PROPOSED DICOMA PV FACILITY AND ASSOCIATED INFRASTRUCTURE, NORTH WEST PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Dicoma PV (Pty) Ltd

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 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 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. 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 North West Province).

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 facility layout/position.

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 resolution 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 infrastructure.

- **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 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 July 2021 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

The Applicant, Dicoma PV (Pty) Ltd, is proposing the construction of a photovoltaic (PV) solar energy facility (known as the Dicoma PV facility) located on a site approximately 5km north-west of the town of Lichtenburg in the North West Province. The solar PV facility will comprise several arrays of PV panels and associated infrastructure and will have a contracted capacity of up to 75MW. The development area is situated within the Ditsobotla Local Municipality within the Ngaka Modiri Molema District Municipality. The site is accessible via an existing gravel road which provides access to the development area off the R505, located east of the development area.

The development area for the PV facility and associated infrastructure will be located on the following properties: [2]

- Portion 1 of the Farm Houthaalboomen 31
- Portion 9 of the Farm Houthaalboomen 31
- Portion 10 of the Farm Houthaalboomen 31
- Portion 0 of Farm Talene 25
- Portion 7 of Farm Elandsfontein 34

Figure 1: Regional locality of the study area.

Two additional 75MW PV facilities (Barleria PV and Setaria PV) are concurrently being considered on the project site (within Portion 1, Portion 9, and Portion 10 of the Farm Houthaalboomen 31) and are assessed through separate Environmental Impact Assessment (EIA) processes.

A facility development area (approximately 180ha) as well as two alternative grid connection solutions (within a 100m wide corridor) has been considered in the Scoping Phase. The infrastructure associated with this 75MW PV facility includes:

[2] Two alternative locations for the grid connection infrastructure have been provided for assessment.

- PV modules and mounting structures
- Inverters and transformers
- Battery Energy Storage System (BESS)
- Site and internal access roads (up to 8m wide)
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.
- Temporary and permanent laydown area
- Grid connection solution (two alternative locations assessed) within a 100m wide corridor, including:

  - 33kV cabling between the project components and the facility substation
  - A 132kV facility substation
  - A 132kV Eskom switching station
  - A Loop-in-Loop out (LILO) overhead 132kV power line between the Eskom switching station and the existing Delareyville Munic–Watershed 1 88kV power line.[3]

The alternative grid connection configurations assessed include:

Grid Connection Alternative 1: 33kV MV cabling will connect the Dicoma PV solar array to the 132kV facility substation. The 132kV Eskom switching station is located directly adjacent to the development footprint of the facility substation. The facility substation and Eskom switching station are located approximately 1.3km east of the Dicoma PV facility on Portion 1 of the Farm Houthaalboomen 31. A 132kV Loop-in-Loop Out power line from the Eskom switching station will connect into the Delareyville Munic–Watershed 1 88kV.3 The grid connection infrastructure is located within an assessment corridor of 100m wide.

Grid Connection Alternative 2: 33kV MV cabling will connect the Dicoma PV solar array to the 132kV facility substation. The 132kV Eskom switching station is located directly adjacent to the development footprint of the facility substation. The facility substation and Eskom switching station are located within the development footprint of the Dicoma PV facility on Portion 1 of the Farm Houthaalboomen 31. A 132kV Loop-in-Loop Out power line from the Eskom switching station will connect into the Delareyville Munic–Watershed 1 88kV.3 The grid connection infrastructure is located within an assessment corridor of 100m wide.

To avoid areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer has identified a suitable development footprint within which the infrastructure of Dicoma PV facility and its associated infrastructure is proposed to be located.

The PV Plant facility will take approximately 12 - 18 months to construct and the operational lifespan of the facility will be a minimum of 20 years.

The proposed properties identified for the PV Plant and associated infrastructure are indicated on the maps within this report. Sample images of similar PV technology and Battery Energy Storage System (BESS) facilities are provided below.

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3 The LILO corridor intersects with several existing parallel Eskom power lines (Watershed-Sephaku 1 132kV, Dudfield–Watershed 2 88kV, Dudfield-Watershed 1 88kV, and Watershed-Klerksdorp North 1 132kV). Therefore, should the connection to the Delareyville Munic–Watershed 1 88kV not be technically feasible, connection to the above mentioned power lines would still be within the assessed LILO corridor and considered feasible through the construction of a shorter LILO connection.

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

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

Figure 4: Aerial view of a BESS facility (*Photo: Power Engineering International)*.

Figure 5: Close up view of a BESS facility *(Photo: Greenbiz.com).*

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed PV facility 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 approximately 298km² (the extent of the full page maps displayed in this report) and includes a 6km buffer zone (area of potential visual influence) from the proposed development footprint. It includes the town of Lichtenburg, sections of the R503 and R505 arterial roads as well as a number of major secondary (local) roads.

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

- The visibility of the facility to, and potential visual impact on, observers travelling along the secondary or arterial roads within the study area.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the farm residences or small holdings in closer proximity to the proposed development.
- 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 an area where additional solar energy facilities have been authorised.
- 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 air/road travel hazard.
- The potential visual impact of solar glint and glare on static ground receptors (residents of homesteads).
- 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:

- National Environmental Management Act 107 of 1998 (NEMA);
- 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); and
- Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

5. THE AFFECTED ENVIRONMENT

The identified site for the proposed PV facility is situated approximately 8km by road north-west of Lichtenburg, consisting of the farms Portion 1, Portion 9, Portion 10 of the Farm Houthaalboomen 31. The grid connection is located on Portion 1 of the Farm Houthaalboomen 31, and traverses Portion 0 of Farm Talene 25 and Portion 7 of Farm Elandsfontein 34. The project site is located in an area that has a distinct rural and agricultural character, with some mining/quarrying activity (cement works) located south-east of the proposed development site at a distance of 5km at the closest. The Watershed substation is located at a distance of 3.4km east of the proposed site. A great number of power lines, associated with this substation, are located south and north of the site. The power lines traversing the site to the south include:

- Watershed-Klerksdorp North 1 132kV
- Delareyville Municipal-Watershed 1 88kV
- Dudfield-Watershed 1 and 2 88kV
- Watershed-Sephaku 88kV line

Additional power lines associated with the Watershed Substation include:

- Watershed-Zeerust 1 132k
- Slurry PPC-Watershed 1 88kV
- Watershed-Mmabatho 1 and 2 88kV
- Pluto-Watershed 1 275kV
- Hera-Watershed 1 275kV
- Halfpad Traction-Watershed 1 132kV
- Whites North-Watershed 1 and 2 88kV
- Lichtenburg Munic/Watershed 1 88kV

Refer to **Figure 6** below for the farm identified for the PV Plant.

