant visual impact. Mitigation entails proper planning and management of the construction sites to forego residual visual impacts.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance both before and after mitigation.

Table 9: Impact table summarising the significance of visual impact of construction activities on sensitive visual receptors

Nature of Impact: Potential visual impact of construction activities on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Medium **(3)**	Medium **(3)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	High **(4)**	Probable **(3)**
Significance	Moderate **(52)**	Moderate **(33)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	Yes	
Mitigation: <u>Construction:</u> ➢ Ensure that vegetation is not unnecessarily cleared or removed during the construction period. ➢ Reduce the construction period through careful logistical planning and productive implementation of resources. ➢ Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. ➢ Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. o Rehabilitate all disturbed areas, construction areas, roads, slopes etc immediately after the completion of construction works.		

Cumulative impacts: The simultaneous construction of up to 8 solar energy facilities within the Solar Valley Development (including site 1.2- Project Ilanga) has the potential to manifest as a cumulative visual impact.
Residual impacts: None.

5.8 Visual impact assessment: secondary impacts

Potential visual impact of the proposed Solar Valley Development on the visual character of the landscape, the sense of place and the tourism potential of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc) play a significant role.

A visual impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the rugged natural beauty of the area and the wide open vistas and expanses.

The overall anticipated visual impact of the solar valley development and associated infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be **moderate** both before and after mitigation.

In terms of tourism potential, the Karoshoek Solar Valley Development is not expected to significantly influence the regional appeal or jeopardise the area's tourism value and potential. The anticipated visual impact of the proposed development on existing tourist routes is expected to be **low**.

The table below illustrates this impact assessment.

Table 10: Impact table summarising the significance of visual impacts on the visual character of the landscape, sense of place and tourism potential of the region.

Nature of Impact: Potential visual impact on the visual character of the landscape, sense of place and tourism potential of the region.		
	No mitigation	***Mitigation considered***
SITE 1.1: Karoshoek LF 1 *(1 x 100 MW Linear Fresnel)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 1.3: Karoshoek PT *(1 x 100 MW Parabolic Trough)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or	Negative	Negative

negative)		
SITE 1.4: Karoshoek LFT 2 *(1 x 100 MW Linear Fresnel or Parabolic Trough)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	V Improbable **(1)**
Significance	Low **(22)**	Low **(11)**
Status (positive or negative)	Negative	Negative
SITE 2: Karoshoek CPVPD 1, 2, 3, *and* ***4*** *(4 x 25 MW Concentrating photovoltaic or parabolic dish technology)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(33)**	Low **(22)**
Status (positive or negative)	Negative	Negative
SITE 3: Karoshoek Tower 1 *and* ***2*** *(2 x 50MW Towers)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
SITE 4: Karoshoek LFTT 1 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
SITE 5: Karoshoek LFTT 2 *(1 X 100 MW Linear Fresnel or Parabolic Trough or Tower)*		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
CUMULATIVE		
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(60)**	Moderate **(45)**
Status (positive or negative)	Negative	Negative
ALL SITES		
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: ➢ The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented. ➢ Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the		

perimeter of each development site. ➢ Retain and maintain natural vegetation in all areas outside of the development footprint. ➢ Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible. Construction: ➢ Rehabilitation of all construction areas. ➢ Ensure that vegetation is not cleared unnecessarily to make way for the access road and ancillary buildings. Operations: ➢ Maintain the general appearance of the facility as a whole. ➢ Maintenance of roads to avoid erosion and suppress dust. Decommissioning: ➢ Remove infrastructure and roads not required for the post-decommissioning use of the site. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. ➢ Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Cumulative impacts: The construction of the solar energy facilities will increase the cumulative visual impact of industrial type infrastructure within the region. This is due to the construction of the seven individual solar energy facilities, as well as the Ilanga Solar Thermal Plant (site 1.2) on the Karoshoek Solar Valley Development site.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

5.9 The potential to mitigate visual impacts

The primary visual impact of the solar energy facilities and ancillary infrastructure, including the power line, is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

The following mitigation is, however possible:

- The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented.

