PROPOSED
STURDEE ENERGY PPC CEMENT 7MW SOLAR PV PROJECT

DE HOEK, BERGRIVIER LOCAL MUNICIPALITY, WESTERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT
AS PART OF A BASIC ASSESSMENT REPORT

Produced for:

Sturdee Energy

On behalf of:

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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), 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 modelling 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 Atlas 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.

CES Environmental and Social Advisory Services appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Sturdee Energy PPC Solar PV Project. 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:

- The information available, and understanding of the study area by the practitioner:

[1] Adapted from Oberholzer (2005).

- 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 the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) 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 AW3D30 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 (VAC) 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 discernible 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 is 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 this VIA report.

- **Site visit**

A site visit was undertaken in May 2021 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

Sturdee Energy has been appointed by PPC Cement to develop a 7MW AC Solar PV Plant and associated infrastructure adjacent to the PPC De Hoek Factory, located in the Bergrivier Local Municipality in the Western Cape Province. The proposed Solar PV plant will encompass an area of less than 20 hectares and will be used to generate power for private consumption at the adjacent cement factory and neighbouring mine.

An 11.5kV single-circuit overhead line (OHL), approximately 1.88km in length, will be required to connect the new proposed plant to the existing PPC (De Hoek) 11.5kV substation. The design specifications of the plant are summarised in **Table 2** below.

The proposed project will contain internal gravel roads, security guardhouse (at the access point) and an operations and maintenance building, together with the features set out in **Table 2** below.

The PV plant will be located on a portion of vacant land within the De Hoek mining property, adjacent to the open cast mine. The site is currently utilised for wheat farming, but the property is zoned as mining and is entirely owned by PPC.

Table 2: Solar PV Plant Specifications

Pre-design Input	PPC De Hoek Solar PV Plant Specifications
Contracted Capacity (AC)	7MW
Maximum Export Capacity (AC)	7MW
Plant Nameplate DC Capacity	7.7MW
DC/AC Ration	110%
PV Module Type	Mono-crystalline N-Type Bifacial Module
Mounting Structure	Single-axis Ground-mount N-S Tracker with Back-tracking Modules in Portrait[2]
Tracker Specifications	Pitch of 6.5m GCR = 34.8% Angle Rotation +-60°
Bi-facial System Specifications	Ground Albedo = 20% Bi-faciality Factor = 74% Rear Shading Factor = 5% Axis Height Above Ground = 2m
Axis Tilt	0 Degrees
PV Inverter Type	Outdoor Grid-tied Central Inverter
Inverter Continuous AC Rated Capacity	4 x 2500kWac
Plant Transformer Rating	4 x 3MVA 400V/11.5kV
Plant Grid Interconnection Voltage	11.5kV
Planned Grid Connection	1,880m 11.5kV Overhead Power Line to PPC 11.5kV Main Distribution Substation

[2] A single-axis tracker moves the PV panels on one axis of movement, usually aligned with north and south. This setup allows the panels to arc from east to west and track the sun as it rises and sets.

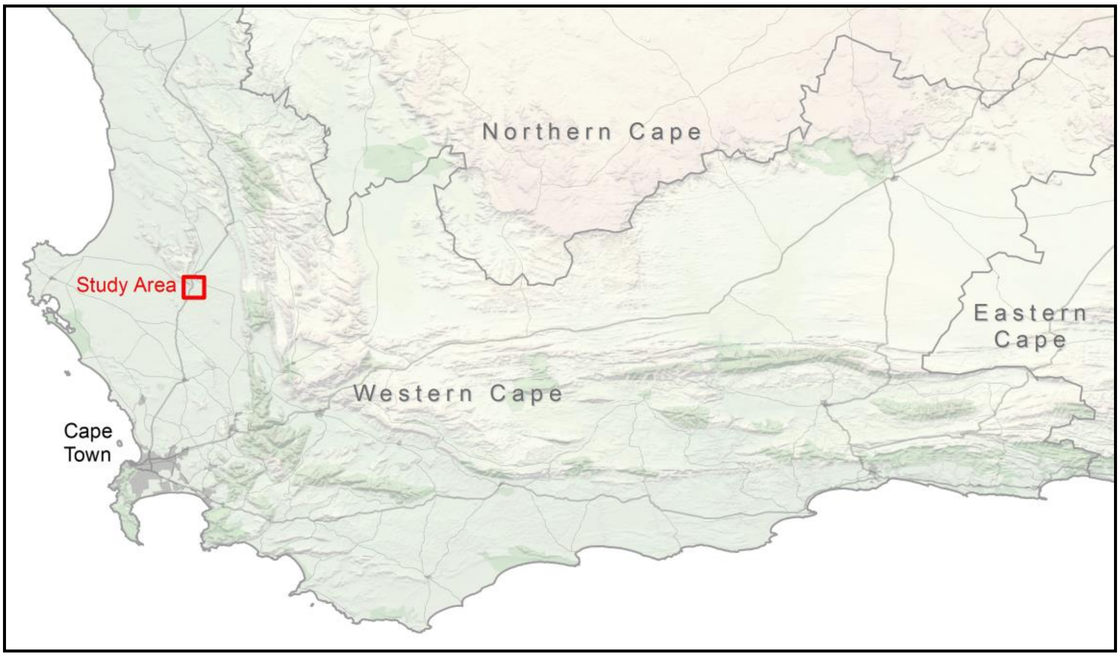


Figure 1: Regional locality of the study area.

Three alternatives are considered for the PV plant to PPC substation 11.5kV single-circuit power line. The first two alignments are very similar and will be between 1.9km (Option 1) and 1.8km (Option 2) in length. The alignments will exit the PV plant in a north-westerly direction, cross over the N7 national road and traverse adjacent (west) to this road for respectively 975m (Option 1) and 740m (Option 2). They veer off in a north-westerly direction, cross over/under two existing 66kV power lines and enter the substation from the west.

The third alignment (Option 3) is just over 2km and will traverse east of the N7 for 895m before crossing this road and entering the substation from the west.

The PV plant and power line will take approximately four months to construct and the operational lifespan of the facility is estimated at up to 30 years.

The proposed positions of the PV plant and the power line alignments are indicated on the maps within this report (also refer to **Figure 4**). Sample images of similar PV plant technologies are provided below.

Figure 2: Single-axis ground-mount tracker PV modules. (Photo: *Solarbuildermag.com)*.

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

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed PPC PV plant and power line as described 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 impact assessment encompasses a geographical area of 131km² (the extent of the full page maps displayed in this report) and includes a minimum 6km buffer zone (area of potential visual influence) from the development footprint of the facility.

Anticipated issues related to the potential visual impact of the proposed PV facility include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the national (N7), arterial (R399) and secondary roads within the study area.
- The visibility of the facility to, and potential visual impact on residents of homesteads or farm dwellings within the study area.
- The potential visual impact of the facility on the visual character or sense of place of the region.
- The potential visual impact of the facility on tourist routes or tourist destinations/facilities (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e. internal access roads, buildings, etc.) on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the placement of the PV plant within a mining area with existing mining activities and industrial structures.
- 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 impact of solar glint and glare as a visual distraction and possible hazard to road users (or an aviation safety risk to pilots).
- Potential visual impacts associated with the construction phase.
- 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. 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 site for the PV plant is located on the farm Rietfontein 184 approximately 5km south of Piketberg, on the De Hoek Mine (PPC Cement) property. The mine and cement factory is located within an area predominantly characterised by agricultural activities (wheat farming) at the south-eastern foot of the Piketberg Mountain. The mine and cement factory, founded in 1923 by the Cape Portland Cement company, is one of the oldest cement factories in the country. The company continued to trade under this name until 1983, when the name changed to Pretoria Portland Cement (PPC).

Regionally, the De Hoek Mine is located some 26km north-east of Moorreesburg and approximately 126km north of Cape Town, within the Bergrivier Local Municipality of the Western Cape Province.

The entire proposed project site (encompassing both the PV panels and the power line) is currently zoned as mining.

Refer to **Figure 4** below for the proposed PV plant project layout.

