PROPOSED ALLEPAD PV THREE SOLAR ENERGY FACILITY, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

ILEnergy Development (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
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- February 2019 -

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1. STUDY APPROACH

1.1. Qualification and experience of the practitioner

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC - previously PLATO), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT book and has had several of his maps published in various tourism, educational and environmental publications.

He 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 (i.e. within the Northern Cape Province).

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Allepad PV Three Solar Energy Facility (SEF). He will not 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:

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[1] Adapted from Oberholzer (2005).

- 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:

    - 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 Geographical Information Systems (GIS) software 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 topographical data provided by NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

Visual Impact Assessment (VIA)

The VIA is determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the Solar Energy Facility layout.

The visual impact is determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) are not considered.

The VIA considers potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region.

The following VIA-specific tasks were undertaken:

- **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 (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on a 30m SRTM digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **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 this type of structure.

Proximity radii for the proposed infrastructure 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 (anticipated) negative visual perception of the proposed facility.

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that may be exposed to the project infrastructure.

This is done in order to focus attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this data set, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, protected areas, etc.), that should be addressed.

- **Determine the visual absorption capacity of the landscape**

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.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **Determine impact significance**

The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section are displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- **Site visit**

A site visit was undertaken on the 22nd of October 2018 in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

2. BACKGROUND

ILEnergy Development (Pty) proposes the development of Allepad PV Three, a commercial solar PV energy generation facility and associated infrastructure on a site near Upington, in the Northern Cape Province. The project is intended to be bid into the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating power generated by the project into the Eskom national electricity grid.

The project is proposed on a portion of the Remaining Extent of Erf 5315 and is located approximately 15km north-west of Upington. The proposed Allepad PV Three development will occupy approximately 250ha of land, comprising mainly of a series of PV panels in rows commonly referred to as a PV array together with some ancillary equipment and access roads. Individual PV panels will be approximately 1800-2000mm tall, 900-1000mm wide and 40-60mm thick whilst producing roughly 340Wp each. The PV panels will be mounted on aluminium frame structures. These could be up to 3.5m high. The project site can be accessed directly via the N10 national road which borders the southern boundary of the site.

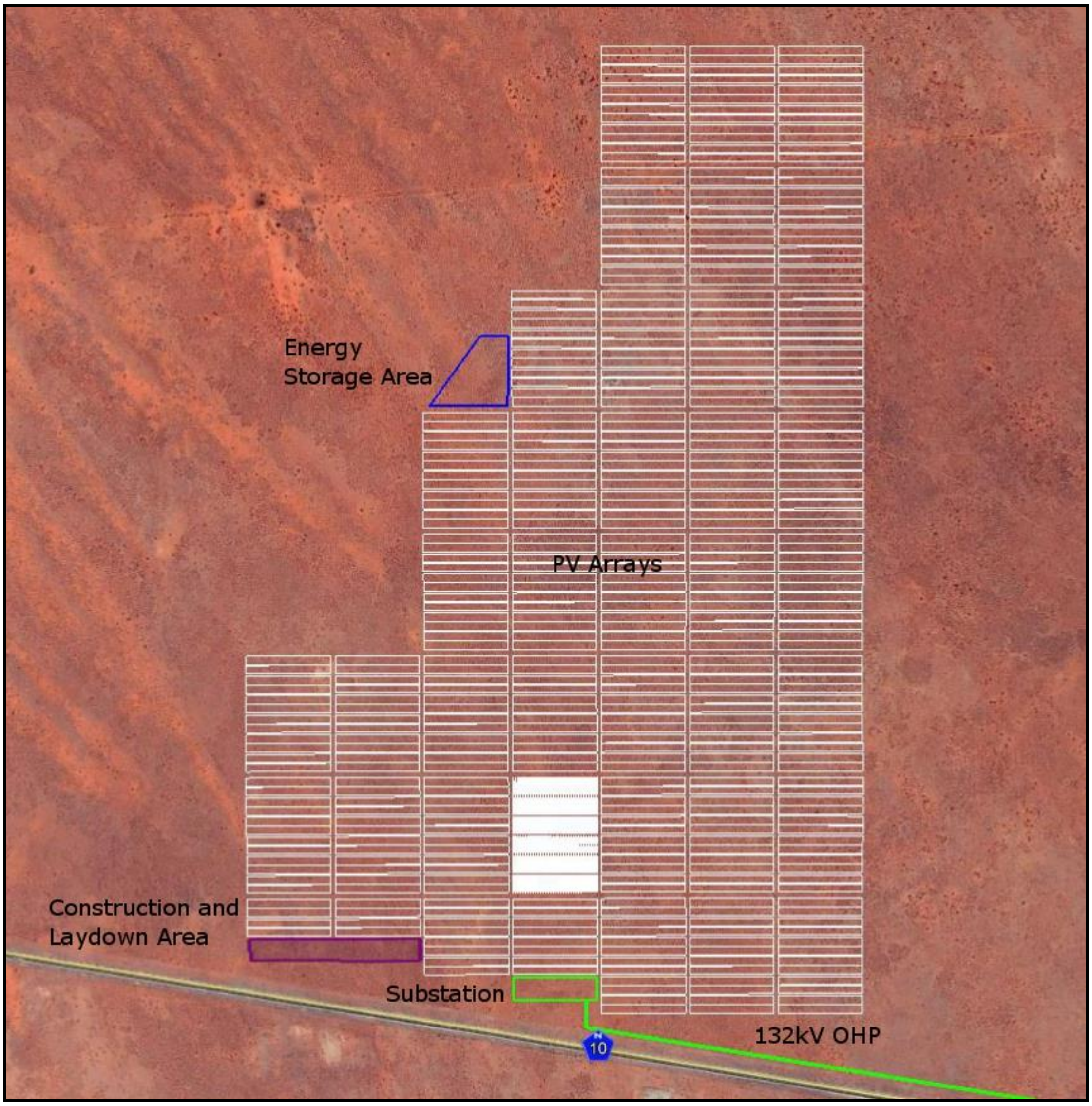


Figure 1: Proposed Allepad PV Three layout.

Photovoltaic (PV) technology is proposed for the generation of electricity. The solar energy facility will have a contracted capacity of up to 100MW, and will make use of fixed-tilt, single-axis tracking, or double-axis tracking PV technology. The solar energy facility will comprise the following key infrastructure components:

- Arrays of PV panels with a generation capacity of up to 100MW.
- Mounting structures to support the PV panels.
- Combiner boxes, on-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and power transformers.
- An on-site substation up to 0.5ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line approximately 9km in length, between the on-site substation and Eskom grid connection point.
- Cabling between the project's components (to be laid underground where practical).
- Meteorological measurement station.
- Energy storage area of up to 2ha in extent.
- Access road and internal access road network.
- On-site buildings and structures, including a control building and office, ablutions and guard house.
- Perimeter security fencing, access gates and lighting.
- Temporary construction equipment camp up to 1ha in extent, including temporary site offices, parking and chemical ablution facilities.
- Temporary laydown area up to 1ha in extent, for the storage of materials during the construction.

Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV power line which will connect the on-site substation to the upgraded 132kV double circuit power line running between the new Upington Main Transmission Substation (MTS) (currently under construction approximately 15km south of the project site), and the Gordonia Distribution Substation (located in Upington town). The point of connection is located approximately 9km east of the project site, and will make use of a loop-in and loop-out configuration. The proposed power line required for the project will be constructed within a 36m wide power line corridor which has been identified immediately north of, and which runs parallel to, the N10 national road.

The proposed project requires Environmental Authorisation (EA) from the Department of Environmental Affairs (DEA) subject to the completion of a full Scoping and EIA process in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA) and the 2014 EIA Regulations (GNR 326).

Figure 2: Photovoltaic (PV) solar panels. (*SunPower Solar Power Plant – Prieska*).

Figure 3: Aerial view of PV arrays. (*Scatec Solar South Africa*).

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed Solar Energy Facility as mentioned above.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual assessment encompasses a geographical area of 679km² (the extent of the maps displayed in this report) and includes a 6km buffer zone (area of potential visual influence) from the development footprint of the solar energy facility. The study area includes the town of Upington (western section), sections of the N10 and N14 national roads, and a section of the R360 arterial road.

Anticipated issues related to the potential visual impact of the proposed PV Solar Energy Facility include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the N10 national and R360 arterial roads traversing near the proposed facility.

- The visibility of the facility to, and potential visual impact on sensitive receptors (such as guests residing at the Kalahari Monate Lodge, and potentially residents of farm residences located within close proximity of the site).

- Potential cumulative visual impacts (or alternately, consolidation of visual impacts) with specific reference to the potential construction of up to four PV SEFs on the site and other existing or authorised SEFs within close proximity to the development site and within the Upington REDZ.

- The potential visual impact of the construction of ancillary infrastructure (i.e. the substation at the facility, associated power line and access roads) 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.

- The visual absorption capacity of natural or planted vegetation (if applicable).