Access to the proposed development area is provided by a secondary (gravel) road that joins the R505 arterial road near the Watershed substation, east of the proposed site.

The natural vegetation or land cover types of the region are described as *Grassland*, with very limited *Thicket and Bushland* and *Wetlands* (in the south-east) and large tracts of agricultural fields (altered vegetation) to the west (see **Map 2**). The majority of the remaining natural vegetation within the study area is indicated as *Carltonville Dolomite Grassland* (to the north) with limited sections of Western *Highveld Sandy Grassland* to the south. Pans are generally absent within the study area.

Land use activities within the broader region are predominantly described as maize farming (both dryland and irrigated agriculture) and cattle farming, with some mining/quarrying activity (cement works located west of Lichtenburg) evident towards the south-east of the proposed site.

Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site, include: *Houthaalbomen, Boskoppie, Elandsfontein, Brakpan, Scherppunt, Greeflaagte*, etc. The Elandsfontein small holdings are located east of the farm identified for the PV facility. The population density of the region is indicated as approximately 19 people per km^2, predominantly concentrated within the town of Lichtenburg.

The topography or terrain morphology of the region is broadly described as *Plains and Pans* or *Slightly Undulating Plains* of the *Central Interior Plain*. The slope of the entire study area is extremely even (flat) with a very gradual drop (approximately 70m) from the northern section of the study area (1520m above sea level) to the *Die Vlei* River (1450m) which flows through Lichtenburg. This perennial river, wetlands and farm dams near this town, account for the dominant hydrological features within this region that receives between 500mm to 650mm rainfall per annum. See **Map 1** for the shaded relief/topography map of the study area.

No formally protected or conservation areas or major tourist attractions/resorts were identified within the study area. [4]

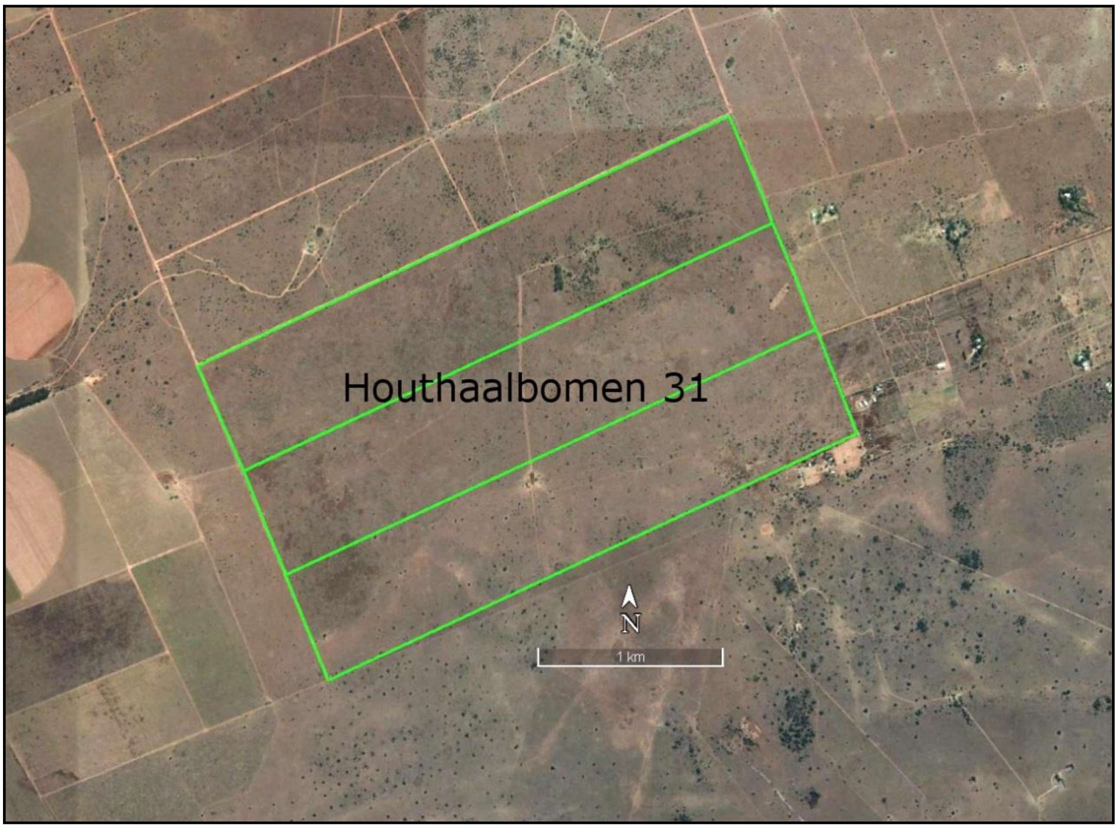

Figure 6: Aerial view of the farm identified for the PV Plant.

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[4] Sources: DEAT (ENPAT North West), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021_Q1 (DEA).