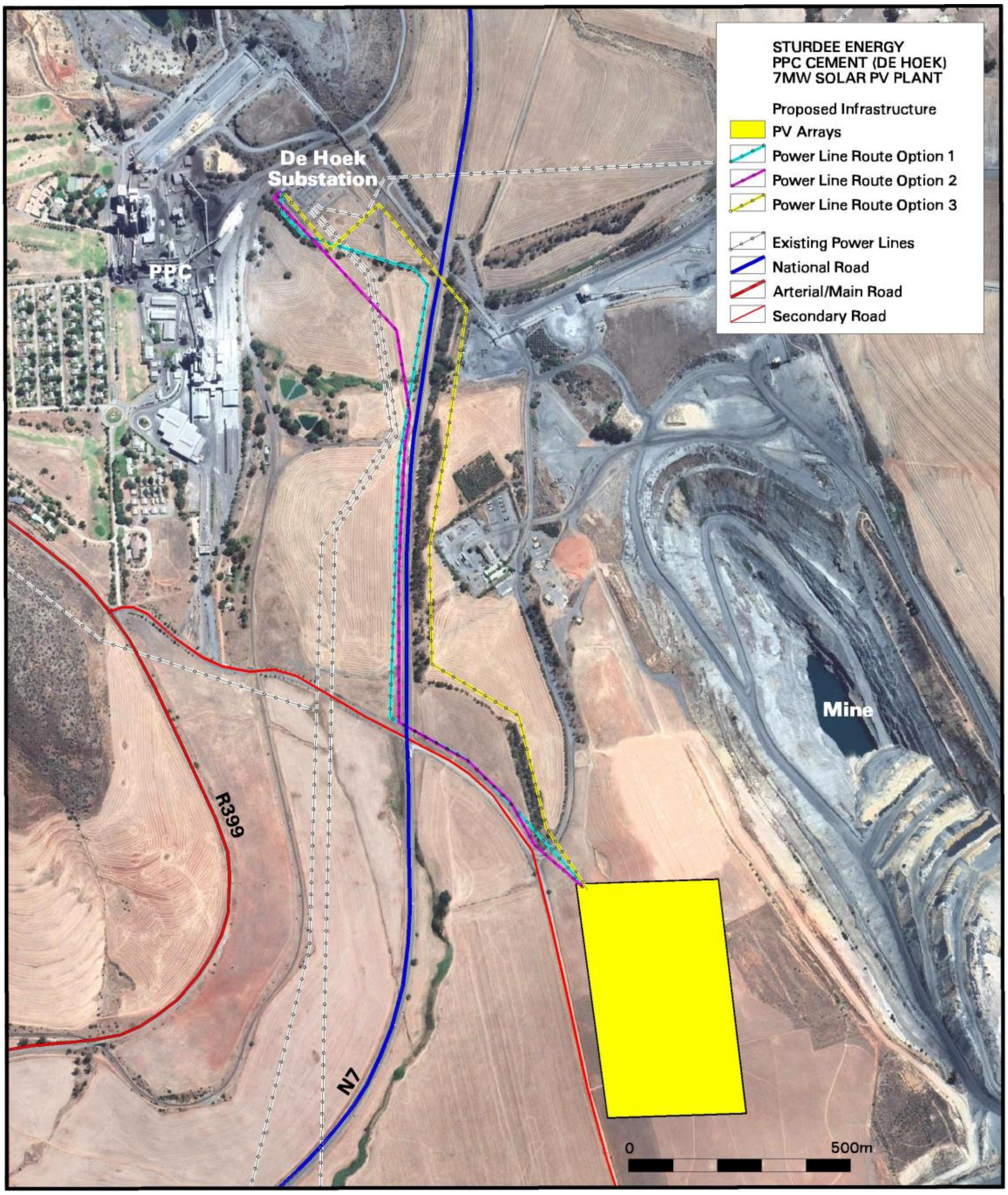


Figure 4: Aerial view of the proposed project site and associated infrastructure.

The proposed development site is located to the east of the Western Cape coastal plain within a region commonly referred to as the *Swartland*. The topography of the study area is relatively flat and homogenous, consisting predominantly of *undulating plains*, with the exception of the prominent Piketberg Mountain to the north-west. The elevation within the study area ranges from 807m above sea level (a.s.l.) at the Aasvoëlkop peak of the Piketberg to below 40m a.s.l. along the Berg River. The lowest point in the landscape is however the man-made open cast pit of the De Hoek Mine, which drops below sea level. The depth of the Zoutkloof pit (the central pit) was in excess of 180m as at 2016, with the southern pit (Vondeling pit) at 60m. The northern De Hoek quarry has been decommissioned, and is no longer mined.

The PV plant site is located at an average elevation of 120m a.s.l. and has an even slope to the east towards the mine pit and to the west towards the N7 national road. Refer to **Map 1**.

The most prominent hydrological features are the perennial Berg River to the south-west and the perennial Krom and Pyls Rivers to the east. Other than these rivers there are a number of non-perennial drainage lines and farm dams located within the region.

Wheat, maize and canola farming dominate the land-use character within the study area. Other land uses include viticulture (vineyards) along the Berg River and sheep farming throughout the region. Refer to **Map 2** for the land cover and broad land use patterns within the study area.

There is limited industrial activity within the study area, other than the PPC Factory, the De Hoek Mine and a smaller scale light industrial area at Piketberg. Additional linear industrial type infrastructure includes a railway line traversing the foot of the Piketberg Mountain, and a number of 66kV power lines. These include:

- Broodkraal - Tee 1 66kV
- De Hoek - Eendekuil 1 66kV
- De Hoek - Misverstand 1 66kV
- Piketberg Switching Station - Soutfontein Switching Station 1 66kV

The region has a population density of less than 10 people per km^2, with the highest concentration in the little town of Piketberg and at the De Hoek Mine village. Other than these residential areas the region has a rural character, with scattered isolated homesteads or farm dwellings occurring within the study area.

With its typical Mediterranean climate, the study area receives in between 200mm and 400mm rainfall per annum. In spite of the relatively low rainfall most of the study area has been transformed by dryland agriculture, with very limited natural vegetation remaining. Natural vegetation is limited to the steep mountainous terrain (*Piketberg Sandstone Fynbos*) and along the floodplains of the larger drainage lines (*Swartland Shale/Silcrete Renosterveld*) within the study area.

The main access route from Cape Town to the region is the N7 national road, with the R44 and R399 arterial roads connecting Piketberg with respectively Porterville and the Atlantic Seaboard at Velddrif. The proposed PV plant is located 413m from the N7 at the closest.

There are no identified protected areas within the study area, yet the visual quality of the receiving environment is largely considered to be of high value due to the pastoral landscapes and distant mountains. Tourist attractions or tourist destinations that were identified include the Org de Rac Wine Estate and the Dunn's Castle Guest House (indicated as *Die Kasteel* on the maps). The former is located just off the N7 north of the Berg River, and the latter is located along the southern foot-slope of the Piketberg Mountain, just off the R399.[3]

Refer to **Maps 1** and **2** for the topography and land cover maps of the study area.

Figure 5: Piketberg and Piketberg Mountain.

[3] Sources: DEAT (ENPAT Western Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2020_Q3 and SAPAD2019-20 (DEA).

Figure 6: De Hoek PPC Cement Factory.

Figure 7: Existing power lines traversing west of the development site.

Figure 8: View from the development site to the PPC Cement Factory.