- Common infrastructure, shared by the solar energy facilities, should be used wherever possible.

- Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site.

- Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint. This measure will help to soften the appearance of the facility within its context.

- In terms of ancillary infrastructure, it is recommended that the access roads, power line and other ancillary infrastructure be planned in such a way and in such a location that clearing of vegetation is minimised. This implies consolidating infrastructure as much as possible and making use of already disturbed areas rather than pristine sites wherever possible.

- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for the Plant and

the ancillary infrastructure will go far to contain rather than spread the light. Additional measures include the following:
    - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
    - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
    - Making use of minimum lumen or wattage in fixtures;
    - Making use of down-lighters, or shielded fixtures;
    - Making use of Low Pressure Sodium lighting or other types of low impact lighting.
    - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:
    - Reduce the construction period through careful planning and productive implementation of resources.
    - Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
    - Ensure that rubble, litter and disused construction materials are managed and removed regularly.
    - Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
    - Reduce and control construction dust through the use of approved dust suppression techniques.
    - Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
    - Rehabilitate all disturbed areas, construction areas, roads and servitudes to acceptable visual standards.

- Secondary impacts anticipated as a result of the proposed facility (i.e. visual character, sense of place and tourism potential) are not possible to mitigate.

The possible mitigation of visual impacts as listed above should be implemented and maintained on an ongoing basis.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 The solar valley development

The construction and operation of the Karoshoek Solar Valley Development and ancillary infrastructure will have a visual impact on the natural scenic resources and rural character of the study area, and particularly within a 4-8km radius of the proposed facility. This falls largely within the footprint of the broader site for the Karoshoek Solar Valley Development.

The author is, however, of the opinion that the facility has an advantage over other more conventional power generating plants (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

The facility further has a number of variations of generally unfamiliar, novel and futuristic solar energy technologies that could invoke a curiosity factor not generally present with other conventional power generating plants. The advantage being that the facility can become an attraction or a landmark within the region, that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

Notwithstanding, the positive aspect should not distract from the fact that the facility would be visible to (a limited number of) sensitive visual receptors that should ideally not be exposed to the type or scale of structures under consideration.

Furthermore, the cumulative visual impact of multiple industrial initiatives in the area, both existing and proposed, is of some concern, as it threatens to alter the visual character of the region as a whole. Of relevance is the fact that up to eight solar energy facilities are proposed (including the Ilanga STPP) within the Solar Valley Development.

Ironically, though, this is also preferred as it will serve to concentrate the electricity generation infrastructure within the region. This apparent contradiction (i.e. trade-off between the potential cumulative visual impacts of the facilities and the concentration of infrastructure) is ultimately favoured above spreading this type of structures throughout the region and over larger tracts of land.

There are a number of recommendations as to the mitigation of the visual impact of the solar valley development. The following is recommended:

- The possible selection of the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over the Tower) for the sites where these alternatives were presented.
- Common infrastructure, shared by the solar energy facilities, should be used wherever possible.
- All access roads must be properly planned, constructed and maintained, and the workshop areas must be kept neat and tidy.
- All disturbed areas should be properly rehabilitated, and all infrastructure and the general surrounds should be maintained in a neat and appealing way. This rehabilitation must also be monitored and maintained.
- A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.
- Secondary visual impacts associated with the construction phase, such as the sight of construction vehicles, dust and construction litter must be managed to reduce visual impacts. The use of dust-suppression techniques on the access roads (where required), timely removal of rubble and litter, and the erection of temporary screening will assist in doing this.
- The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.
- The facility should be dismantled upon decommissioning and the site and surrounding area should be rehabilitated to its original (current) visual status.

Should the proposed development proceed, then the possible mitigation of visual impacts as listed above should be implemented and maintained on an ongoing basis.

6.2 The No-Project Alternative

Should the proposed Karoshoek Solar Valley Development as proposed not go ahead, then the anticipated visual impacts as described above would not occur.