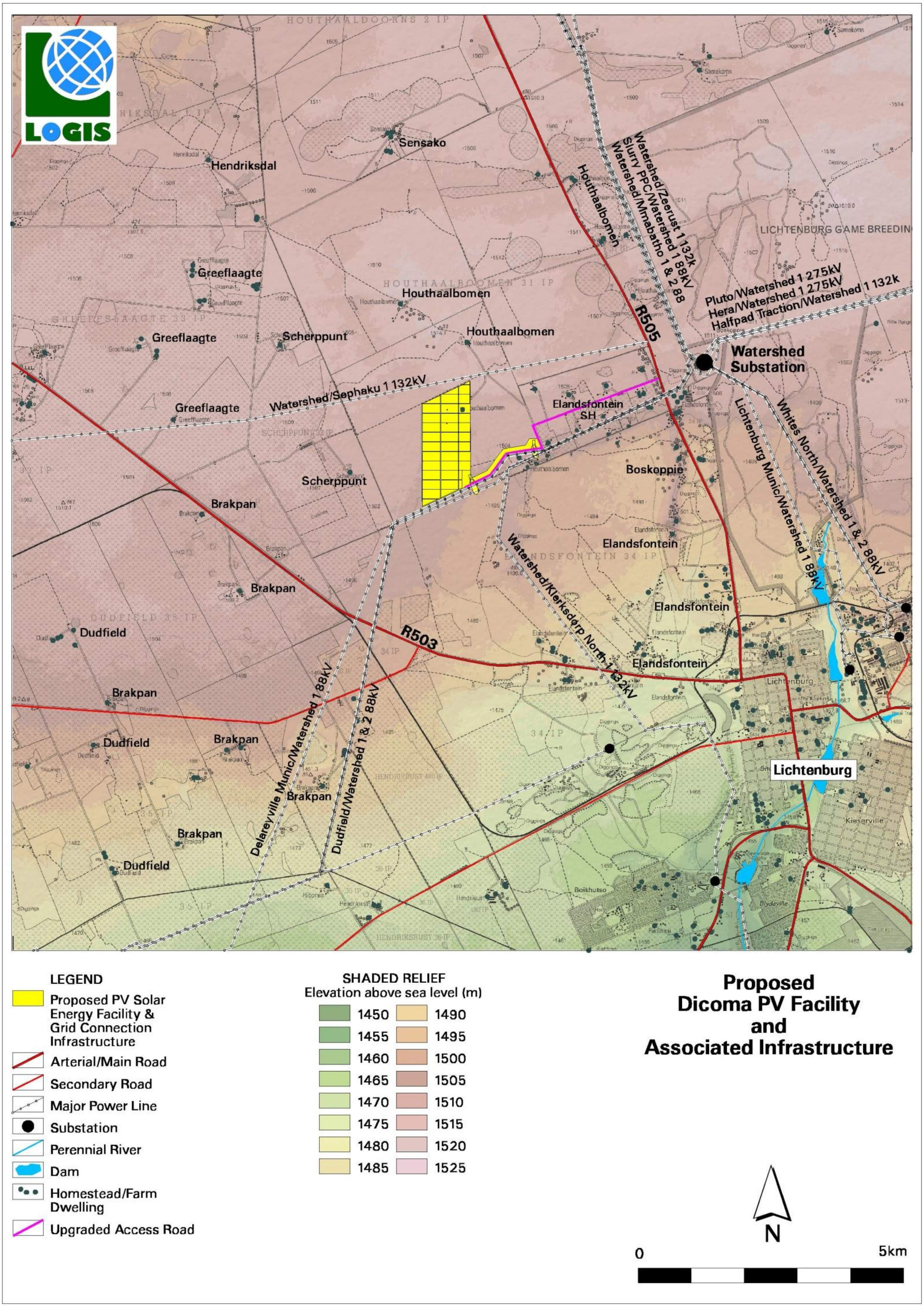
Figure 7: The Watershed Substation viewed from the R505 Arterial Road.

Figure 8: Power lines near the Watershed Substation.

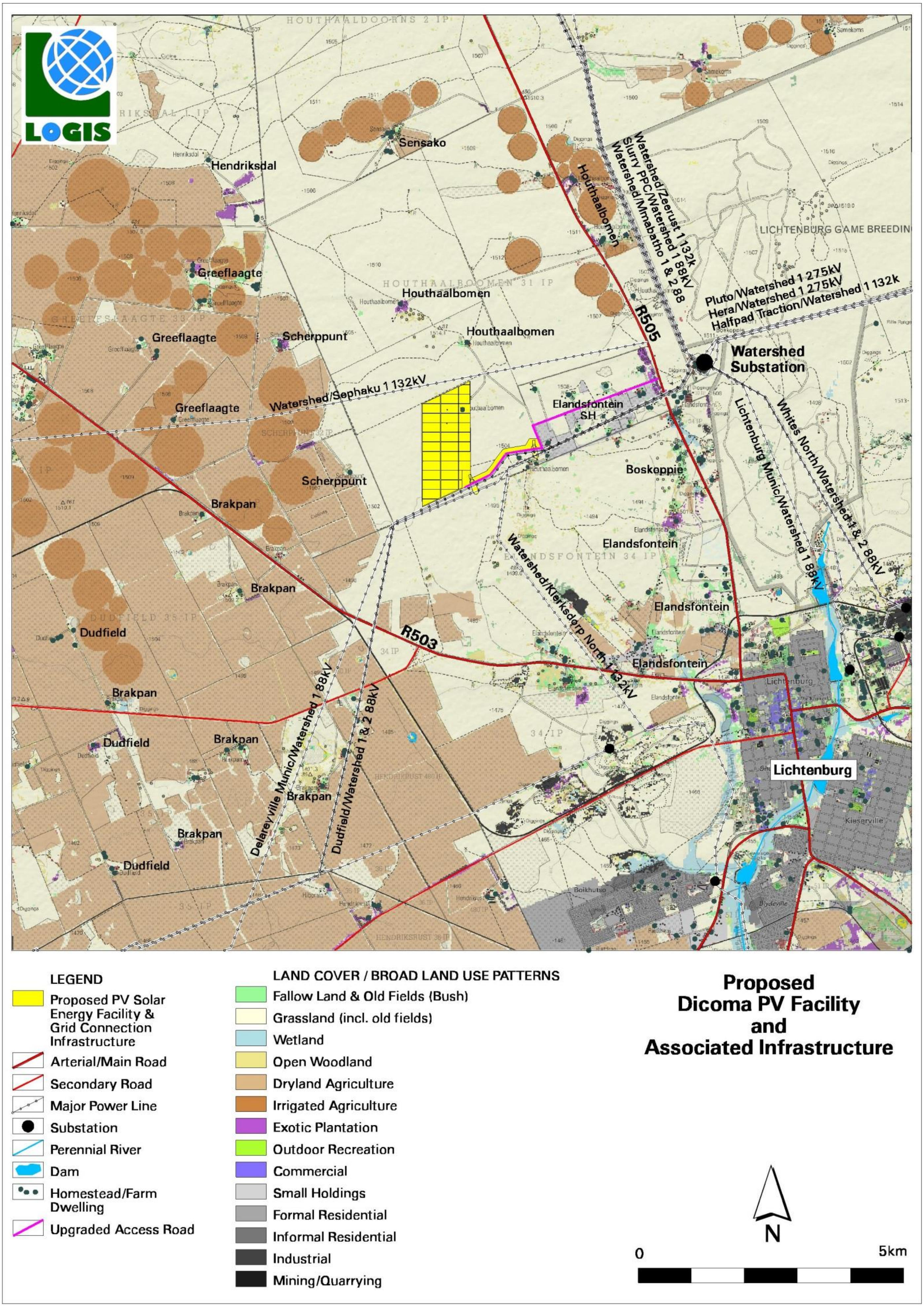
Figure 9: Irrigated (pivot) agriculture in the study area.

Figure 10: The general environment surrounding the proposed development site.

Figure 11: Cattle farming within the study area.



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

The result of the viewshed analysis for the proposed facility is shown on the map below (**Map 3**). The viewshed analysis was undertaken from a representative number of vantage points within the 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.

Map 3 also indicates proximity radii from the development footprint in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds.

The viewshed analysis includes the effect of vegetation cover and existing structures on the exposure of the proposed infrastructure.

Results

The following is evident from the viewshed analysis:

0 – 1km

The development would be quite easily visible within a 1km radius of the site. This area of visual exposure (0 – 1km) is generally restricted to vacant farmland and agricultural fields, but may contain some potential sensitive visual receptors. This pattern of exposure is generally attributed to the flat topography of the study area, with no hills or ridges influencing or interrupting the viewshed analysis. There is a single residence (Houthaalboomen 1) within this zone (to the north of the proposed PV facility).