- Potential visual impacts associated with the construction phase.

- The potential to mitigate visual impacts.

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

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The project is proposed on a portion of the Remaining Extent of Erf 5315 and is located approximately 15km north-west of Upington, in the Dawid Kruiper Local Municipality, of the ZF Mgcawu District, in the Northern Cape Province.

The property mentioned above has a surface area of 3,889ha, but the final surface area (development footprint) to be utilised for the facility will be 250ha, and will depend on the type of technology selected, the final site layout and the placement of ancillary infrastructure. The site is located north of the N10 national road which forms the southern boundary of the proposed development. Access to the site is provided directly from the N10 national road.

The N14, N10 and R360 are the primary roads in the region and are the main link between Gauteng and Namibia, the Augrabies Falls National Park and the Kgalagadi Trans-frontier National Park.

The N10 national road also forms the northern boundary of the Upington Renewable Energy Development Zone (REDZ). Refer to **Figure 4** for the regional locality of the site in relation to the Upington REDZ. REDZ are described as:

"areas where large scale wind and solar PV energy facilities can be developed in terms of SIP 8 and in a manner that limits significant negative impacts on the environment, while yielding the highest possible socio-economic benefits to the country."

Source: https://redzs.csir.co.za

Figure 4 also indicates the status of Renewable Energy Environmental Applications (REEA) within and around this REDZ (as at 2018 2nd quarter). Applications that have been approved include the Eskom Concentrating Solar Park (CSP) and the Khi Solar One SEF (operational), with a number of applications still in process.

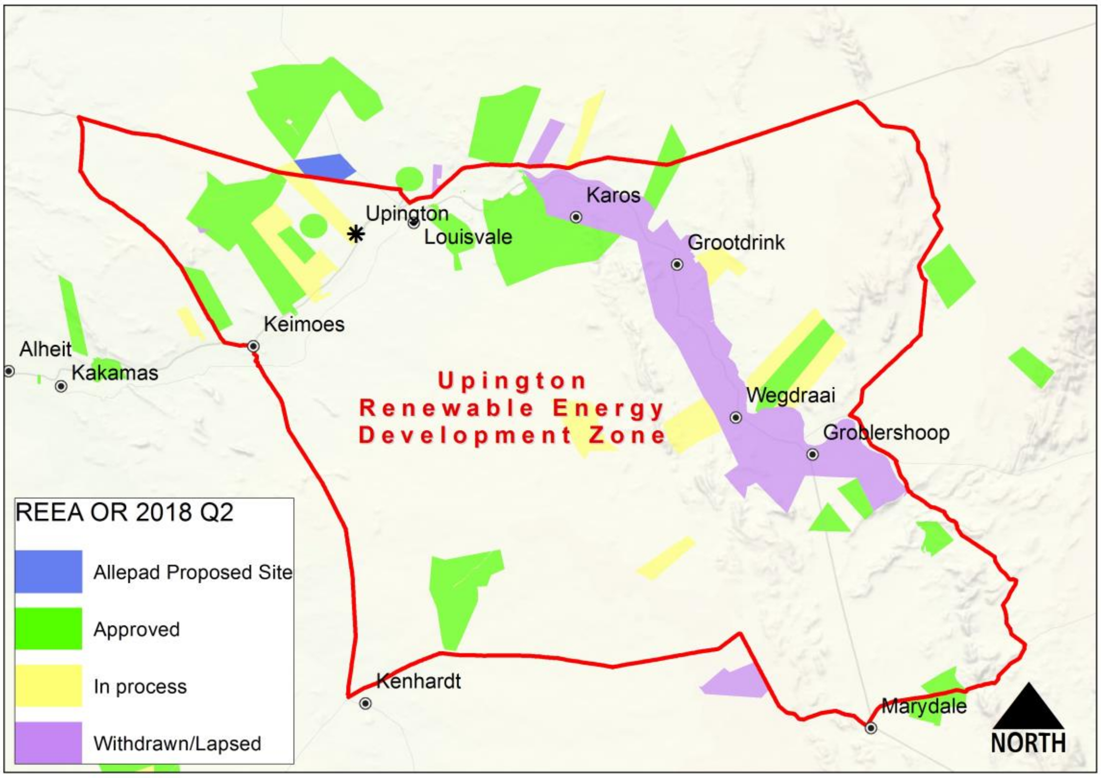


Figure 4: Regional locality of the Allepad PV Three SEF in relation to the Upington Renewable Energy Development Zone (REDZ).

The topography 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 hills occur towards the north-east of the study area. See **Map 1** for the shaded relief/topography map of the study area.

The terrain surrounding the property is predominantly flat with an even south-eastern slope towards the Orange River valley that forms a distinct hydrological feature in the region. The Orange River has, to a large degree, dictated the settlement pattern in this arid region by providing a source of perennial water for the cultivation of grapes and other irrigated crops. This and the associated production of wine is the primary agricultural activity of this district.

Cattle and game farming practises also occur, although less intensive. An example of this is the Spitskop Farm east of the R360 arterial road. This farm is indicated on Google Earth as a private game farm. It is not a designated protected area in the South African Protected Areas Database (SAPAD) and it is not expected to be accessible to the public. Indications are that the farm is in the property market and not operating as a tourist lodge/destination, but rather as a private cattle and game ranch. The farm does have a rocky outcrop that appears to be (or have been) a favourite viewpoint from which to look out over the generally flat expanse surrounding it. It is expected that this viewpoint (see **Figure 6**) would be exposed to the proposed Allepad PV Three SEF (albeit from a distance of 6km at the closest), the other larger solar energy facilities (e.g. Khi Solar One SEF) and structures at the Upington Airport located within the region.

Another potential sensitive visual receptor is the Kalahari Monate Lodge (see **Figure 5**) located immediately west of the R360 arterial road, approximately 5km east-north-east of the proposed development site. This lodge provides self-catering and camping amenities and may also be exposed to the proposed Allepad PV Three SEF.

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open expanses and vast desolation. The scarcity of water and other natural resources has dictated the settlement patterns of this region. The population distribution is primarily concentrated in Upington and the smaller towns/settlements along the Orange River. There are a very limited number of farm residences or homesteads within the remaining part of the study area. Some residential structures in relative close proximity to the proposed Allepad PV Three SEF, south of the N10 national road, appear to be informal settlements.

Vegetation cover in this semi-desert region is predominantly restricted to *low shrubland*, described as *Kalahari Karroid Shrubland* and *Gordonia Duneveld*. Planted vegetation in the form of vineyards and cotton fields is found along the Orange River floodplain. See **Map 2** for the broad land cover types map of the study area. Of note is the occurrence of a dry riverbed or seasonal wetland (pan) east of the proposed development site.

Linear infrastructure, besides the previously mentioned roads, includes a railway line traversing south of the N10 national road and a number of 132kV overhead power lines. Some of these include:

- Gordonia to Upington 1 and 2
- Gordonia to Oranje
- Gordonia to Upington
- McTaggerts to Oranje
- Klipkraal to Upington