These impacts, regardless of their significance, are all negative in nature. No positive visual impacts are anticipated as a result of the proposed facility. This does not mean, however, that the absence of the proposed facility would result in a positive visual impact. Rather, the No-Project alternative would result in the absence of visual impact. The anticipated visual impact would be nil.

7. IMPACT STATEMENT

In light of the results and findings of the Visual Impact Assessment undertaken for the proposed Karoshoek Solar Valley Development and ancillary infrastructure, it is acknowledged that the rural, natural, and relatively unspoilt views surrounding the site will be transformed for the entire operational lifespan of the facility.

Due to the nature of the topography, however, significant areas will not be visually exposed, and due to settlement patterns, very few visual receptors will be impacted upon.

The following is a summary of those visual impacts expected to remain, assuming mitigation as recommended is exercised:

- The potential visual impact on users of the national road (i.e. the N10 and N14) and the secondary roads in close proximity (i.e. within 4-8km) of the proposed solar energy facility is expected to be:
    - Of **low** significance for sites 1.1, 1.3 and 1.4,
    - Of **moderate** significance for sites 2, 3, 4 and 5 and
    - Of **modertate** cumulative significance.

- The potential visual impact on residents of homesteads in close proximity (i.e. within 4-8km) of the proposed solar energy facilities is expected to be:
    - Nil for sites 1.1, 1.3, 1.4,
    - Of **moderate** significance for sites 2, 3, 4 and 5 and
    - Of **modertate** cumulative significance.

- The potential visual impact on sensitive visual receptors within the region is likely to be:
    - Of **low** significance for all sites and
    - Of **low** cumulative significance.

- The potential visual impact of the on-site ancillary infrastructure is expected to be of **low** significance, as is the potential visual impact of the 400kV overhead power line (i.e. ancillary infrastructure beyond the development footprint).

- Potential visual impact of lighting at night on sensitive visual receptors is likely to be:
    - Of **low** significance for sites 1.1, 1.3 and 1.4,

    - Of **moderate** significance for sites 2, 3, 4 and 5 and
    - Of **modertate** cumulative significance.

- Potential visual impact of construction activities on sensitive visual receptors is likely to be of **moderate** significance.

- The anticipated visual impact of the solar valley development and associated infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be:
    - Of **low** significance for sites 1.1, 1.3, 1.4 and 2,
    - Of **moderate** significance for sites 3, 4 and 5 and
    - Of **modertate** cumulative significance.

- In terms of tourism potential, the Karoshoek Solar Valley Development is not expected to significantly influence the regional appeal or jeopardise the area's tourism value and potential. The anticipated visual impact of the proposed development the visual character and sense of place of the region, as well as on tourism potential, is expected to be **low**.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from moderate to low. Of relevance is the fact that post mitigation impacts for sites hosting smaller scale infrastructure (i.e. sites 1.1, 1.3, 1.4 and 2) are generally of lower significance than those of sites hosting the taller 200m towers (i.e. sites 3, 4 and 5). In addition, the post mitigation significance of visual impacts for the three sites clustered close together (i.e. sites 1.1, 1.3 and 1.4) also tend to be of lower than that of the more remote site 2.

Therefore, from a visual perspective, the smaller scale infrastructure is favoured, as is the clustering of facilities in close proximity to one another. This effectively contains the extent and ultimately the significance of potential visual impacts.

Notwithstanding the above, none of the post mitigation imacts anticipated for the proposed dvelelopment, both for the individual sites and cumulatively, are considered to be fatal flaws from a visual perspective. The most pertinent factor is the low occurrence of potential visual receptors.

It is therefore recommended that the development of all components of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (chapter 6) and management actions (chapter 8).

8. MANAGEMENT PLAN

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts.