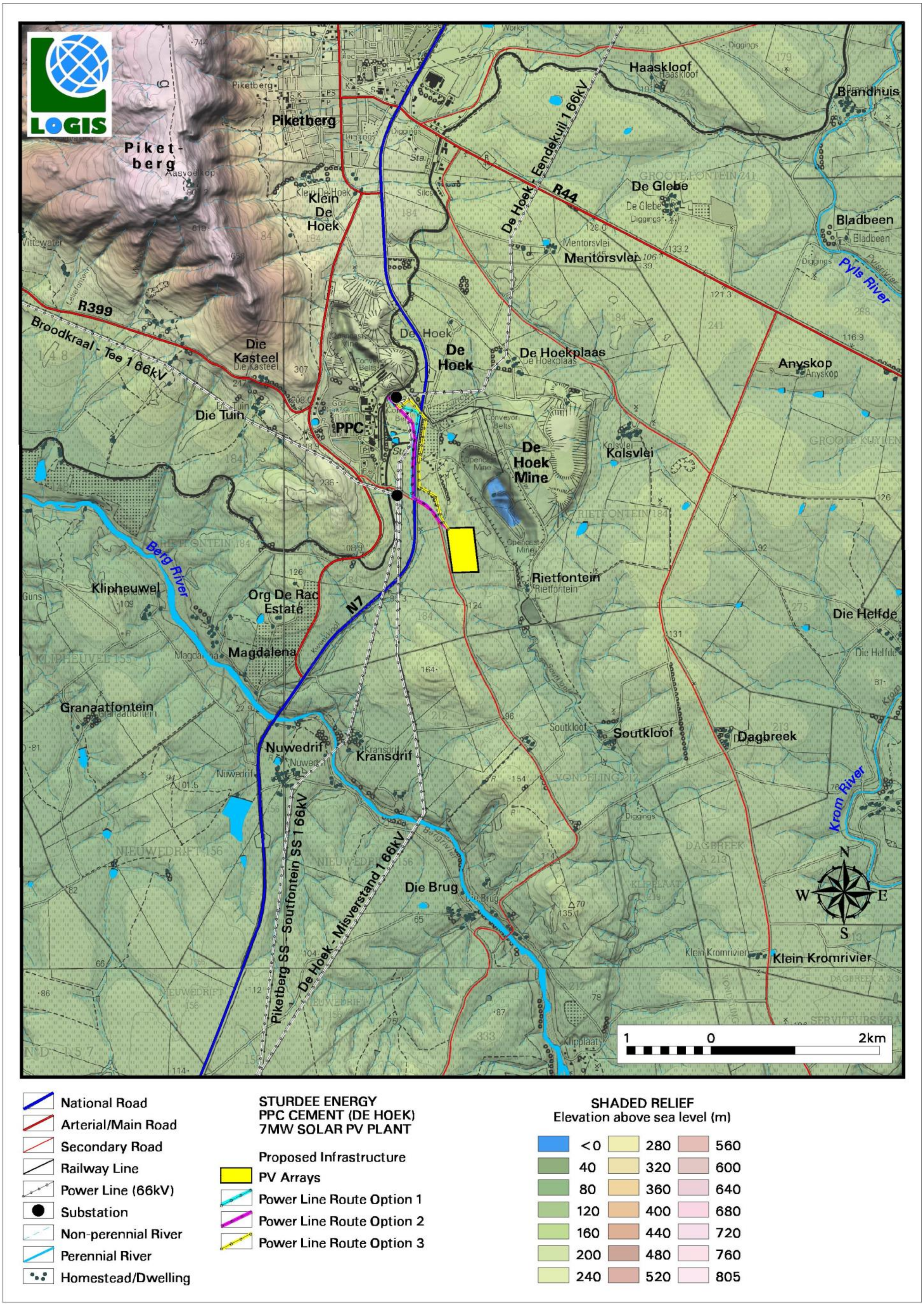
Figure 9: View from the development site to the Org de Rac Wine Estate.

Figure 10: The N7 national road north of the site (note road cutting).

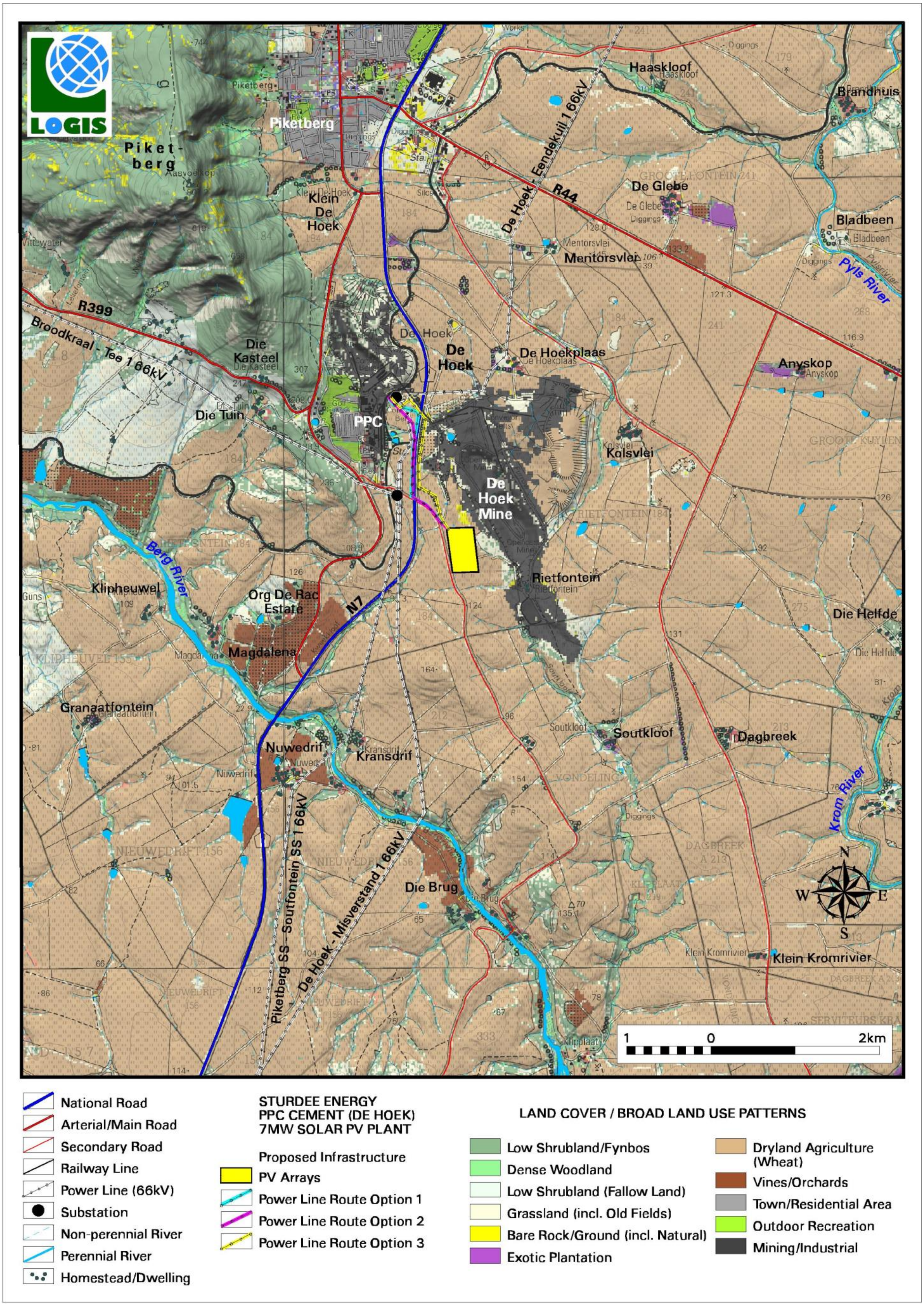
Figure 11: De Hoek Substation and railway line.

Figure 12: View from the R399 (at Dunn's Castle) towards the development site.

Figure 13: Vineyards at Org de Rac.



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 plant and ancillary infrastructure

The result of the viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The viewshed analysis was undertaken from 1,683 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 and inverters) associated with the facility.

The viewshed analyses include the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

It is expected that the proposed PV plant may be relatively visible within a 1km radius from the plant. The position of the plant on a slight rise within the landscape will expose it to observers travelling along the N7 national road, the R399 arterial road and Die Brug secondary road (traversing adjacent to the plant). It is also evident from the viewshed analysis that the Zoutkloof pit and the dump north-east of this pit would shield exposure to the north-east. There are no residences or homesteads within this zone, as the Rietfontein homestead does not exist anymore due to the expansion of the mining activity to the Vondelings pit.

Within a 1 – 3km radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography, and planted vegetation cover and structures present at the PPC Cement village and factory. Visibility is expected from sections of the roads mentioned above, as well as from the eastern outlying areas of the Org de Rac Wine Estate and vineyards. The PV plant will not likely be visible from the buildings and other facilities at the estate. Potential visual exposure to homesteads may include the Soutkloof and an unnamed dwelling located south-east of the plant. The De Hoekplaas homestead is located north of the plant and the Zoutkloof pit, but exposure from this receptor site is unlikely due to existing structures and disturbances located between the plant and the residences.