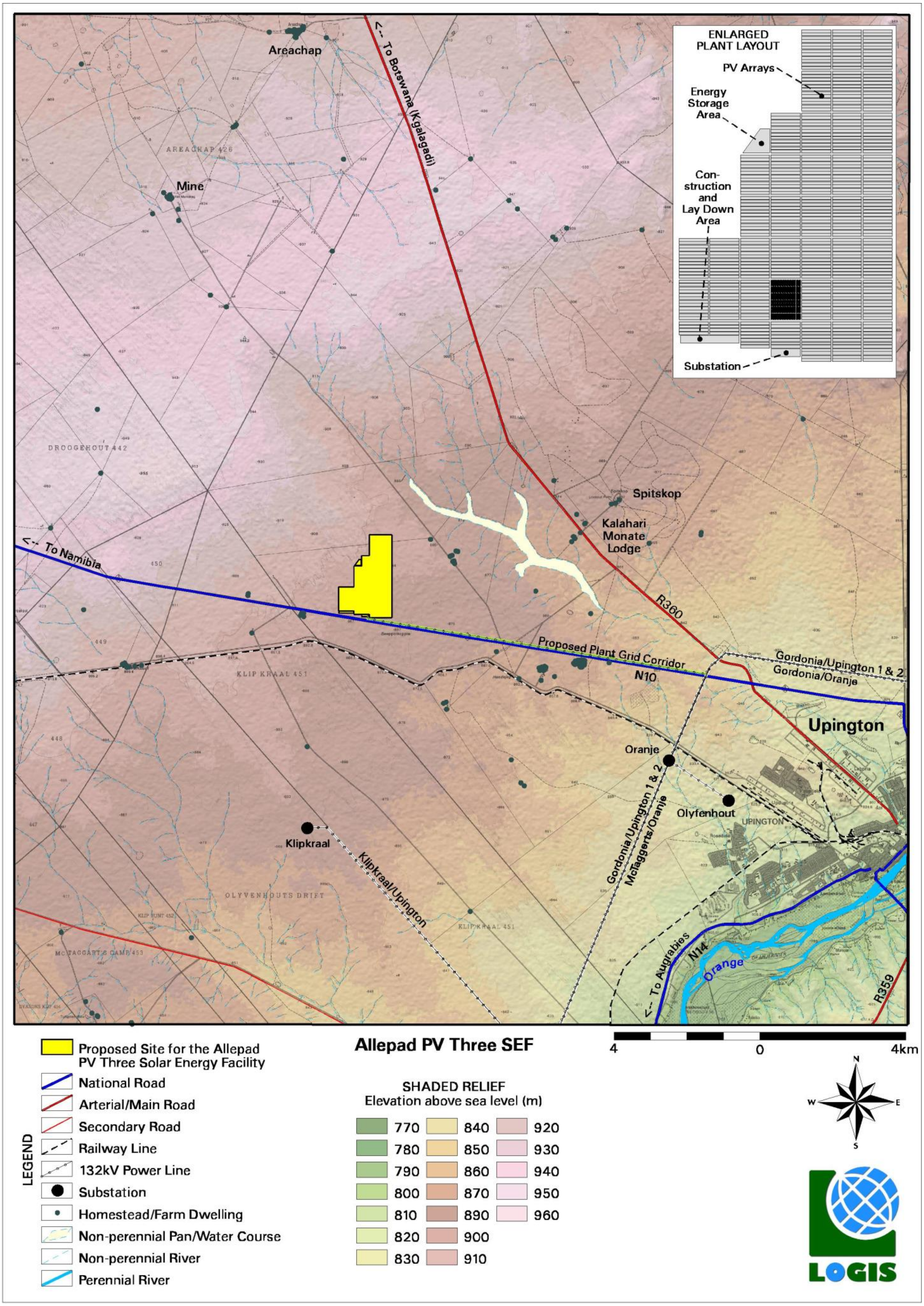
Sources: DEA (ENPAT Northern Cape), NLC2013-14, the South African Renewable Energy EIA Application Database and NBI (Vegetation Map of South Africa, Lesotho and Swaziland).

Figure 5: Accommodation and antelope at the Kalahari Monate Lodge. (Source and photo credit: Google Earth, Kobus du Toit).

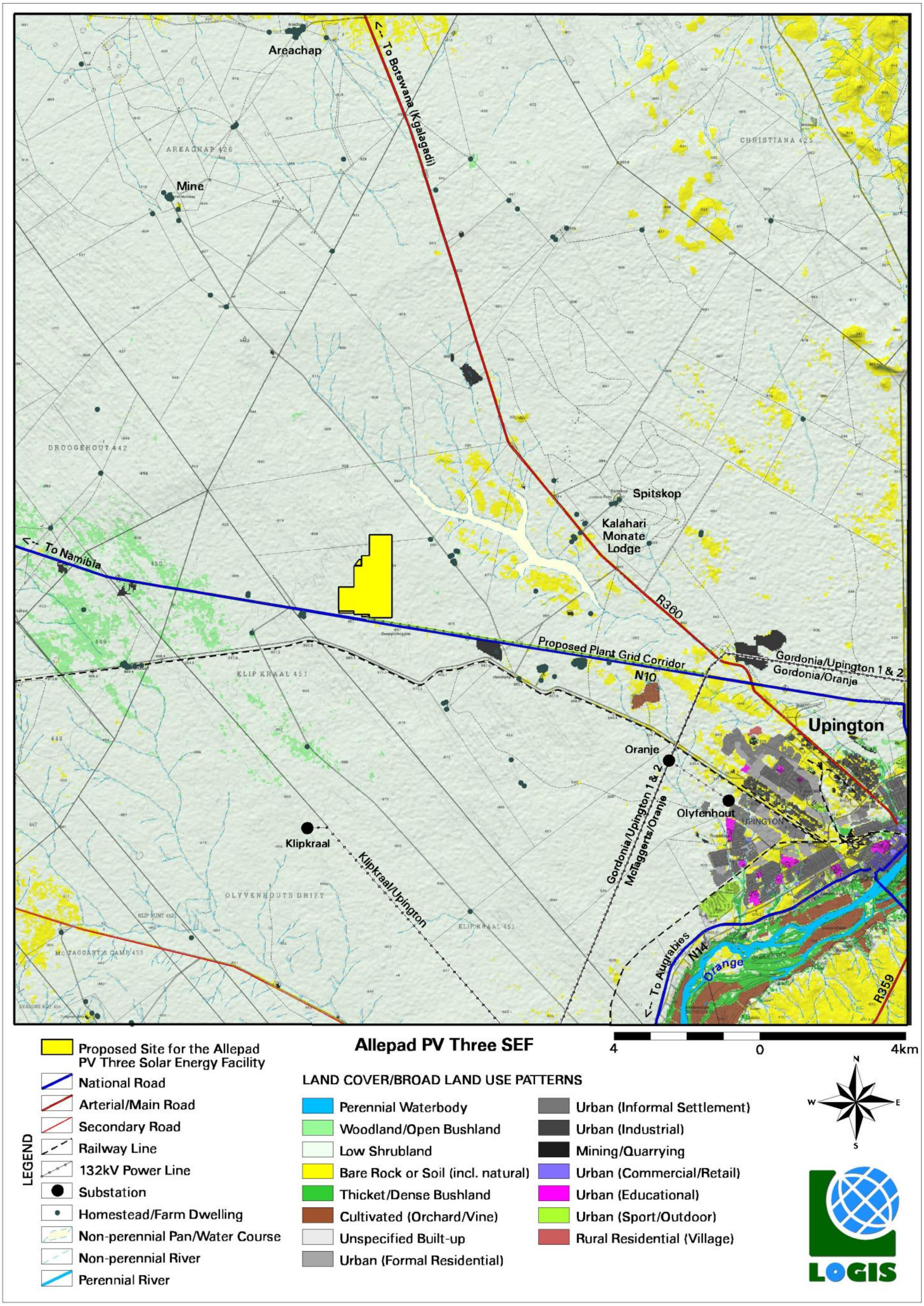
Figure 6: View from the Spitskop Farm viewpoint looking to the south-west (Source and photo credit: Google, Ibrahim Jarad).

Figure 7: Spitskop farm, with koppie (hill) and cattle watering point (photo supplied by project proponent).

Figure 8: The rural environment within the region.



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure – PV facility

The result of the viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The viewshed analysis was undertaken from 71 vantage points within the proposed development footprint at an offset of 4m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels) associated with the facility.

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed SEF, therefore signifying a worst-case scenario.

Results

The proposed Allepad PV Three Solar Energy Facility is expected to have a fairly contained core area of visual exposure, generally restricted to a 1km radius of the site. Receptors located within this zone include observers travelling along the N10 national road and residents of the settlement located west of the proposed SEF and south of the N10. It must be noted that this informal settlement appears to be deserted at present.

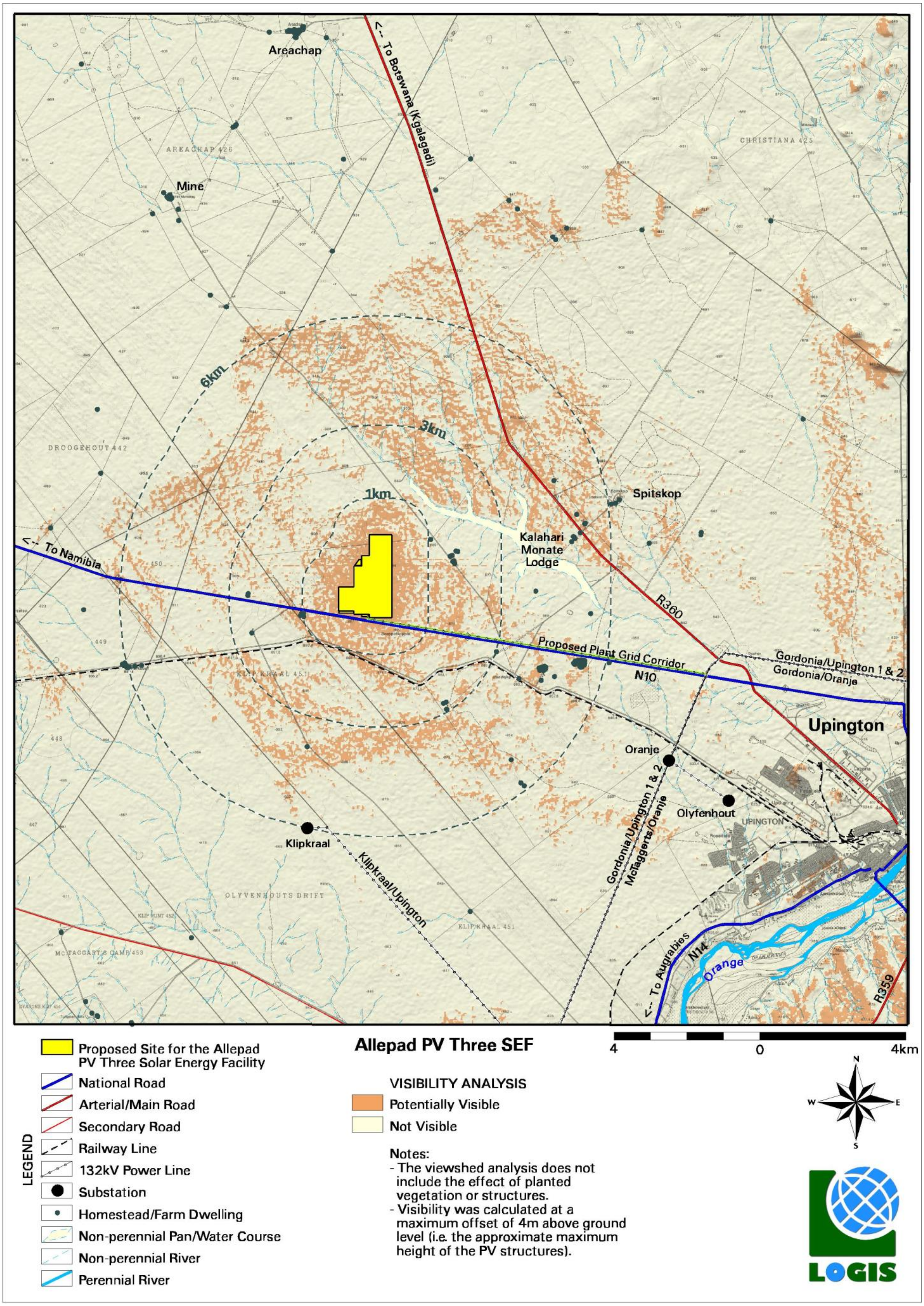
Visibility within 1-3km is more scattered and interrupted due to the undulating nature of the topography and the generally constrained height of the PV panel structures. Receptors located within this zone include observers travelling along the N10 national road and residents of the property earmarked for the PV facility.