1 – 3km

Within a 1 – 3km radius, the visual exposure is more scattered and interrupted due to the undulating nature of the topography. Most of this zone falls within vacant open space and agricultural land, but does include some farm dwellings and residences. Some of these include Scherppunt 1 and 2, and Houthaalboomen 2, as well as residences within the Elandsfontein small holdings. The R503 arterial road traverses a section of this zone to the south, where the facility may be visible.

3 - 6km

Visibility between the 3 - 6km radii is greatly reduced, but does include sections of the R505 and R503 arterial roads and a number of farm residences, namely Boskoppie, Elandsfontein and Brakpan.

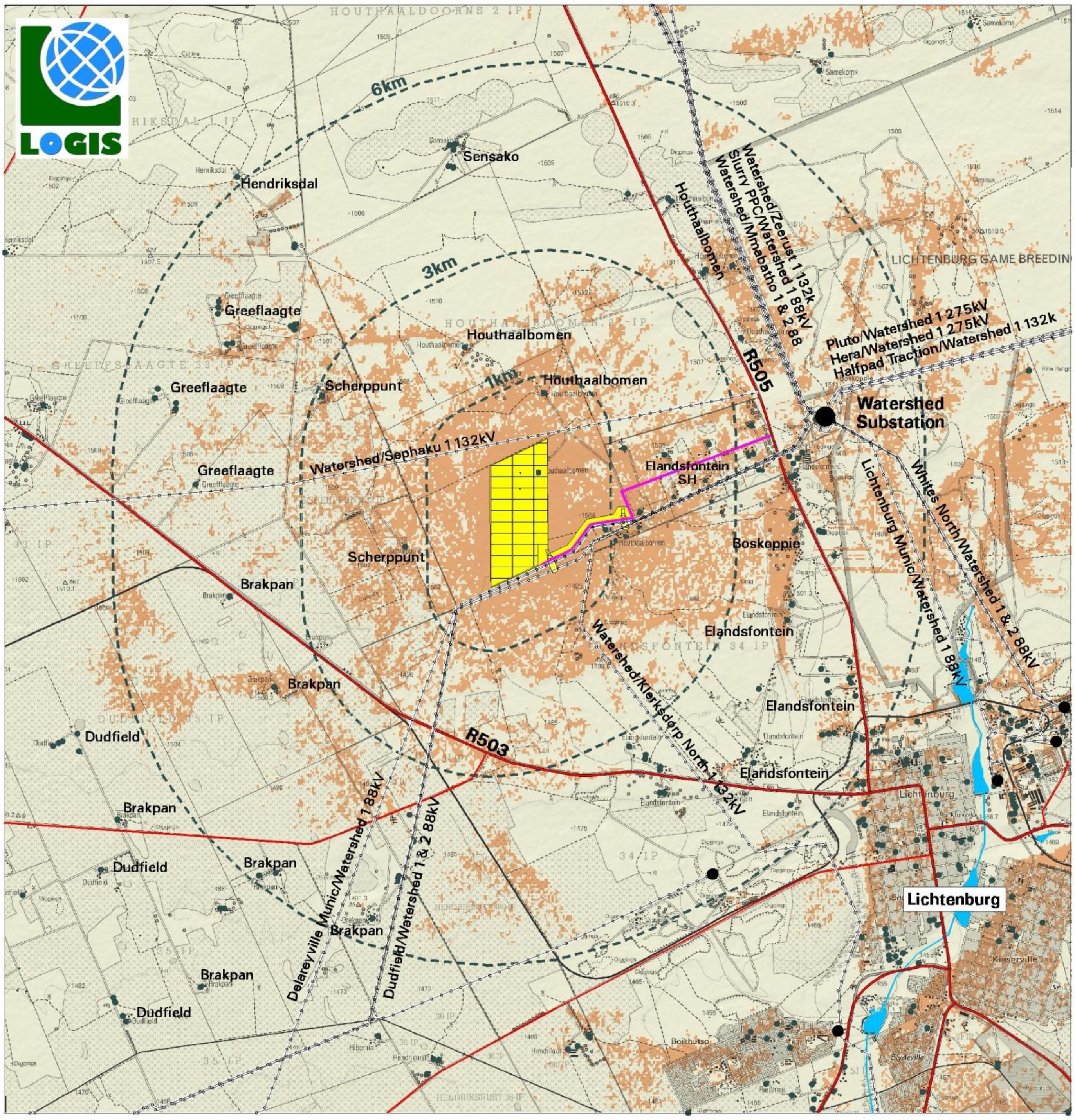
> 6km

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. The town of Lichtenburg is located beyond 6km from the facility, and although visibility my theoretically be possible, it is highly unlikely due to the built-up nature of the town.

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 farm dwellings mentioned above, as well as observers travelling along the R503 arterial road in closer proximity to the facility.

The incidence rate of sensitive visual receptors is however expected to be quite low, due to the generally remote location of the proposed development, the low number of potential observers and the assumed support of (most of) the land owners to the solar energy facility developments. This assumption is based on the number of applications for solar energy facilities in the study area.



LEGEND

- Proposed PV Solar Energy Facility & Grid Connection Infrastructure
- Arterial/Main Road
- Secondary Road
- Major Power Line
- Substation
- Perennial River
- Dam
- Homestead/Farm Dwelling
- Upgraded Access Road

PRELIMINARY VISIBILITY ANALYSIS

- Potentially Visible
- Not Visible
- Proximity Radii to the Proposed Development Site