Table 11: Management plan – Planning

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Karoshoek Solar Valley Development.	
Project Component/s	Solar Valley Development and ancillary infrastructure.
Potential Impact	Primary visual impact of the core facilities, power line, and night lighting.
Activity/Risk	The viewing of the above mentioned by observers on or near the site as

Source	well as within the region.		
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.		
Mitigation: Action/Control		**Responsibility**	**Timeframe**
Select the less intrusive solar energy technology (i.e. Linear Fresnel or Parabolic Trough technology over Tower) for the sites where these alternatives were presented. Share common infrastructure between solar energy facilities, wherever possible. Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of each development site. Retain and maintain natural vegetation in all areas outside of the development footprint. Plan internal roads and ancillary infrastructure in such a way and in such a location that clearing of vegetation is minimised. Consolidate infrastructure as much as possible, and make use of already disturbed areas rather than pristine sites wherever possible.		Project proponent, or design consultant	Planning.
Consult a lighting engineer in the planning and placement of light fixtures for the Plant and the ancillary infrastructure: ➢ Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); ➢ Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; ➢ Making use of minimum lumen or wattage in fixtures; ➢ Making use of down-lighters, or shielded fixtures; ➢ Making use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		Project proponent, or design consultant	Planning.
Performance Indicator	Lighting impact is minimal and no complaints received from settlements or homesteads.		
Monitoring	Not applicable.		

Table 12: Management plan – Construction

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Karoshoek Solar Valley Development.

Project Component/s	Construction site and construction accommodation.
Potential Impact	Visual impact of general construction activities and construction

	accommodation, and the potential scarring of the landscape due to vegetation clearing.
Activity / Risk Source	The viewing of the above mentioned by observers on or near the site.
Mitigation: Target / Objective	Minimal visual intrusion by construction activities and construction accommodation and intact vegetation cover outside of immediate works areas.

Mitigation: Action / Control	**Responsibility**	**Timeframe**
Reduce the construction period through careful planning and productive implementation of resources. Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing. Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. Ensure that rubble, litter, and disused construction materials are managed and removed regularly. Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way Reduce and control construction dust using approved dust suppression techniques. Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. Rehabilitate all disturbed areas, construction areas, roads, and servitudes to acceptable visual standards.	Project proponent, or contractor	Construction

Performance Indicator	Vegetation cover on and near the site is intact with no evidence of degradation or erosion.
Monitoring	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas post construction.

Table 13: Management plan – Operation

OBJECTIVE: The mitigation and possible negation of the potential visual impacts associated with the operation of the Karoshoek Solar Valley Development.

Project Component/s	Solar Valley Development and ancillary infrastructure.		
Potential Impact	Visual impact of facility degradation and vegetation rehabilitation failure.		
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.		
Mitigation: Target/Objective	Well maintained and neat facility.		
Mitigation: Action/Control		**Responsibility**	**Timeframe**
Maintain the general appearance of the facility in an aesthetically pleasing way. Maintenance of roads to avoid erosion and suppress dust. Monitor rehabilitated areas, and implement remedial action as and when required.		Project proponent, or operator	Operation.
Performance Indicator	Well maintained and neat facility with intact vegetation on and near the facility.		
Monitoring	Monitoring of rehabilitated areas.		

Table 14: Management plan – Decommissioning

OBJECTIVE: The mitigation and possible negation of the potential visual impacts associated with the decommissioning of the Karoshoek Solar Valley Development.

Project component/s	Solar Valley Development and ancillary infrastructure.		
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.		
Activity/risk source	The viewing of the above mentioned by observers on or near the site.		
Mitigation: Target/Objective	Infrastructure required for post decommissioning use of the site and rehabilitated vegetation in all disturbed areas.		
Mitigation: Action/control		Responsibility	Timeframe
Remove structures and infrastructure not required for the post-decommissioning use of the site. Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. Monitor rehabilitated areas, and implement remedial action as and when required.		Project proponent, or operator	Decomissioning
Performance Indicator	Site with intact vegetation on and near the facility.		
Monitoring	Monitoring of rehabilitated areas.		

9. REFERENCES / DATA SOURCES

Chief Directorate National Geo-Spatial Information, varying dates. *1:50 000 Topo-cadastral Maps and Data.*

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the Northern Cape Province (ENPAT NC).*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.*

Solar PACES, 2006. Website: http://www.solarpaces.org/SOLARTRES.HTM