The intensity of visual exposure is expected to subside within a 3-6km radius with the predominant visibility expected to the north-east. Other than a section of the R360 arterial road and a settlement north of the railway line this zone includes limited potentially sensitive visual receptors and comprises mainly of vacant land and natural open space. The Kalahari Monate Lodge, although located within this zone, is not expected to be visually exposed to the Allepad PV Three Solar Energy Facility.

Visibility beyond 6km from the proposed development is expected to be negligible and highly unlikely due to the distance between the object (development) and the observer. The SEF will not likely be visible from Upington.

Conclusion

It is envisaged that the structures, where visible from shorter distances (e.g. less than 3km), may constitute a high visual prominence, potentially resulting in a high visual impact.



Map 3: Viewshed analysis of the proposed Allepad PV Three SEF.

6.2. Potential cumulative visual exposure

There are quite a number of applications for Solar Energy Facilities in relative close proximity to the proposed Allepad PV Three SEF. There are an additional three Allepad PV projects, the Upington Solar Park and the Sasol Concentrated Solar Power (CSP) project all located within the study area. These projects are all in various stages of the EIA process. Applications that have been approved include the Eskom Concentrating Solar Park (CSP) and the Khi Solar One SEF (operational). The latter facility is located just beyond the Allepad PV Three study area to the south.

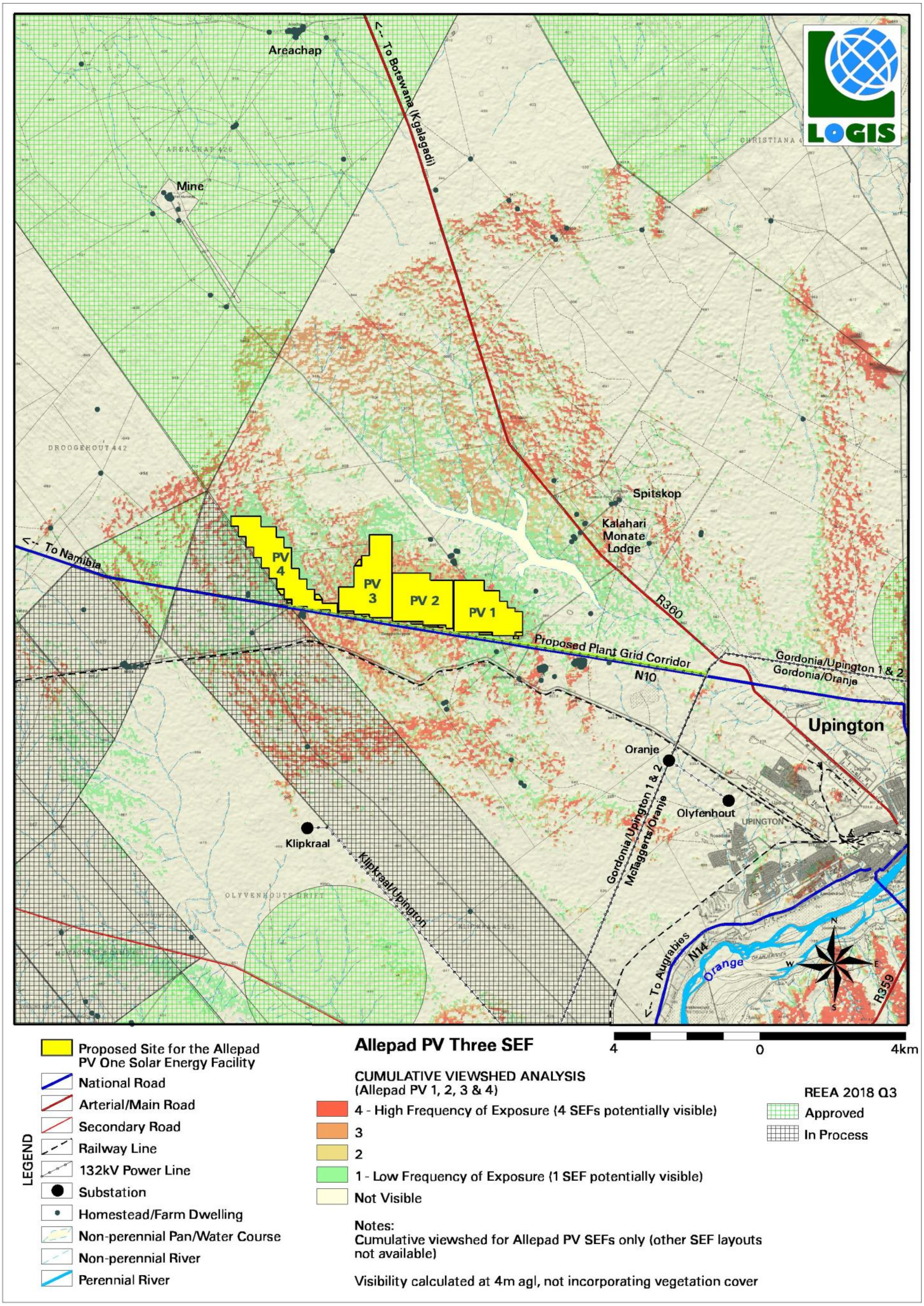
These applications and the four proposed Allepad PV SEFs are indicated on **Map 4**. This map also indicates the potential cumulative visual exposure of these four SEFs. The visual exposure for the other mentioned applications are not included in the cumulative viewshed analysis because of the absence of more detailed layout information. It is however expected that the applications, especially the much taller CSP structures, once constructed, would contribute significantly to the potential cumulative visual exposure of solar energy infrastructure within the region.

A visibility analysis of the Allepad PV SEFs was undertaken individually from each of the proposed sites from a representative number of vantage points per development footprint at 4m above ground level. The results of these analyses were merged in order to calculate the combined visual exposure. Red areas indicate higher levels of cumulative exposure (where all four facilities may potentially be visible) whilst green areas represent areas where only one facility may be visible. There is a good correlation between the visual exposure of the four facilities due to their close proximity to each other and the generally flat topography within the region. This means that the combined visual exposure of these four facilities are generally contained or restricted to the same areas.

The more exposed areas are generally located on terrain that is slightly more elevated than its surrounds, or closer to the theoretical centre point of the four SEF footprints. Cumulative visual exposure from the formerly mentioned elevated areas occurs at varying distances from the sites, with some sites appearing in the foreground, and others further away in the distance. It is also possible that solar panel structures from a SEF closer to the observer may obstruct views of SEFs structures located further away, thereby negating the potential cumulative visual impact.

This statement should however not distract from the fact that there will be a large amount of solar energy generation structures and ancillary infrastructure (e.g. overhead power lines) within this area that currently have very little built structures besides the existing Khi Solar One SEF and the railway line south of the N10 national road.

Alternately, it is preferable to concentrate future solar energy infrastructure within this area, considering the fact that there are already a number of approved SEFs in relative close proximity to the proposed Allepad PV sites. This will largely help to prevent the scattered proliferation of SEF structures throughout the greater region.