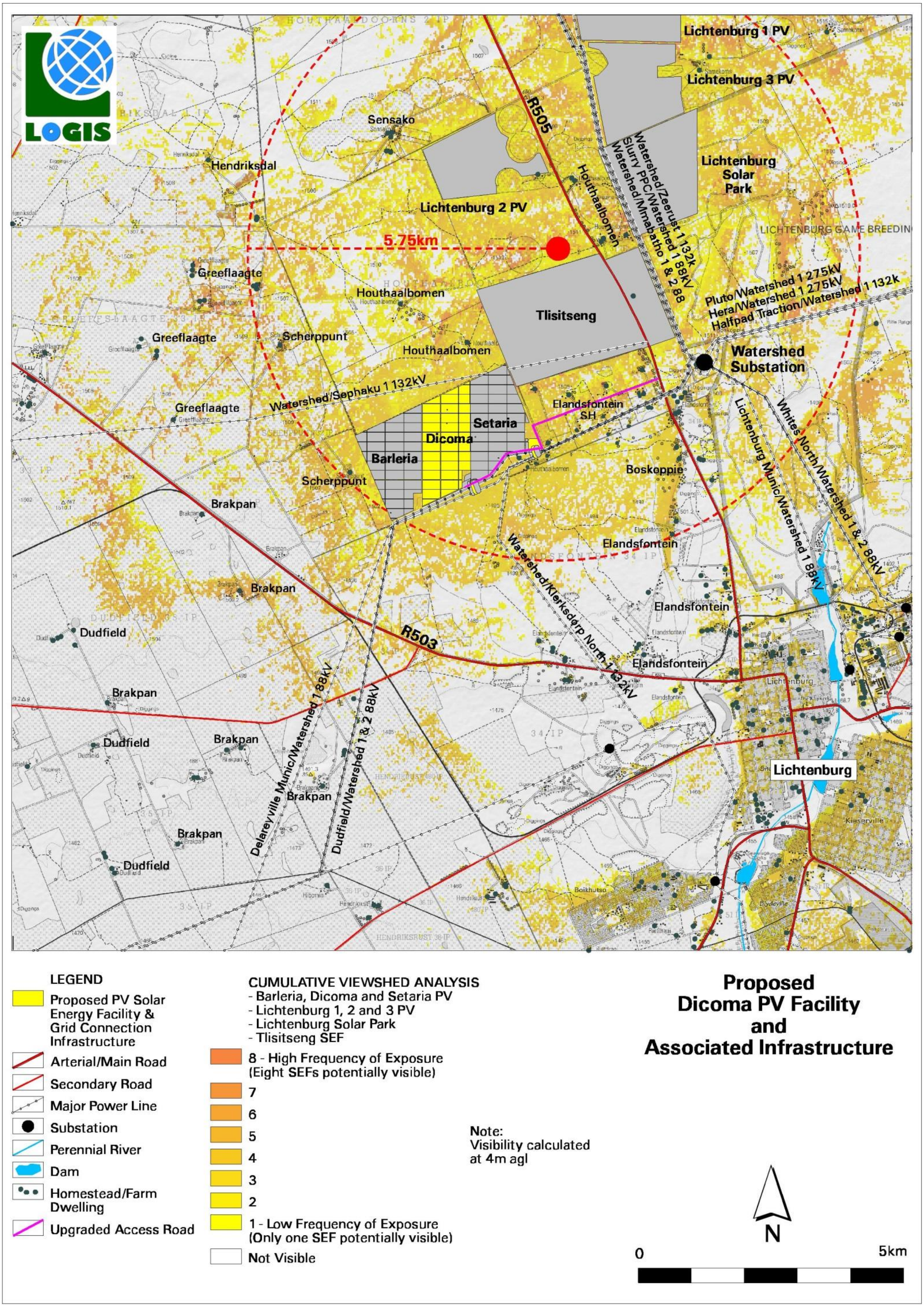
Notes:
Visibility was calculated at a maximum offset of 4m above ground level (i.e. the approximate maximum height of the PV structures).

Proposed Dicoma PV Facility and Associated Infrastructure

N

0 5km

Map 3: Viewshed analysis of the proposed Dicoma PV facility.



Map 4: Cumulative visual exposure.

6.2. Potential cumulative visual exposure

There are eight applications for Solar Energy Facilities (SEFs) in relative close proximity to the Watershed Substation. There are the Barleria, Dicoma and Setaria PV projects (currently in process) and five approved/authorised, but not yet constructed, SEFs. The authorised facilities include: Lichtenburg Solar Park, Tlisitseng SEF and Lichtenburg 1, 2 and 3 PVs. These facilities are located north-east of the proposed Dicoma PV facility.

The physical development footprints of all of the above SEFs are contained within an approximately 6km radius of each other, effectively creating a 12km diameter solar energy generation hub (shown on **Map 4**). This map also indicates the potential cumulative visual exposure of all six SEFs.

A visibility analysis of the 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. The result of the combined visual exposure is indicated in hues of yellow to red, where the darker areas indicate a higher number of SEFs visible, and the lighter areas represent lower levels of cumulative exposure.

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 eight 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, whilst 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 Watershed Substation and associated power lines.

Alternately, it is preferable to concentrate future solar energy infrastructure within this solar hub, considering the fact that there are already five approved SEFs and they are all in relative close proximity to an existing grid connection point (i.e. the Watershed Substation). This will largely help to prevent the scattered proliferation of SEF structures throughout the greater region.

6.3. Potential visual exposure – 132kV overhead power line and substations

The proposed facility substation, the Eskom switching station, 132kV power line and LILO are discussed in **Section 2** (Background). The proposed infrastructure (both alternatives) will be located adjacent to the existing Delareyville-Watershed 1 88kV, Dudfield-Watershed 1 and 2 88kV, and Watershed-Klerksdorp North 1 132kV power lines. It is expected that the existing power line infrastructure and the relatively constrained dimensions of the proposed infrastructure, would largely absorb the potential visual exposure of the substations and power line. The visual amenity of this area has largely been compromised by the presence of the existing power line structures.

6.4. Visual distance / observer proximity to the PV facility

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger solar facilities/technologies (e.g. more extensive infrastructure associated with power plants exceeding 100MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the proposed 75 MW Dicoma PV facility). 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 facility 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