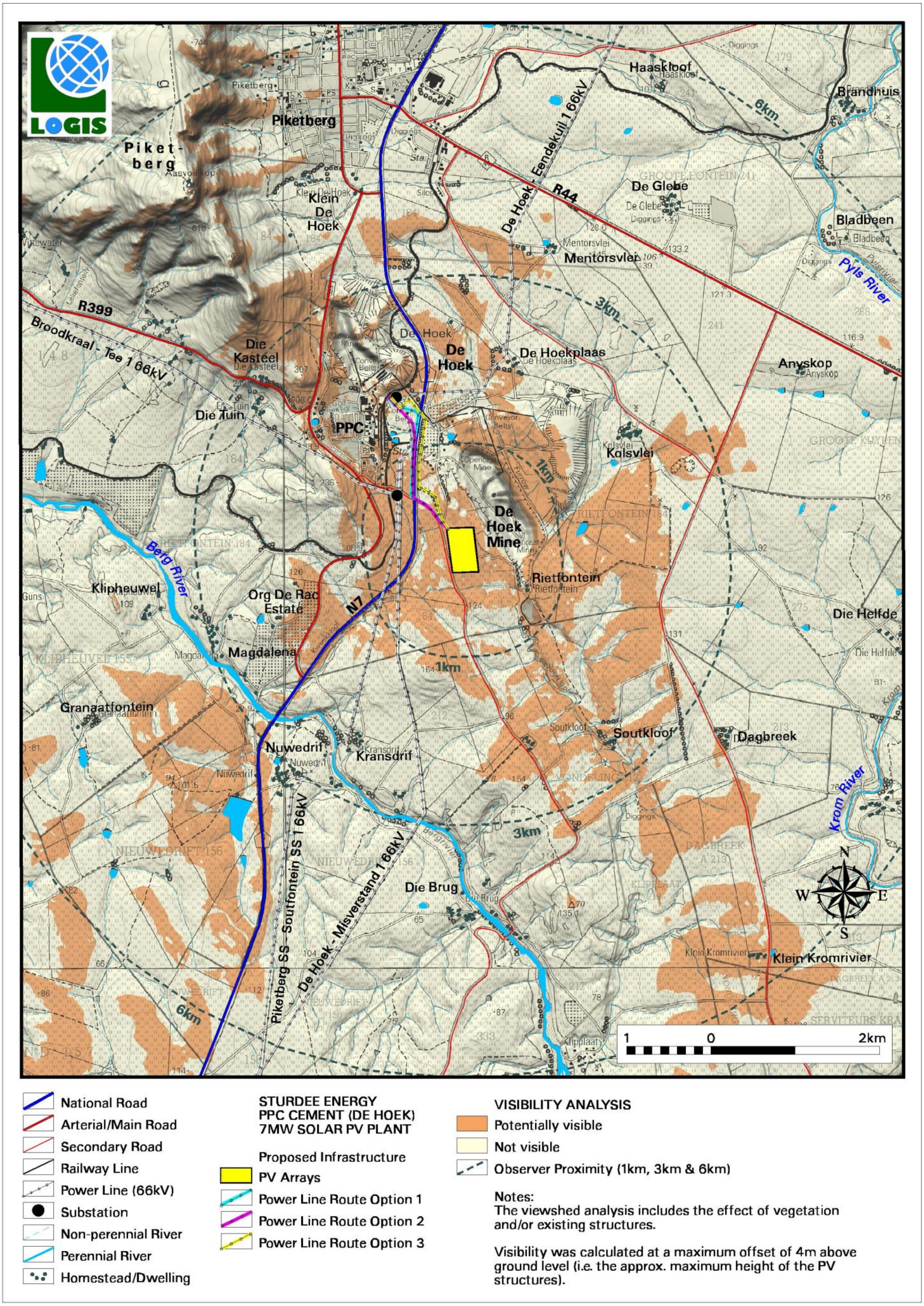
The Dunn’s Castle Guest House and associated facilities are not expected to be exposed to the PV plant infrastructure.

Visibility within 3 - 6km is greatly reduced and is primarily expected from higher ground (e.g. the south-east-facing slopes of the Piketberg) or vacant farm land to the south-west (south of the Berg River). The Klein Kromrivier homestead is located to the south-east and may be exposed to the PV plant at a distance of almost 6km.

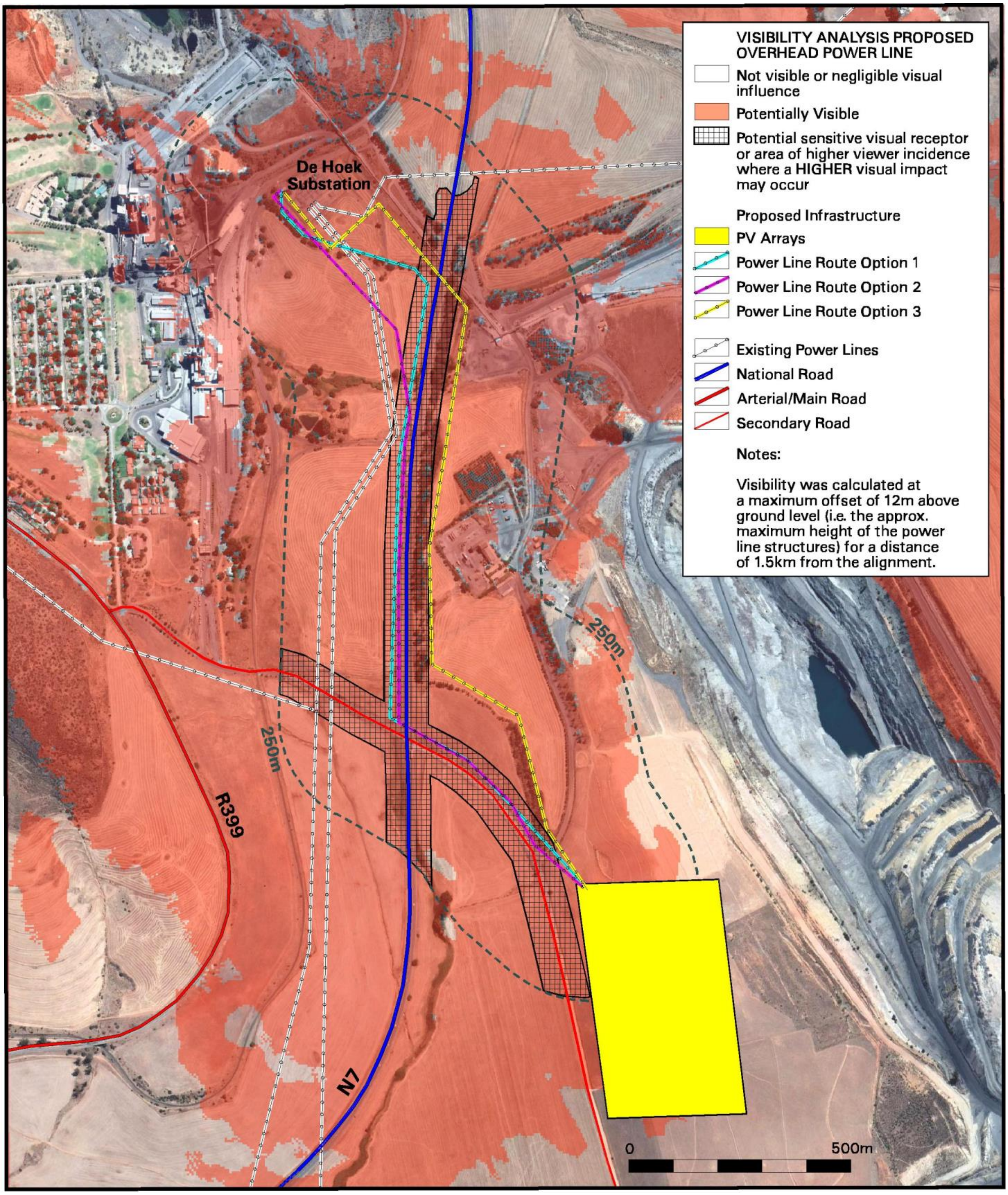
At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer. Overall, most of the areas of visual exposure, not just beyond a 6km radius but within the entire study area, fall within vacant farm land, generally devoid of potential observers.

Conclusion

In general terms it is envisaged that the structures, where visible from shorter distances (e.g. less than 1km and potentially up to 3km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. This may include residents of the Soutkloof and unnamed homesteads to the south-east (at distances exceeding 2km), but is more likely to impact on observers travelling along the roads in closer proximity (less than 1km) to the facility.



Map 3: Viewshed analysis of the proposed PV plant.



Map 4: Viewshed analysis of the proposed 11.5kV power line options.