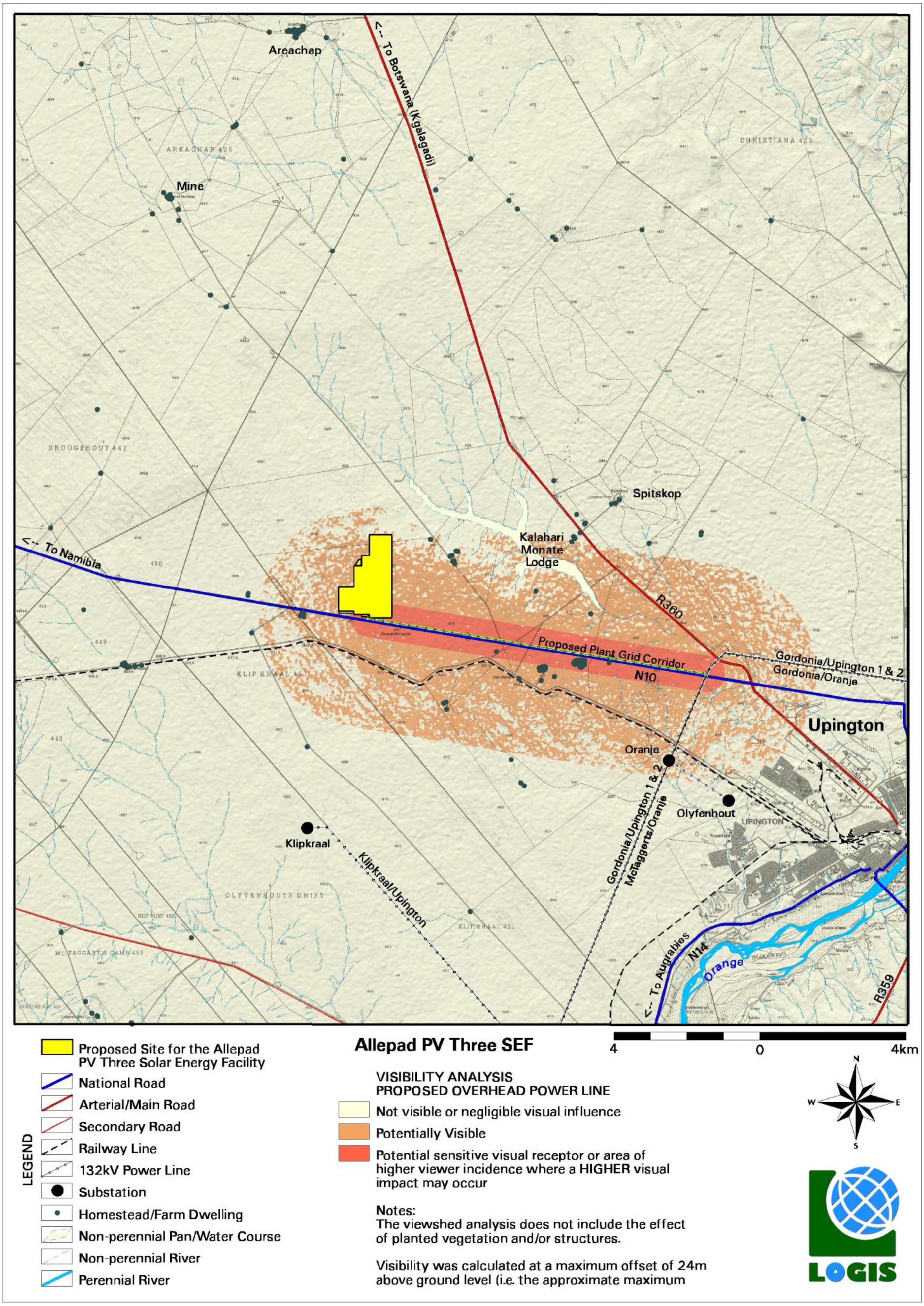
Map 4: Cumulative viewshed analysis.

6.3. Potential visual exposure – 132kV overhead power line

The visibility of the proposed power line alignment between the Allepad PV Three SEF and Gordonia to Upington 132kV power line is shown on **Map 5**. The visibility analysis was undertaken along the alignment at an offset of 24m above average ground level (i.e. the approximate height of the power line structures), for a distance of 3km from the centre line. The viewshed analysis was restricted to a 3km radius due to the fact that visibility beyond this distance is expected to be negligible/highly unlikely for the relatively constrained vertical dimensions of this type of power line (i.e. a 132kV power line).

Figure 9: Examples of 132kV overhead power lines.

It is expected that the power line may be visible within the 3km corridor and potentially highly visible within a 500m radius of the power line structures, due to the generally flat terrain it traverses. Potential observers (that may be visually impacted) include residents of the settlements south of the N10 national road and observers travelling along this road.



Map 5: Visibility analysis of the proposed overhead power line.

6.4. Visual distance / observer proximity to the SEF

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger SEFs (e.g. more than 100MW capacity) and downwards for smaller SEFs (e.g. less than 100MW capacity). This methodology was developed in the absence of any known and/or accepted standards for South African SEFs.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the SEF were 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 proximity radii, based on the dimensions of the proposed development area (footprint) are indicated on **Map 6**, and include the following:

- 0 - 1km. Very short distance view where the SEF would dominate the frame of vision and constitute a very high visual prominence.

- 1 – 3km. Short distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.

- 3 - 6km. 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 moderate visual prominence.

- > 6km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

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 potentially negative visual perception of the proposed facility.

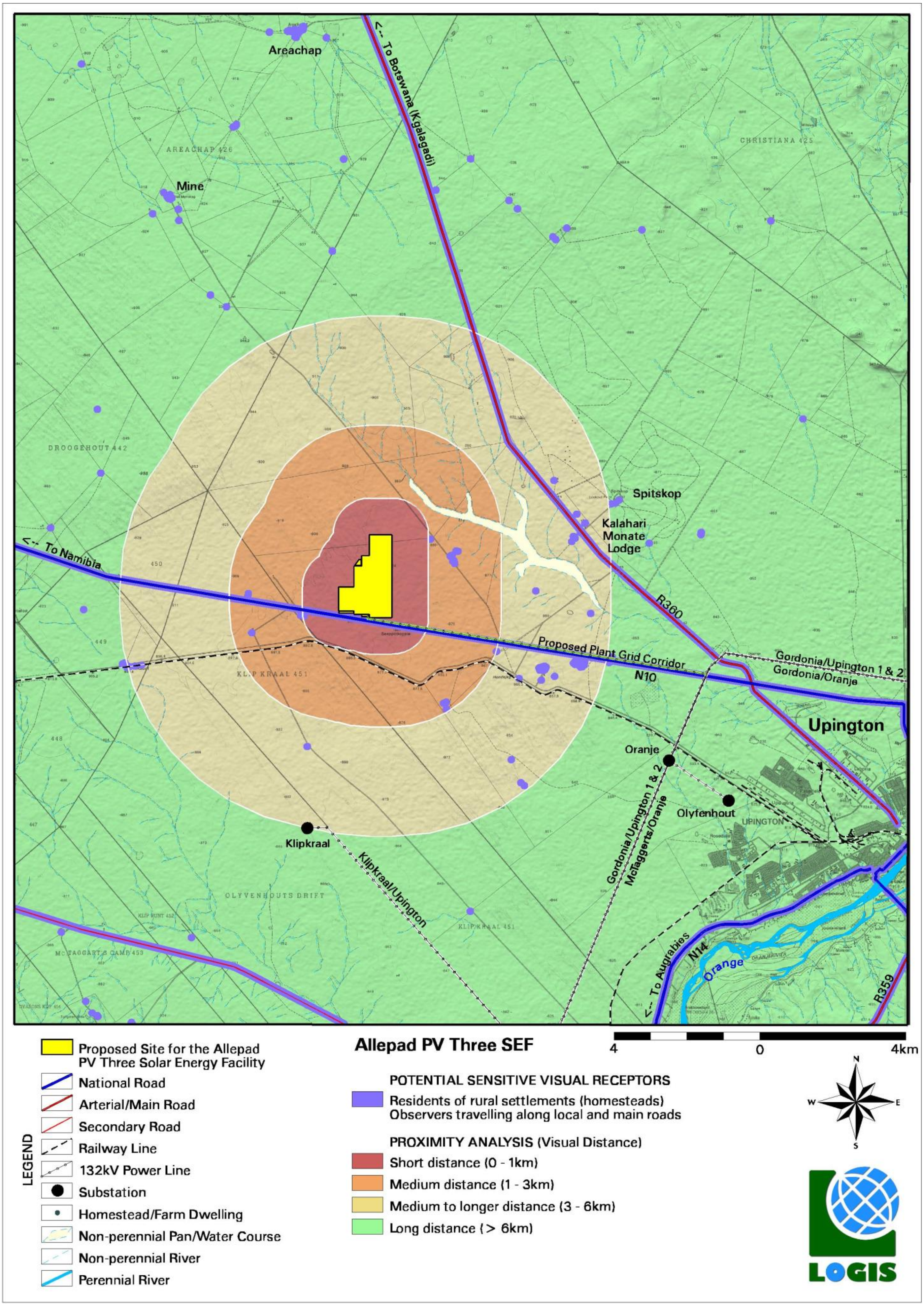
6.5. Viewer incidence / viewer perception

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

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed solar energy facility 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, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence is calculated to be the highest along the national, arterial and secondary roads within the study area. Commuters and tourists using these roads may be negatively impacted upon by visual exposure to the SEF.