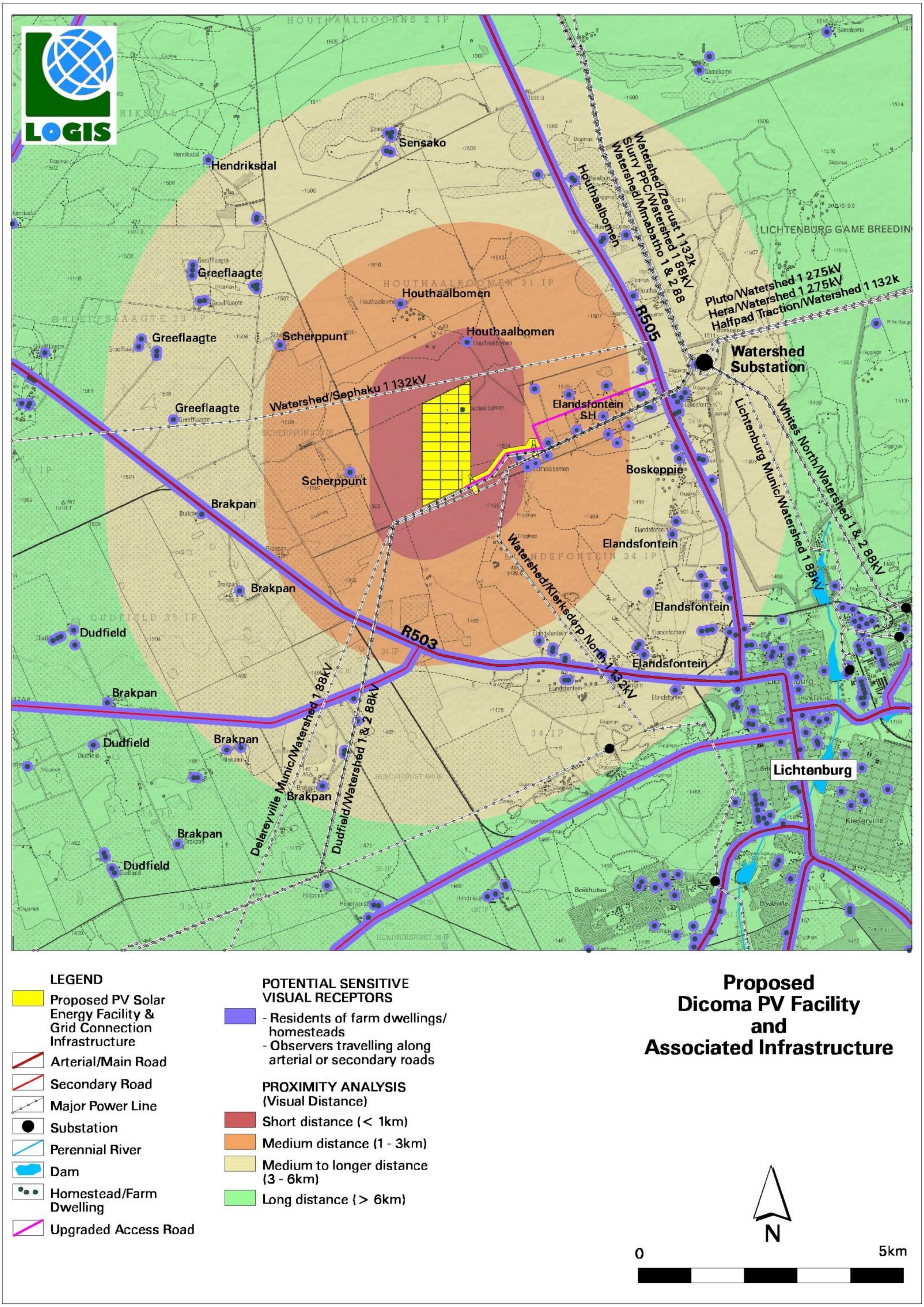
The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

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 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 5** below.

The author is not aware of any objections raised against the Dicoma PV facility.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The broader study area is located within the grassland biome characterised by large open grassy plains and low *shrubland* (**Figure 12**). Large tracts of land are utilised for maize production. Depending on the time of the season, or after the harvesting season, these agricultural fields are devoid of any significantly tall or dense vegetation. Some *thicket and bushland* and planted vegetation occur in places (e.g. along the R505 arterial road – see **Figure 13**). These are expected to reduce the visual exposure to a large degree and are generally effective in shielding the proposed infrastructure from observers.

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, therefore assuming a worst case scenario in the impact assessment.

Figure 12: Grassland and low *shrubland* within the study area – low VAC.

Figure 13: Thicket and bushland along the R505 – high VAC.

6.6. 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 PV facility 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 facility is expected to have a visual impact of **very high** magnitude on resident or visitors to Houthaalbomen (north) located within a 500m radius of the facility.

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

Residents of/or visitors to:

- Scherppunt (west and north)
- Houthaalbomen (far north)
- Western and central residences within the Elandsfontein agricultural holdings

Observers travelling along the:

- R503 arterial road south of the facility

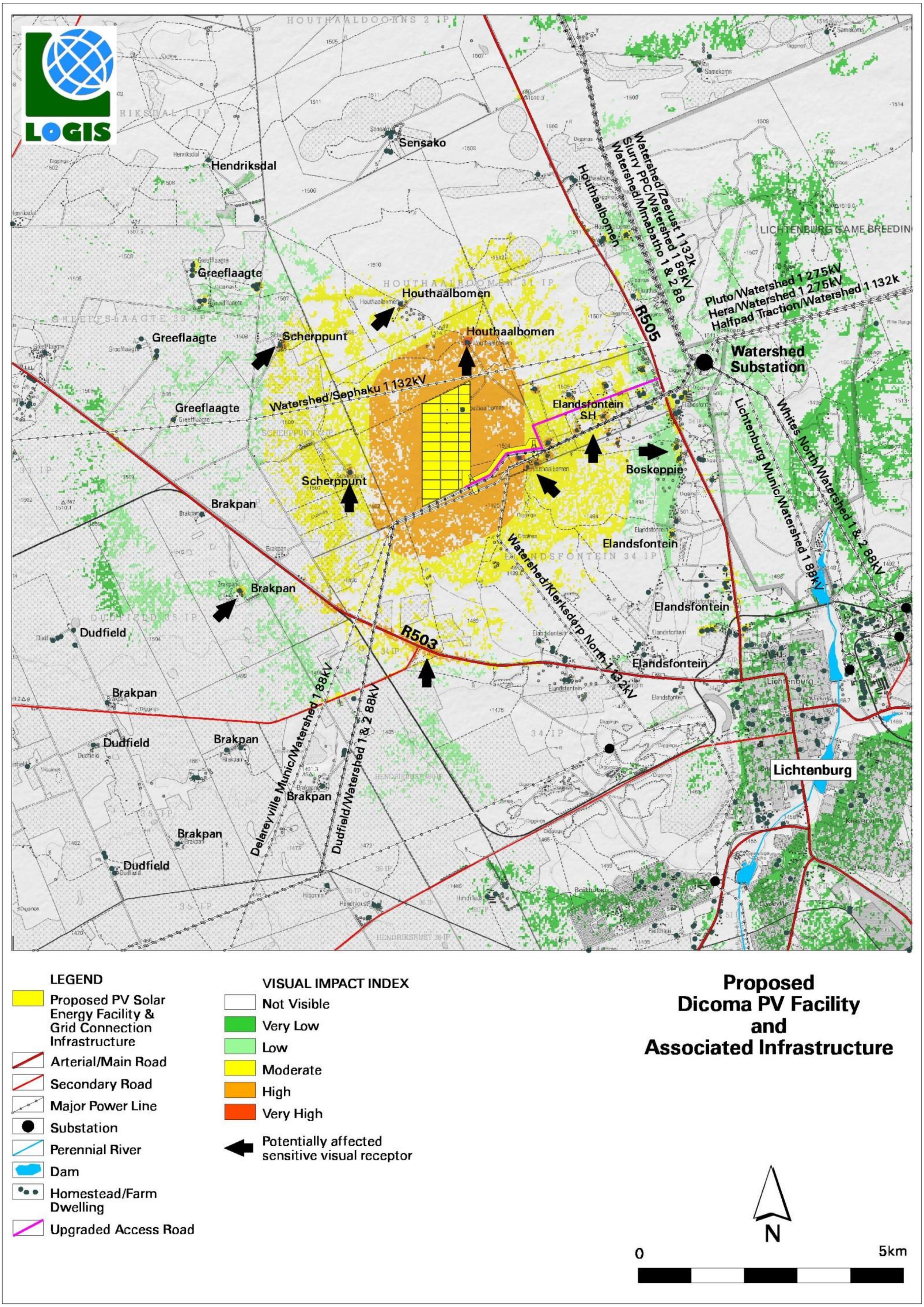
The facility may have a visual impact of **moderate** magnitude on the following observers:

Residents of/or visitors to:

- Brakpan (south-west)
- The eastern residences within the Elandsfontein agricultural holdings
- Boskoppie
- Elandsfontein homestead

Notes:

Where homesteads 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.