6.2. Potential visual exposure – 11.5kV overhead power line

The visibility of the proposed power line alignment between the PV plant and the 11.5kV De Hoek substation (at the PPC cement factory) is shown on **Map 4** above. The visibility analysis was undertaken along the alignments at an offset of 12m above average ground level (i.e. the maximum height of the power line structures), for a distance of 1.5km from the centre line. The viewshed analysis was restricted to a 1.5km 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. an 11.5kV power line). The diagram below indicates the relative size and prominence of 11.5kV power lines in comparison to larger power line towers (e.g. 132kV and 400kV power lines).

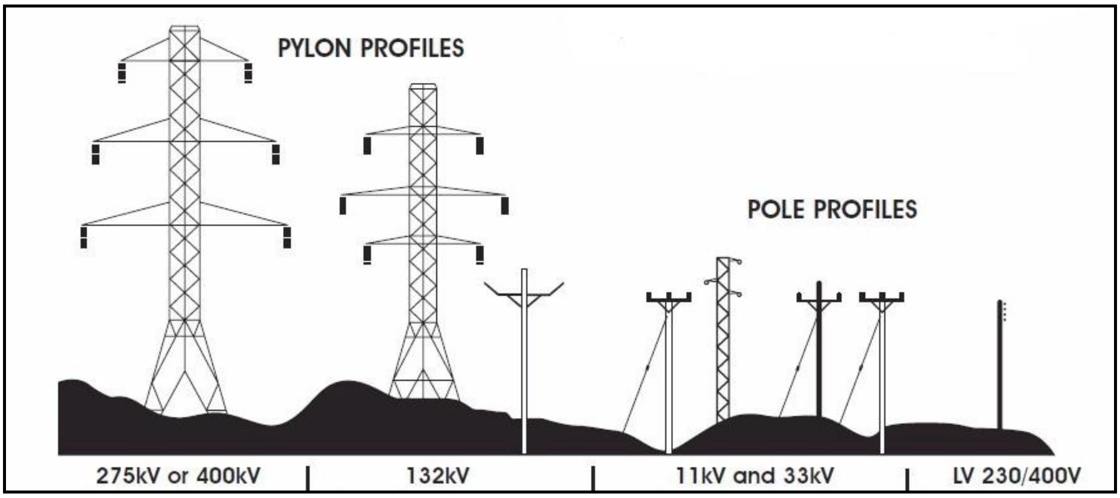


Figure 14: Schematic comparison of power line towers.

It is expected that the power line may be visible (all three alternatives) within the 1.5km corridor and potentially highly visible within a 250m radius of the power line structures, due to the generally flat terrain it traverses. Potential sensitive visual receptors for Options 1 and 2 include observers travelling along the Die Brug secondary road and the N7 national road. These proposed power line options will traverse adjacent to the N7 national road for respectively 975m (Option 1) and 740m (Option 2).

It should be noted that the power line Options 1 and 2 will not be viewed in isolation due to the presence of the *De Hoek - Misverstand 1 66kV* and *Piketberg Switching Station - Soutfontein Switching Station 1 66kV* power lines that also traverse adjacent to this road. These power lines are larger in size (66kV) and are expected to absorb the exposure of the 11.5kV power line to some degree.

The Option 3 power line alternative will traverse west of the N7 for a distance of 895m. Visual exposure to this road is however largely obstructed by planted vegetation (*eucalyptus* trees) alongside the road (see **Figure 16**). It is expected that this alternative will only be visible from the N7 where it crosses the road

6.3. Potential cumulative visual exposure

There are no existing or authorised renewable energy facilities within the study area. The closest authorised or proposed facilities include a solar PV plant at Porterville and a wind energy facility south of Moorreesburg. Given the constrained visual exposure of the proposed PPC solar PV plant and the relatively long distances (beyond 20km) between the facilities, no cumulative visual exposure (or combined visual impact) is expected.

6.4. Visual distance / observer proximity

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger solar plants (e.g. more extensive infrastructure associated with power plants exceeding 20MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the proposed 7MW PV plant). This methodology was developed in the absence of any known and/or accepted standards for South African solar energy facilities.

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 predominantly 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 proposed PV plant 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 footprint are indicated on **Map 5**, and include the following:

- 0 - 1km. Very short distance view where the PV facility 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.

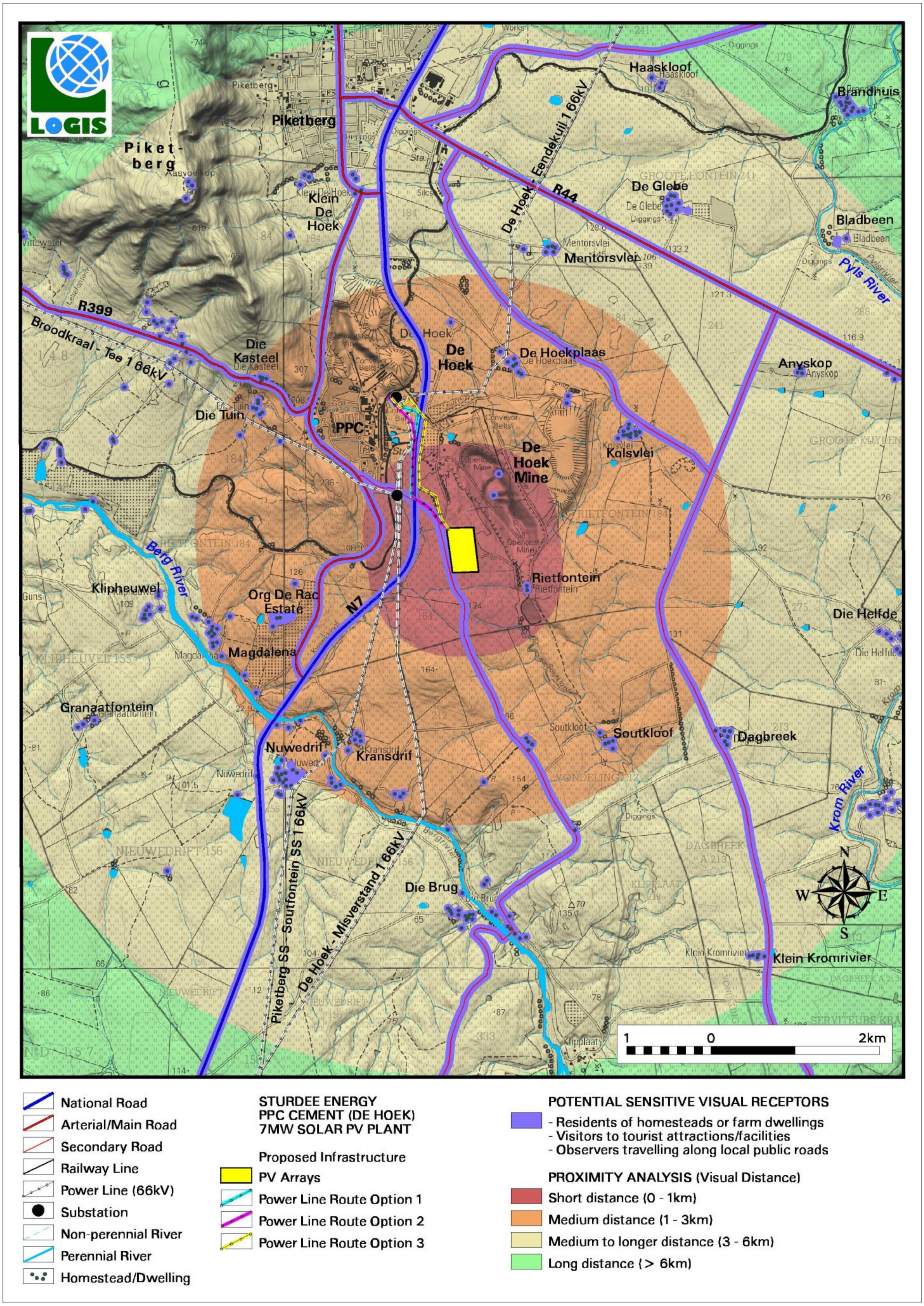
It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed solar energy facility and its related infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, 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 public roads within the study area. Travellers using these roads may be negatively impacted upon by visual exposure to the PV plant.

Additional sensitive visual receptors are located at the farm dwellings or homesteads located throughout the study area. The two identified tourist attractions, or tourist facilities (Org de Rac and Dunn's Castle) are also included as potential sensitive receptor sites.

It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the PPC PV plant, would generally be negative.