Additional sensitive visual receptors are located at the farm residences (homesteads) and settlements throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the SEF, would generally be negative. These potential sensitive visual receptors are mentioned in **Section 6.1** and displayed on **Map 6** below.



Map 6: Proximity analysis and potential sensitive visual receptors.

6.6. Visual absorption capacity

The broader study area is located within the Savanna and Nama Karoo biomes characterised by large open grassy plains, low *shrubland* and bare soil in places (**Figure 10**).

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is deemed low by virtue of the nature of the vegetation and the low occurrence of urban development. In addition, the scale and form of the proposed structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

Where homesteads and settlements occur, some more significant vegetation and trees may have been planted, which would contribute to the visual absorption capacity (i.e. shielding the observers from the facility). As this is not a consistent occurrence, however, VAC will not be taken into account for any of the homesteads or settlements, thus assuming a worst case scenario in the impact assessment.

Figure 10: Grassland and low *shrubland* within the study area – low VAC.

6.7. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Allepad PV Three SEF are displayed on **Map 7**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. 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 visual exposure to the proposed infrastructure, a high viewer incidence and a potentially 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 and determining the potential **magnitude** of the visual impact.

General
The index indicates that potentially sensitive visual receptors within a 1km radius of the SEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsides with distance to:

- **High** within a 1 – 3km radius
- **Moderate** within a 3 – 6km radius
- **Low** beyond 6km.

Potentially affected visual receptors are highlighted and numbered on **Map 7** and referenced below.

The SEF may have a **very high** visual impact on the following observers:

Residents of:
- 4) The settlement west of the proposed SEF (and south of the N10).

Observers travelling along the:
- 5) N10 national road

The SEF may have a **high** visual impact on the following observers:

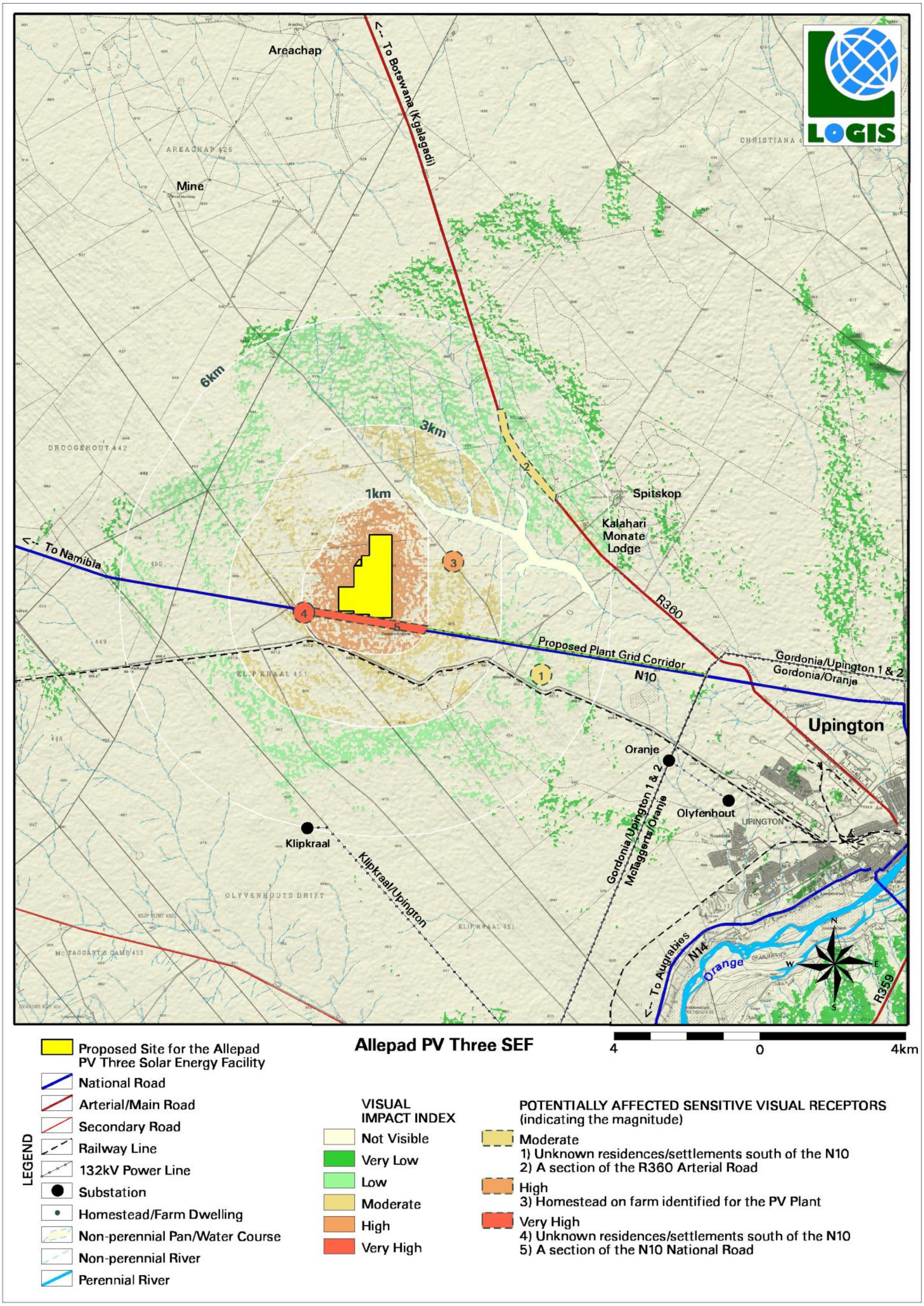
Residents of:
- 3) The house located on the proposed SEF property

*Notes relating to potentially **very high** and **high** visual impact receptors:*

The location of receptor no. 3 on the property earmarked for the proposed Allepad PV Three SEF, reduces the probability of this impact occurring (i.e. it is assumed that the residents are in agreement with the development of the SEF).

Where homesteads are derelict or deserted (e.g. receptor no. 4), the visual impact will be non-existent until such time as it is inhabited again.

The SEF may have a **moderate** visual impact on observers travelling along the R360 arterial road (receptor no. 2) and residents of the homesteads at receptor no. 1.



Map 7: Visual impact index and potentially affected sensitive visual receptors.

6.8. Visual impact assessment: impact rating methodology

The previous section of the report identified specific areas where likely visual impacts would occur and indicate the expected **magnitude** of potential impact. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see **Section 3:** 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 in the vicinity of the proposed SEF) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[2].
- **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)[3].
- **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)

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[2] Local = within 3km of the development site. Regional = between 3-6km from the development site.

[3] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

6.9. Visual impact assessment

The primary visual impacts of the proposed Allepad PV Three SEF are assessed below.

6.9.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed SEF and ancillary infrastructure.

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

Construction activities may potentially result in a **moderate** (significance rating = 40), temporary visual impact, that may be mitigated to **low** (significance rating = 24)

Table 2: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed SEF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed SEF.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(40)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction phase. ➢ 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 using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Residual impacts: None, provided rehabilitation works are carried out as specified.

Operational Visual Impacts

6.9.2. Potential visual impact on sensitive visual receptors located within a 3km radius of the SEF structures.

The Allepad PV Three SEF is expected to have a **moderate** visual impact (significance rating = 42) on observers traveling along the N10 national road and residents of homesteads within a 3km radius of the operational SEF structures.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact to **low**. The table below illustrates this impact assessment.

Table 3: Visual impact on observers in close proximity to the proposed SEF structures.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 3km radius of the SEF structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be	Yes	

mitigated?	

Mitigation / Management:
Planning:

- Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.
- Consult adjacent landowners in order to inform them of the development and to identify any (valid) visual impact concerns.

Operations:

- Maintain the general appearance of the facility as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:
The visual impact will be removed after decommissioning, provided the SEF infrastructure is removed. Failing this, the visual impact will remain.

6.9.3. Potential visual impact on sensitive visual receptors within the region (3 – 6km radius)

The operational SEF could have a **low** visual impact (significance rating = 26) on observers located between a 3 – 6km radius of the SEF structures, both before and after the implementation of mitigation measures.

Table 4: Visual impact of the proposed SEF structures within the region.

Nature of Impact:
Visual impact on observers travelling along the roads and residents at homesteads within a 3 – 6km radius of the SEF structures

	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(26)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, however best practice measures are recommended.	

Mitigation / Management:
Planning:

- Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.