6.7. 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** - long distance (very low = 1), medium to longer distance (low = 2), short distance (medium = 3) and very short distance (high = 4)[5].
- **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)[6].
- **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)
- 30-60 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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[5] Long distance = > 6km, medium to longer distance = 3 – 6km, short distance = 1 – 3km and very short distance = < 1km (refer to Section 6.4. Visual distance/observer proximity to the PV facility).

[6] 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.

6.8. Visual impact assessment

The primary visual impacts of the proposed PV facility infrastructure are assessed below.

6.8.1. Construction impacts

6.8.1.1. Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility 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 closer proximity (< 1 km) to the construction activities.

Construction activities may potentially result in a **moderate** (significance rating = 48), temporary visual impact, that may be mitigated to **moderate** (significance rating = 30).

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

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed PV facility.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(30)**
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 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.
Residual impacts: None, provided rehabilitation works are carried out as specified.

6.8.2. Operational impacts

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

The PV facility is expected to have a **moderate** post mitigation visual impact (significance rating = 42) on residents of homesteads within a 1km radius of the operational PV facility 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. The table below illustrates this impact assessment.

Table 3: Visual impact on observers in close proximity (<1 km) to the proposed PV facility structures.

Nature of Impact: Visual impact on residents at homesteads within a 1km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation / Management: 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. ➢ Investigate the potential to screen affected receptor sites (located within 1km of the facility) with planted vegetation cover. 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 PV facility infrastructure is removed. Failing this, the visual impact will remain.		

6.8.2.2. Potential visual impact on sensitive visual receptors within a 1 – 3km radius

The operational PV facility could have a **moderate** visual impact (significance rating = 39) on observers (residents and road users) located between a 1 – 3km radius of the PV facility structures, both before and after the implementation of mitigation measures.

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. The table below illustrates this impact assessment.

Table 4: Visual impact of the proposed PV facility structures within a 1 – 3km radius.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 1 – 3km radius of the PV facility structures		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(45)**	Moderate **(39)**
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: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. <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 PV facility infrastructure is removed. Failing this, the visual impact will remain.		

6.8.2.3. 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 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 5: Impact table summarising the significance of visual impact of lighting at night on visual receptors in close proximity to the proposed PV facility.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors in close proximity to the proposed PV facility.		
	Without mitigation	**_With mitigation_**
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(48)**	Low **(28)**
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 PV facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.8.2.4. Solar glint and glare impacts

Potential visual impact of solar glint and glare as a visual distraction and possible air/road 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, 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 Dicoma 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.[7]

The proposed PV facility is not located near any operational airports or airfields.

There are no major (national or arterial) roads in close proximity to the PV facility, and the closest road, the R503, is located more than 2km away. The intensity of the light reflected from the solar panels decrease with increasing distance, and is therefore not expected to influence motorists travelling along this road. As such, the potential visual impact related to solar glint and glare as an air/road travel hazard is expected to be of **low** significance (significance rating = 24).

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

Nature of Impact: The visual impact of solar glint and glare as a visual distraction and possible air/road travel hazard		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	N.A.
Duration	Long term **(4)**	N.A.
Magnitude	Low **(4)**	N.A.
Probability	Improbable **(2)**	N.A.
Significance	Low **(24)**	N.A.
Status (positive or negative)	Negative	N.A.
Reversibility	Reversible **(1)**	N.A.
Irreplaceable loss of resources?	No	N.A.
Can impacts be mitigated?	N.A.	

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

Mitigation: N.A.
Residual impacts: N.A.

Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility

The closest residence (Houthaalbomen) is located approximately 750m north of the proposed PV facility. The PV facility is unlikely to cause glint and glare impacts on this residence due to its location north of the facility.[8]

Impacts associated with solar glint and glare from the PV facility is expected to be of **low** significance (significance rating = 24) both before and after mitigation.

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. The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of the visual impact of solar glint and glare on static ground receptors.

Nature of Impact: The visual impact of solar glint and glare on residents of homesteads in close proximity to the PV facility		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Moderate **(24)**	Moderate **(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: ➢ 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.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

6.8.2.5. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes a 132kV power line, substation, inverters, 33kV cabling between the PV arrays, meteorological measurement station, internal access roads, upgraded existing roads, workshop, office buildings, etc.

[8] 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.

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 8: 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	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
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/power line 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.		

6.8.2.6. 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 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 PV facility 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.

<table>
<tr><td colspan="3">Nature of Impact:
The potential impact on the sense of place of the region.</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Medium to longer distance (2)</td><td>Medium to longer distance (2)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>Low (4)</td><td>Low (4)</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>Improbable (2)</td></tr>
<tr><td>Significance</td><td>Low (20)</td><td>Low (20)</td></tr>
<tr><td>Status (positive, neutral or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Reversibility</td><td>Reversible (1)</td><td>Reversible (1)</td></tr>
<tr><td>Irreplaceable loss of resources?</td><td>No</td><td>No</td></tr>
<tr><td>Can impacts be mitigated?</td><td colspan="2">No, only best practise measures can be implemented</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Residual impacts:
The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.</td></tr>
</table>

The potential cumulative visual impact of the PV facility on the visual quality of the landscape.

There are eight applications for Solar Energy Facilities (SEFs) in relative close proximity to the Watershed Substation. There are the Barleria, Dicoma and Setaria PV projects (currently in process) and five approved/authorised, but not yet constructed, SEFs. The authorised facilities include: Lichtenburg Solar Park, Tlisitseng SEF and Lichtenburg 1, 2 and 3 PVs. These facilities are located north-east of the proposed Dicoma PV facility.

The construction and operation of all of these renewable energy facilities is expected to increase the cumulative visual impact of industrial type infrastructure within the region. Details of these applications are indicated in the table below and their locations are displayed on **Map 4**.