Refer to **Map 5** below for the location of these receptor sites.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.6. Visual absorption capacity

The broader study area is located within the Fynbos biome generally characterised by natural, low woody shrubland communities, where the total plant canopy cover is typically both dominant over any adjacent bare ground exposure, and the canopy height ranges between 0.2 – 2 metres. The majority of these shrubland communities have been transformed through dryland agriculture (predominantly wheat farming) and only occur within mountainous terrain.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment in closer proximity to the proposed PV plant and power line is deemed low due to removal of the natural 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. Within this area the VAC of vegetation will not be taken into account, thus assuming a worst case scenario in the impact assessment.

Within the built-up and industrial areas at the PPC village and the cement factory the VAC will be very high due to the shielding effect of built structures and planted vegetation. This has largely been demonstrated by the viewshed analyses (**Section 6.1**) where the built structures and vegetation cover were built into the DTM, prior to performing the analyses.

Figure 15: Ploughed fields (low VAC).

Figure 16: Planted vegetation along the N7 national road (high VAC).

6.7. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed PV facility are displayed on **Map 6**. 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 to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) 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.

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 subsequently subsides with distance to; **high** within a 1– 3km radius (where/if sensitive receptors are present) and

moderate within a 3 – 6km radius (where/if sensitive receptors are present). Receptors beyond 6km are expected to have a **low** potential visual impact.

Magnitude of the potential visual impact

The PV Plant may have a visual impact of **very high** magnitude on the following observers:

Observers travelling along the:

- N7 national road, the R399 arterial road and Die Brug secondary road west of the proposed facility

There are no residences within a 1km radius of the proposed PV plant.

The facility may have a visual impact of **high** magnitude on the following observers:

Residents of/or visitors to:

- The Org de Rac eastern outlying areas and vineyards
- The De Hoekplaas homestead
- The Soutkloof homestead

The facility may have a visual impact of **moderate** magnitude on the following observers:

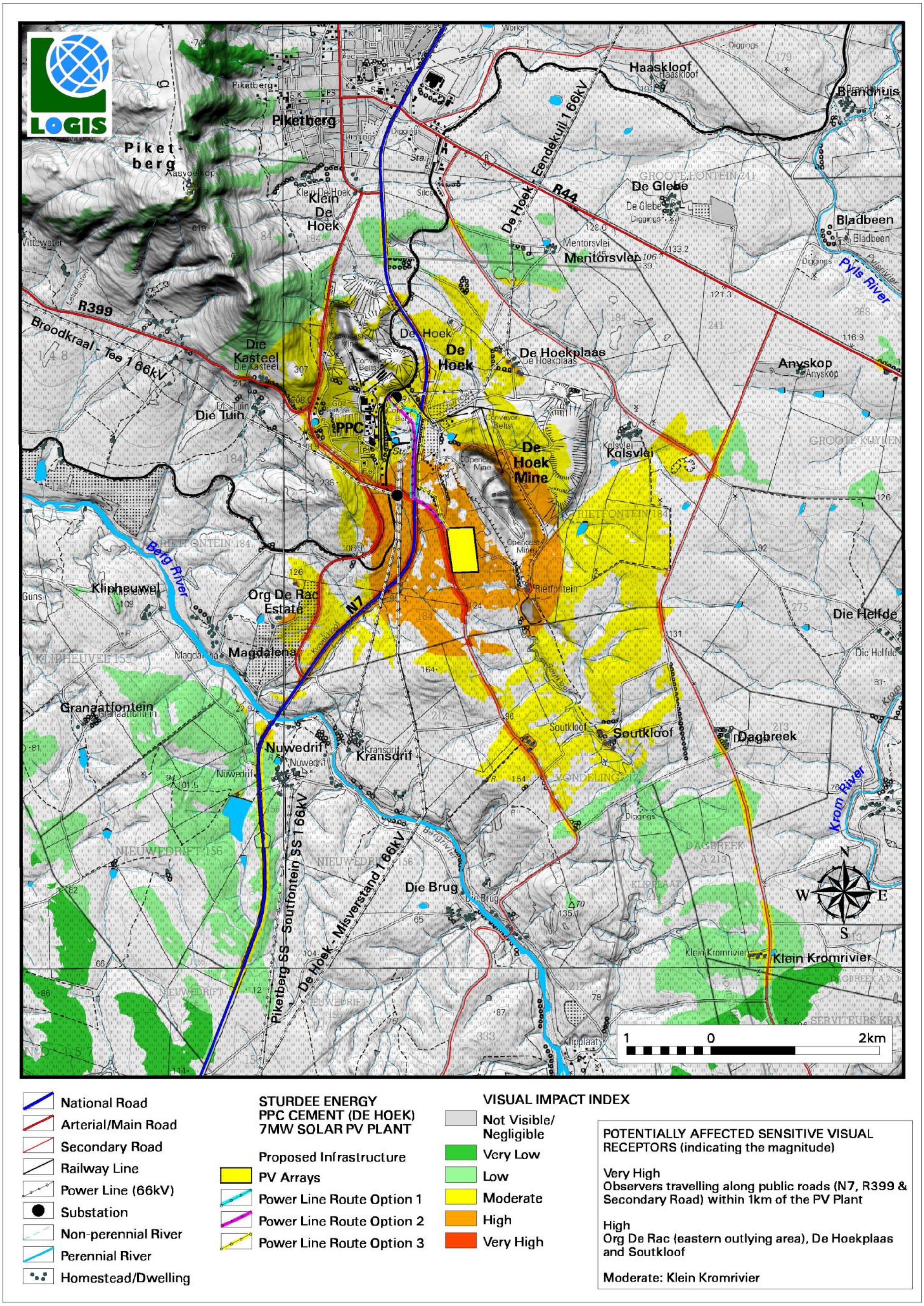
Residents of/or visitors to:

- The Klein Kromrivier homestead

Notes:

The presence of mining activities and infrastructure in between the De Hoekplaas homestead and the proposed PV plant reduces the probability of this impact occurring.

Where dwellings are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.



Map 6: 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 PV facility) 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)[4].
- **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)[5].
- **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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[4] Local = within 1km of the development site. Regional = between 1-3km (and potentially up to 6km) from the development site.
[5] 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 PV plant are assessed below.

6.9.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV plant 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 3: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV plant.

Activity/Structure:	Construction activities: PV plant and power line				
Impact:	Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility and power line.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	2	2	6	4	**40**
Post-mitigation	2	2	4	3	**24**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Retain and maintain natural vegetation (if present) immediately adjacent to the development footprint and any fire break buffer zones. Construction: •Construct temporary screens west of the PV plant construction site to shield construction activities from observers travelling along public roads. •Ensure that vegetation is not unnecessarily removed (outside of the development footprint/power line servitude) during the construction phase. •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. •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.
Cumulative impacts:	•None
Residual impacts:	•None, provided rehabilitation works are carried out as specified.
Climate change:	•N.A.

6.9.2. Potential visual impact on sensitive visual receptors located within a 1km radius of the PV facility structures.

There are no homesteads within a 1km radius of the proposed PV facility.

The PV facility is expected to have a **moderate** visual impact (significance rating = 36) on observers traveling along the N1 national road and the R399 arterial road within a 1km radius of the operational PV structures, after mitigation.

Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended. The table below illustrates this impact assessment.

Table 4: Visual impact on observers in close proximity to the proposed PV plant structures.

Activity/Structure:	PV plant				
Impact:	Visual impact on observers travelling along the roads within a 1km radius of the PV facility structures.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	8	4	**56**
Post-mitigation	4	2	6	3	**36**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. •Consult adjacent landowners (if present) 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.				
Cumulative impacts:	•None				
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.				

Climate change:	•N.A.

6.9.3. Potential visual impact on sensitive visual receptors within the region (1 – 3km radius)

The following potential sensitive visual receptors are located within a 1 – 3km radius of the proposed PV facility:

- The Org de Rac eastern outlying areas and vineyards
- The De Hoekplaas homestead
- The Soutkloof homestead

The operational PV facility could have a **moderate** visual impact (significance rating = 30) on observers located between a 1 – 3km radius of the PV facility structures, both before and after the implementation of mitigation measures.

Table 5: Visual impact of the proposed PV facility structures within the region.

Activity/Structure:	PV plant				
Impact:	Visual impact on observers travelling along the roads and residents at homesteads within the region (within a 1 – 3km radius of the PV facility structures).				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	3	8	2	**30**
Post-mitigation	4	3	8	2	**30**
Is the impact reversible?	Yes				
Mitigation measures:	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.				
Cumulative impacts:	•None				
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.				
Climate change:	•N.A.				