Operations:

- Maintain the general appearance of the facility as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:
The visual impact will be removed after decommissioning, provided the SEF infrastructure is removed. Failing this, the visual impact will remain.

6.9.4. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the proposed SEF.

Lighting impacts relate to the effects of glare and sky glow. The source of glare light is unshielded luminaries which emit light in all directions and which are visible over long distances.

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. It is possible that the SEF may contribute to the effect of sky glow within the environment which is currently undeveloped.

Mitigation of direct lighting impacts and sky glow entails the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the SEF and the ancillary infrastructure (e.g. workshop and storage facilities) will go far to contain rather than spread the light.

The following table summarises the assessment of this anticipated impact, which is likely to be of **moderate** significance, and may be mitigated to **low**.

Table 5: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed SEF.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed facility.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make 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.
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.

6.9.5. Solar glint and glare impacts

Potential visual impact of solar glint and glare as a visual distraction and possible air travel hazard

Glint and glare occur when the sun reflects of surfaces with specular (mirror-like) properties. Examples of these include glass windows, water bodies and potentially some solar energy generation technologies (e.g. parabolic troughs and CSP heliostats). Glint is generally of shorter duration and is described as "a momentary flash of bright light", whilst glare is the reflection of bright light for a longer duration.

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. residents of neighbouring properties), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, airbases, etc.). It is generally possible to mitigate the potential glint and glare impacts through the design and careful placement of the infrastructure.

PV panels are designed to generate electricity by absorbing the rays of the sun and are therefore constructed of dark-coloured materials, and are covered by anti-reflective coatings. Indications are that as little as 2% of the incoming sunlight is reflected from the surface of modern PV panels (i.e. such as those proposed for the Allepad PV Three facility).

Sources: Blue Oak Energy, FAA and Meister Consultants Group.

The proposed Allepad PV Three facility is not located near any airports or airfields and is relatively remote in terms of exposure to other potentially sensitive visual receptors. As such, the potential visual impact related to solar glint and glare is expected to be of **low** significance (significance rating = 20).

Table 6: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction and possible air travel hazard.

Nature of Impact: The visual impact of solar glint and glare as a visual distraction and possible air travel hazard		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	N.A.
Duration	Long term **(4)**	N.A.
Magnitude	Low **(4)**	N.A.
Probability	Improbable **(2)**	N.A.
Significance	Low **(20)**	N.A.
Status (positive or negative)	Negative	N.A.
Reversibility	Reversible **(1)**	N.A.
Irreplaceable loss of	No	N.A.

resources?		
Can impacts be mitigated?	N.A.	
Mitigation: N.A.		
Residual impacts: N.A.		

6.9.6. Ancillary infrastructure

On-site ancillary infrastructure associated with the SEF includes a 132kV substation, smaller substations (inverters), 33kV cabling between the PV Arrays, internal access roads, workshop, office buildings, etc.

No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within that of the PV Arrays. The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 7: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.9.7. Potential visual impact on sensitive visual receptors located within a 500m radius of the power line structures

The power line is expected to have a **moderate** visual impact (significance rating = 42) on observers traveling along the N10 arterial road and residents of the informal settlements within a 0.5km radius of the power line structures.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 8: Visual impact on sensitive visual receptors in close proximity to the 132kV overhead power line.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads in close proximity to the power line structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation / Management: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the power line servitude. Operations: ➢ Maintain the general appearance of the servitude as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the power line infrastructure is removed. Failing this, the visual impact will remain.		

6.10. Visual impact assessment: secondary impacts

The potential visual impact of the proposed SEF on the sense of place 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, 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.), plays a significant role.

An 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.

The greater environment has a rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development represents existing visual disturbances.

The anticipated visual impact of the proposed SEF on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development site.

Table 9: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(26)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. <u>Operations:</u> ➢ Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the SEF infrastructure is removed. Failing this, the visual impact will remain.		

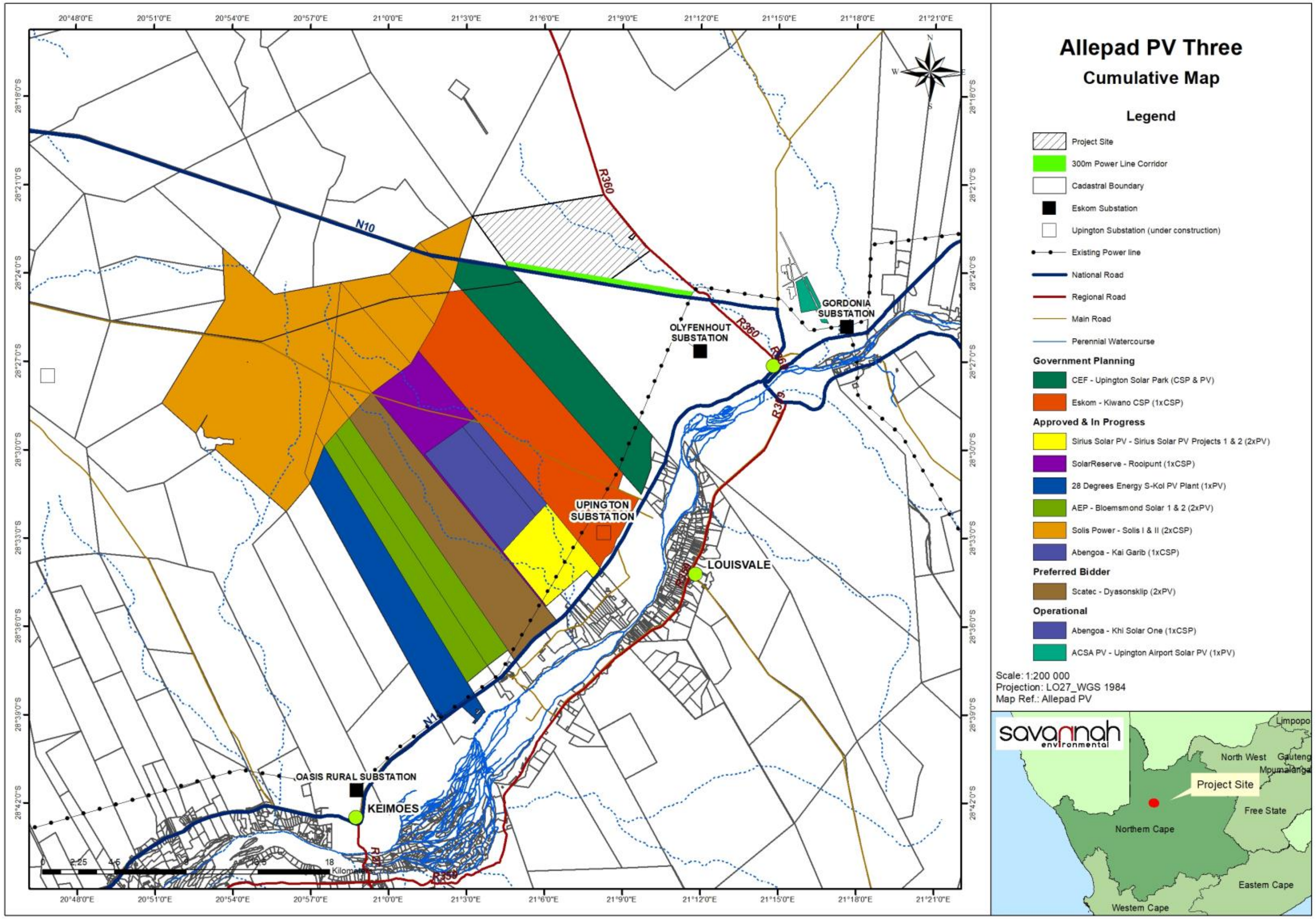
The potential cumulative visual impact of the SEFs on the visual quality of the landscape.

The construction of the Allepad PV One, Two, Three, Four, Sasol CSP, Upington Solar Park, Eskom CSP and the existing Khi Solar One SEF is expected to increase the cumulative visual impact of industrial type infrastructure within the region.

On the other hand the location of these SEFs within a close proximity to the Upington REDZ will contribute to the consolidation of SEF structures to this locality and avoid a potentially scattered proliferation of solar energy infrastructure throughout the region. It should also be borne in mind that the approval of the three latter SEFs has set the trend for applications for Solar Energy Generation projects within this area, which is not likely to abate within the foreseeable future. Also refer to **Map 8**.

Table 10: Applications for Renewable Energy Developments within the region.

Project Name	DEA Reference Number(s)	Location	Approximate distance from Allepad PV Three	Project Status
Allepad PV One (1 x 100MW PV)	14/12/1/3/3/2/1105	Remaining Extent of Erf 5315 Upington	Within the project site	EIA in process
Allepad PV Two (1 x 100MW PV)	14/12/1/3/3/2/1106	Remaining Extent of Erf 5315 Upington	Within the project site	EIA in process
Allepad PV Four (1 x 100MW PV)	14/12/1/3/3/2/1108	Remaining Extent of Erf 5315 Upington	Within the project site	EIA in process
Upington Solar Park (1 x 1 000MW CSP and PV)	12/12/20/2146	Farm Klip Kraal No. 451	Immediately adjacent (south-west)	Approved
Sirius One Solar PV Project (1 x 75MW PV)	14/12/16/3/3/2/469	Remaining Extent of the Farm Tungsten Lodge No. 638	~14km south	Preferred Bidder project under construction
Sirius Two Solar PV Project (1 x 75MW PV)	14/12/16/3/3/2/470	Remaining Extent of the Farm Tungsten Lodge No. 638	~14km south	Approved
Rooipunt (1 x 150MW CSP)	14/12/16/3/3/1/427	Farm McTaggarts Camp No. 435	~8.5km south-west	Approved
S-Kol PV Plant (1 x 100MW PV)	12/12/20/2230	Farm Geelkop No. 456	~18km south-south-west	Approved
Bloemsmond Solar 1 and 2 (1 x 75MW PV)	14/12/16/3/3/2/815	Portions 5 and 14 of the Farm Bloems Mond No. 455.	~17km south-south-west	Approved
Bloemsmond Solar 2 (1 x 75MW)	14/12/16/3/3/2/816	Portions 5 and 14 of the Farm Bloems Mond No. 455.	~17km south-south-west	Approved
Solis Power I Project (1 x 150MW CSP)	14/12/20/16/3/3/3/82	Portion 443 to 450 of the Farm Van Rooys Vlei	Immediately adjacent (west)	Approved
Solis Power II Project (1 x 125MW CSP)	14/12/16/3/3/2/621	Portion 443 to 450 of the Farm Van Rooys Vlei	Immediately adjacent (west)	Approved
Dyason's Klip 1 and 2 (2 x 75MW)	14/12/16/3/3/2/538/1 14/12/16/3/3/2/538/2	Portion 12 of the Farm Dyasonklip No. 454	~12.5km south-south-west	Preferred Bidder projects under construction
Kai Garib (1 x 125MW CSP)	14/12/16/3/3/2/656	Portion 03 of the Farm McTaggarts Camp No. 435	~11.5km south-south-west	Approved
Khi Solar One (1 x 50MW CSP)	12/12/20/1831	Portion 03 of the Farm McTaggarts Camp No. 435	~11.5km south-south-west	Operational
Upington Airport Solar PV (1 x 8.9MW PV)	12/12/20/2146	Erf 6013 Upington	~8.5km east	Operational



Map 8: Allepad PV Three Cumulative Map.

The anticipated cumulative visual impact of the proposed SEFs is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the proposed development sites. See **Table 11** below.

Table 11: The potential cumulative visual impact of the SEFs on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of the SEFs on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation (with mitigation)	***Cumulative impact of the project and other projects within the area (with mitigation)***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	High **(8)**
Probability	Improbable **(2)**	Probable **(3)**
Significance	Low **(26)**	Moderate **(45)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the SEF infrastructure is removed. Failing this, the visual impact will remain.		

6.11. The potential to mitigate visual impacts

The primary visual impact, namely the layout and appearance of the PV Panels is not possible to mitigate. The functional design of the PV panels cannot be changed in order to reduce visual impacts.

The following mitigation is, however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) immediately adjacent to the development footprint be maintained, both during construction and operation of the proposed facility. This will minimise visual impact as a result of cleared areas and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. The construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

- Mitigation of lighting impacts includes the pro-active design, planning and specification of lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed SEF and ancillary infrastructure will go far to contain rather than spread the light. Mitigation 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.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

    - 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 any potential temporary construction 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.
    - Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the PV Arrays and ancillary structures and infrastructure will ensure that the facility does not degrade, therefore avoiding aggravating the visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as and when required.

- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

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

- Where sensitive visual receptors are likely to be affected (e.g. residents of homesteads in close proximity to the SEF), it is recommended that the developer enter into negotiations with property owners regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

- Similar screening (e.g. vegetation barriers or vegetated berms) may be considered along the southern boundary of the SEF site, negating potential visual impacts on observers travelling along the N10 national road.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed Allepad PV Three SEF and its associated infrastructure, may have a visual impact on the study area, especially within (but not restricted to) a 3km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of up to eight solar energy facilities (i.e. Allepad PV One, Two, Three, Four, Sasol CSP, Upington Solar Park, Eskom CSP and the existing Khi Solar One SEF) is expected to increase the area of potential visual impact within the region. The intensity of visual impact to exposed receptors, especially those located within a 3km radius, is expected to be greater than it would be for a single SEF. It is however still more preferable that these solar energy developments are all concentrated within this area than being spread further afield.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who may consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of rural homesteads and settlements. See Impact Statement below.

Potential mitigation factors for the Allepad PV Three SEF include the fact that 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.

A number of mitigation measures have been proposed (**Section 6.10.**). Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed facility.

If mitigation is undertaken as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the Allepad PV Three SEF would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

8. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Allepad PV Three SEF is that the visual environment surrounding the site, especially within a 3km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

This impact is applicable to the individual Allepad PV Three SEF and to the potential cumulative visual impact of the facility in relation to the proposed Allepad PV One, Two, Four, Sasol CSP, Upington Solar Park, Eskom CSP and the existing Khi Solar One SEF, where the combined frequency of visual impact may be greater. The potential area of cumulative visual exposure is however not expected to increase significantly and is deemed to be within acceptable limits.

The following is a summary of impacts remaining, assuming mitigation as recommended, is exercised:

- During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and landowners in the area. Construction activities may potentially result in a **moderate**, temporary visual impact that may be mitigated to **low**.

- The Allepad PV Three SEF is expected to have a **moderate** visual impact on observers traveling along the N10 national road and residents of homesteads within a 3km radius of the PV plant structures. Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact to **low**.

- The SEF is expected to have a **low** visual impact on observers located between a 3 – 6km radius of the SEF structures, both before and after the implementation of mitigation measures.

- The anticipated impact of lighting at the SEF is likely to be of **moderate** significance, and may be mitigated to **low**.

- The potential visual impact related to solar glint and glare is expected to be of **low** significance.

- The anticipated visual impact resulting from the construction of on-site ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The overhead power line could have a **moderate** visual impact on observers traveling along the N10 national road and residents of the informal settlements within a 0.5km radius of the power line structures. No mitigation of this impact is possible, but measures are recommended as best practice.

- The anticipated visual impact of the proposed SEF on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance. This is due to the relatively low viewer incidence within close proximity to the proposed development.

- The anticipated cumulative visual impact of the proposed SEFs is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the proposed development.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **moderate** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility are not considered to be fatal flaws for the proposed SEF.

Considering all factors, it is recommended that the development of the facility as proposed be supported; subject to the implementation of the recommended mitigation measures (**Section 6.11.**) and management programme (**Section 9.**).

Where sensitive visual receptors are likely to be affected (i.e. residents of homesteads and settlements in close proximity), it is recommended that the developer enter into negotiations regarding the potential screening of visual impacts at the receptor site. This may entail the planting of vegetation, trees or the construction of screens. Ultimately, visual screening is most effective when placed at the receptor itself.

9. MANAGEMENT PROGRAMME

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

Table 12: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Allepad PV Three SEF.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, substation, meteorological metering station, security lighting, workshop and power line).	
Potential Impact	Primary visual impact of the facility due to the presence of the PV panels and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 3km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise the visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent / contractor	Early in the planning phase.
Retain and maintain natural vegetation immediately adjacent to the development footprint/servitude.	Project proponent/ design consultant	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant	Early in the planning phase.
Consult a design engineer (with the relevant experience) in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the SEF and the ancillary infrastructure. The following is recommended: o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). o Limit mounting heights of fixtures, or use foot-lights or bollard lights. o Make use of minimum lumen or wattage in fixtures. o Making use of down-lighters or shielded fixtures. o Make use of Low Pressure Sodium lighting or other low impact lighting. o Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.	Project proponent / design consultant	Early in the planning phase.
Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 3km) and within the region.	

Monitoring	Not applicable.

Table 13: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Allepad PV Three SEF.		
Project Component/s	Construction site and activities	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
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 intact vegetation cover outside of immediate construction work areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction phase.	Project proponent / contractor	Early in the construction phase.
Reduce the construction phase through careful logistical planning and productive implementation of resources.	Project proponent / contractor	Early in the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Project proponent / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes, etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 14: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Allepad PV Three SEF.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, substation, meteorological metering station, workshop and power line).	
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 as a whole, including the PV panels, servitudes and the ancillary structures.	Project proponent / operator	Throughout the operation phase.
Maintain roads and servitudes to forego erosion and to suppress dust.	Project proponent / operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent / operator	Throughout the operation phase.
Investigate and implement (should it be required) the potential to screen visual impacts at affected receptor sites.	Project proponent / operator	Throughout the operation phase.
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 15: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Allepad PV Three SEF.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, substation, workshop, transformers and power line).	
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	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site.	Project proponent / operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Project proponent / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent / operator	Post decommissioning.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

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