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 PV facility.

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 PV facility may contribute to the effect of sky glow within the environment which is currently (predominantly) 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 PV facility 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 6: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed PV plant.

Activity/Structure:	PV plant				
Impact:	Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed PV plant.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	8	3	**42**
Post-mitigation	4	2	6	2	**24**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •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.				
Cumulative impacts:	•None				
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.				
Climate change:	•N.A.				

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 off 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, military 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 7MW PV facility) especially where the incidence angle (angle of incoming light) is smaller i.e. the panel is facing the sun directly. This is particularly true for tracker arrays that are designed to track the sun and keep the incidence angle as low as possible.[6]

The proposed PV facility is not located near any airports or airfields and there are no residences within a 1km radius of the proposed development. As such, the potential visual impact related to solar glint and glare is expected to be of **low** significance (significance rating = 20).

Table 7: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction and possible air travel hazard.

Activity/Structure:	PV panels				
Impact:	The visual impact of solar glint and glare as a visual distraction and possible air travel hazard.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	4	2	**20**
Post-mitigation	N.A.	N.A.	N.A.	N.A.	**N.A.**
Is the impact reversible?	N.A.				
Mitigation measures:	•N.A.				
Cumulative impacts:	•None				
Residual impacts:	•N.A.				

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

Climate change:	•N.A.

Potential visual impact of solar glint and glare as a visual distraction and possible hazard to road users

The previous section addressed solar glint and glare as a possible air travel hazard. This section relates to ground-based receptors, and specifically to the possible impact of glint and glare as a hazard to road users travelling along the N7 national road. The exposed section of this road is located 413m west of the proposed PV plant (at the closest). This section of road is located at an average elevation of 96m above sea level (a.s.l.). The PV plant is located at an average elevation of 120m a.s.l., with a minimum elevation of 117m a.s.l. The road is therefore located approximately 21m lower within the landscape than the PV plant (refer to **Figure 17** below).

The R399 arterial road is located 824m west of the PV plant at an average elevation of 130.5m a.s.l. or approximately 13.5m higher up in the landscape than the PV plant.

Based on research and industry experience, the glint and glare from tracking panels with back tracking towards ground-based receptors are most common when the panels are flat in the morning/evening. This is when the larger incidence angle (angle of incoming light) yields more reflected light. Therefore, based on the topographical conditions described above, ground-based receptors located lower than the PV panels (i.e. observers travelling along the N7) would not experience a reflection due to the 0° tilt (lying flat) of the panels in the mornings. The observers would theoretically be looking at the base (underside) of the panels.

The R399 arterial road would be at a greater risk of glint and glare impacts due to its elevated position within the landscape. However, this road is located at a distance of more than 800m away. The intensity of the light reflected from the solar panels decrease with increasing distance, and is directly proportional to the size of the PV array, which in this case is a relatively small 7MW installation.[7]

Based on the above the visual impacts associated with glint and glare on road users are expected to be of **low** significance (significance rating = 21), both before and after mitigation.

Table 8: Impact table summarising the significance of the visual impact of solar glint and glare as a visual distraction and possible hazard to road users.

Activity/Structure:	PV panels				
Impact:	The visual impact of solar glint and glare as a visual distraction and possible hazard to road users.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	1	2	6	3	**27**
Post-mitigation	1	2	4	3	**21**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Use anti-reflective panels and dull polishing on structures.				

[7] Sources: Pager Power Urban and Renewables & Forge Solar.

	•Operations: •Adjust tilt angles of the panels if glint and glare issues become evident. •If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site. Decommissioning: •Remove infrastructure not required for the post-decommissioning use.
Cumulative impacts:	•None
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.
Climate change:	•N.A.

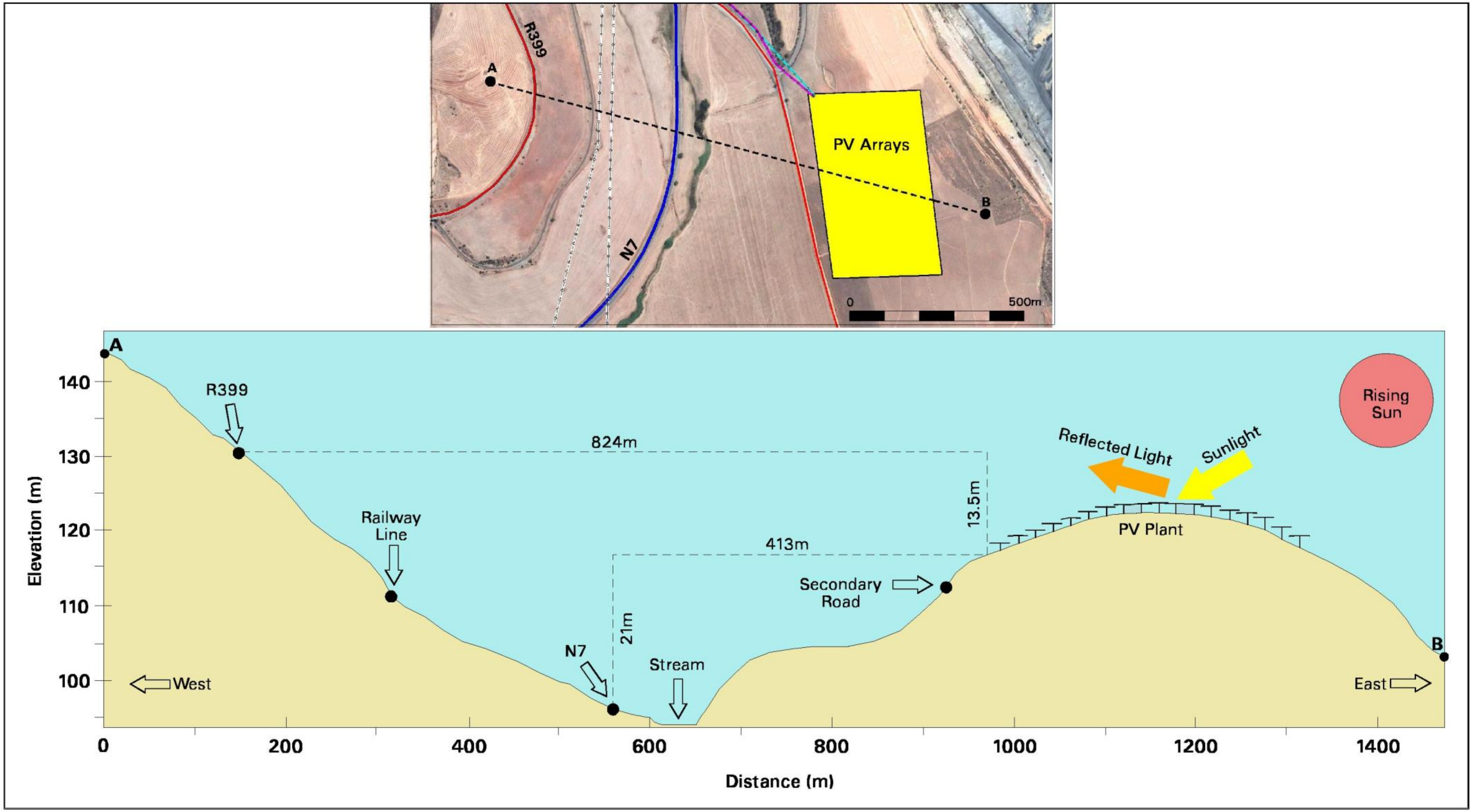

Figure 17: Surface profile indicating the elevation an orientation of the PV plant in relation to the N7 and R399.

6.9.6. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes 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 9: Visual impact of the ancillary infrastructure.

Activity/Structure:	PV plant ancillary infrastructure				
Impact:	Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	4	2	**20**
Post-mitigation	4	2	4	2	**20**
Is the impact reversible?	Yes				
Mitigation measures:	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.				
Cumulative impacts:	•None				
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.				
Climate change:	•N.A.				

6.9.7. Potential visual impact on sensitive visual receptors located within a 250m radius of the power line structures

There are no homesteads within a 1km radius of the proposed 11.5kV power line.

The construction of the proposed power line (Options 1 and 2) could have a **moderate** visual impact (significance rating = 36) on observers traveling along the N1 national road and the R399 arterial road within a 250m radius of the power line structures. It should be borne in mind that the power line will be a more constrained 11.5kV line, potentially reducing the probability of the impact occurring.

The Option 3 power line alternative is expected to have a **low** visual impact (significance rating = 24) due to its visual exposure largely being obstructed by planted vegetation alongside the N7 national road.

No mitigation of this impact is possible (i.e. the power line structures will be visible regardless), but mitigation measures are recommended as best practice. The tables below illustrate this impact assessment.

Table 10: Visual impact on observers in close proximity to the proposed power line structures (Options 1 and 2).

Activity/Structure:	11.5kV power line				
Impact:	Visual impact on observers travelling along the public roads in close proximity to the power line.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	6	3	**36**
Post-mitigation	4	2	6	3	**36**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Retain/re-establish and maintain natural/planted vegetation immediately adjacent to the servitude. Operations: •Maintain the general appearance of the servitude as a whole. Decommissioning: •Remove infrastructure not required for the post-decommissioning use of the servitude. •Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.				
Cumulative impacts:	•The construction of an additional power line, together with the existing distribution power lines in the area is likely to increase the potential cumulative visual impact of electricity distribution infrastructure within the region.				
Residual impacts:	•The visual impact will be removed after decommissioning, provided the power line infrastructure is removed. Failing this, the visual impact will remain.				
Climate change:	•N.A.				

Table 11: Visual impact on observers in close proximity to the proposed power line structures (Option 3).

Activity/Structure:	11.5kV power line				
Impact:	Visual impact on observers travelling along the public roads in close proximity to the power line.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	2	6	2	**24**
Post-mitigation	4	2	6	2	**24**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Retain/re-establish and maintain natural/planted vegetation immediately adjacent to the servitude. Operations: •Maintain the general appearance of the servitude as a whole.				

	Decommissioning: •Remove infrastructure not required for the post-decommissioning use of the servitude. •Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Cumulative impacts:	•The construction of an additional power line, together with the existing distribution power lines in the area is likely to increase the potential cumulative visual impact of electricity distribution infrastructure within the region.
Residual impacts:	•The visual impact will be removed after decommissioning, provided the power line infrastructure is removed. Failing this, the visual impact will remain.
Climate change:	•N.A.

6.10. Visual impact assessment: secondary impacts

The potential visual impact of the proposed PV facility 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 beyond the PPC cement factory and De Hoek mine has a rural, undeveloped character and a predominantly 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 PV plant and power line 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.

Table 12: The potential impact on the sense of place of the region.

Activity/Structure:	PV plant and power line				
Impact:	The potential impact on the sense of place of the region.				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Pre-mitigation	4	3	4	2	**22**
Post-mitigation	4	3	4	2	**22**
Is the impact reversible?	Yes				
Mitigation measures:	Planning: •Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: •Maintain the general appearance of the facility/servitude as a whole. Decommissioning:				

	•Remove infrastructure not required for the post-decommissioning use. •Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.
Cumulative impacts:	•None
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility and power line infrastructure is removed. Failing this, the visual impact will remain.
Climate change:	•N.A.

The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

There are no existing or authorised renewable energy facilities within the study area. The closest authorised or proposed facilities include a solar PV plant at Porterville and a wind energy facility south of Moorreesburg. Given the constrained visual exposure of the proposed PPC solar PV plant and the relatively long distances (beyond 20km) between the facilities, no cumulative visual exposure (or combined visual impact) is expected.

Table 13: The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

Activity/Structure:	The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.				
Impact:	Cumulative				
Significance rating:	**Duration**	**Extent**	**Magnitude**	**Probability**	**Significance**
Overall impact of the proposed project considered in <u>isolation</u> (with mitigation)	4	2	6	3	**36**
<u>Cumulative</u> impact of the project and other projects within the area (with mitigation)	4	3	0	1	**7**
Is the impact reversible?	No, only best practise measures can be implemented				
Mitigation measures:	<u>Planning:</u> ***Generic best practise mitigation/management measures:*** •Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. <u>Operations:</u> •Maintain the general appearance of the facility/servitude 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.
Cumulative impacts:	•None
Residual impacts:	•The visual impact will be removed after decommissioning, provided the PV facility 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 PV facility 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:

- Construct temporary screens west of the PV plant construction site to shield construction activities from observers travelling along public roads.
- 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 laydown 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.

- Glint and glare impact mitigation measures include the following:

  - Use anti-reflective panels and dull polishing on structures.
  - Adjust tilt angles of the panels if glint and glare issues become evident.
  - If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site.

- 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 PV facility (i.e. visual character and sense of place) are not possible to mitigate.

- Where sensitive visual receptors (if present), are likely to be affected it is recommended that the developer enter into negotiations with the 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.

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 7MW SEF and its associated infrastructure, may have a visual impact on the study area, especially within (but potentially not restricted to) a 1km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The proposed development site for the PV plant is located on mining land within relatively close proximity to existing mining infrastructure, activities and other visual disturbances. The PV plant will primarily be visible to observers travelling along the N7 national road, the R399 arterial road and the Die Brug secondary road. There are no residences within a 1km radius of the proposed PV plant.

The immediate environment surrounding the proposed development site is not considered to have a high visual quality or specific sense of place due to the disturbance brought about by the PPC cement factory and De Hoek mining operations. The visual impacts associated with the PV plant is therefore considered to be within acceptable limits and do not constitute an irreplaceable loss of visual resources.

Overall, the post mitigation significance of the visual impacts is expected to range from **moderate** to **low**. An additional mitigating factor for the proposed Solar PV plant is the fact that the facility utilises a renewable source of energy (considered as an international priority) to generate electricity and is therefore generally perceived in a more favourable light. The PV plant 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 6.11.**). 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 PV plant and associated infrastructure (both power line alternatives) 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 7MW PV plant and associated infrastructure is that the visual environment surrounding the site, especially within a 1km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

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

- 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. The construction activities may potentially result in a **moderate**, temporary visual impact that may be mitigated to **low**.

- The PV facility is expected to have a **moderate** visual impact on observers traveling along the N1 national road and the R399 arterial road within a 1km radius of the operational PV structures, after mitigation.

- The operational PV facility could have a **moderate** visual impact on observers located between a 1 – 3km radius of the PV facility structures, both before and after the implementation of mitigation measures.

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

- The proposed PV facility is not located near any airports or airfields and there are no residences within a 1km radius of the proposed development. As such, the potential visual impact related to solar glint and glare (in terms of a visual distraction and possible air travel hazard) is expected to be of **low** significance.

- The visual impacts associated with glint and glare on road users (N7 and R399) are expected to be of **low** significance, both before and after mitigation.

- 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 construction of the 11.5kV power line (Options 1 and 2) could have a **moderate** visual impact on observers traveling along the N1 national road and the R399 arterial road within a 250m radius of the power line structures. The Option 3 power line is expected to have a **low** visual impact on these observers. This is the preferred option from a visual impact perspective.

- The anticipated visual impact of the proposed PV plant and power line on the regional visual quality, and by implication, on the sense of place, is generally expected to be of **low** significance.

- The anticipated cumulative visual impact of the proposed PV facility is expected to be of **low** significance.

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

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.**).

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 the tables overleaf.

Table 14: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed 7MW PV facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, security lighting, workshop, power line, etc.).	
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 1km 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**
Use anti-reflective panels and dull polishing on structures.	Project proponent / contractor	Early in the planning phase.
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 lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the PV Facility and the ancillary infrastructure. The following is recommended: ○ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ○ Limit mounting heights of fixtures, or use foot-lights or bollard lights. ○ Make use of minimum lumen or wattage in fixtures. ○ Making use of down-lighters or shielded fixtures. ○ Make use of Low Pressure Sodium lighting or other low impact lighting. ○ 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	Monitor the resolution of complaints on an ongoing basis (i.e. during all phases of the project).

Table 15: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed 7MW PV facility.		
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**
Construct temporary screens south of the construction site to shield construction activities from observers travelling along local roads.	Project proponent / contractor	Early in the construction phase.
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 present 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 16: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed 7MW PV facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, workshop, etc.).	
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**
Adjust tilt angles of the panels if glint and glare issues become evident. If specific sensitive visual receptors are identified during operation, investigate screening at the receptor site.	Project proponent / operator	Throughout the operation phase.
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 17: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed 7MW PV facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, workshop, transformers, etc.).	
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	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover	

Indicator	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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