On the other hand the location of these SEFs within a 6km radius of each other 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 five 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.

Table 10: Renewable energy applications.

Project Name	Location	Approximate distance from the PV facility	Project Status
Lichtenburg Solar Park	Refer Map 4	4.2km north-east	Approved
Tlisitseng SEF	Refer Map 4	770m east	Approved
Lichtenburg 1 PV Facility	Refer Map 4	8.8km north-east	Approved
Lichtenburg 2 PV Facility	Refer Map 4	3.5km north	Approved
Lichtenburg 3 PV Facility	Refer Map 4	5.1km north-east	Approved
Barleria PV Facility	Refer Map 4	Adjacent east	In process
Dicoma PV Facility	Refer Map 4	N.A.	In process
Setaria PV Facility	Refer Map 4	Adjacent west	In process

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 due to the relatively low viewer incidence within close proximity to the proposed development sites and the presence of the existing electricity infrastructure and mining activities (at Bakerville, Grasfontein and north of Lichtenburg) within the region[9]. See **Table 11** below.

Table 11: The potential cumulative visual impact of the renewable energy facilities on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of the PV facility 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	Very short distance **(4)**	Medium to longer distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(48)**	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, only best practise measures can be implemented	

[9] Regional = medium to longer distance due to the projects being located within a 5.7km radius of each other (refer to Map 4).

Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint. <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 PV facility infrastructure is removed. Failing this, the visual impact will remain.

6.9. 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 north 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. PREFERRED GRID CONNECTION ALTERNATIVE

Grid connection alternative 1 is 1.3km long, while the alternative 2 is located immediately adjacent to the PV arrays. Alternative 2 will remove the substation and switching station further away from the Elandsfontein small holdings and consolidate it with the PV facility infrastructure (i.e. PV arrays, BESS, buildings, etc.). It is therefore the preferred alternative.

Even though alternative 2 is preferred, it does not exclude alternative 1 from being implemented, as neither alternative are considered fatally flawed.

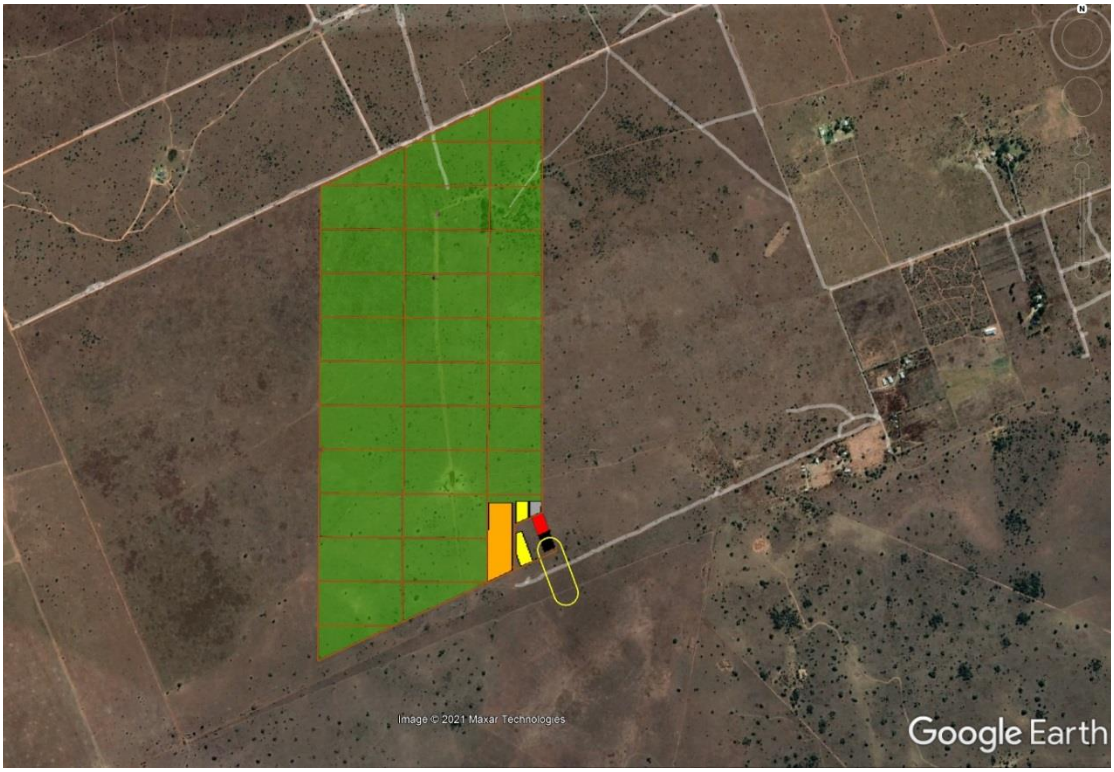

Figure 14: Dicoma PV facility preferred layout.

8. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed Dicoma PV facility and its associated infrastructure may have a visual impact on the study area, especially within a 1km radius (and potentially up to a radius of 3km) 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. the Lichtenburg 1, 2, 3 PVs, Lichtenburg Solar Park, Tlisitseng SEF, and Dicoma and Setaria PV facilities) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of PV arrays visible) 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 would 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 Dicoma PV facility 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 Dicoma PV facility would be considered to be acceptable from a visual impact perspective and can therefore be authorised.

9. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed 75MW PV facility is that the visual environment surrounding the site, especially within a 1km radius (and potentially up to a radius of 3km) of the proposed facility, 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 Dicoma PV facility and to the potential cumulative visual impact of the facility in relation to the other proposed and authorised PV facilities, where the combined frequency of visual impact is expected be greater. The potential area of cumulative visual exposure is however still deemed to be within acceptable limits, considering the PV facilities' close proximity to each other.

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.

- The Dicoma PV facility is expected to have a **moderate** visual impact on observers traveling along the roads and residents of homesteads within a 1km radius of the PV plant structures both before and after the implementation of impact mitigation measures.

- The PV Facility is expected to have a **moderate** visual impact within a 1-3km radius of the PV facility, 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 potential visual impact related to solar glint and glare as an air/road travel hazard is expected to be of **low** significance.

- The potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility 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 anticipated visual impact of the proposed PV facility 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 up to eight proposed PV facilities is expected to be of **moderate** significance, which is considered to be acceptable from a visual perspective. This is mainly due to the relatively low viewer incidence within close proximity to the proposed development site.

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 facility.

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 6.10.**) and management programme (**Section 10.**).

10. 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 below.

Table 12: Management programme – Planning.

<table>
<tr><th colspan="3">OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed 75MW PV facility.</th></tr>
<tr><td>Project Component/s</td><td colspan="2">The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, security lighting, workshop, power line, etc.).</td></tr>
<tr><td>Potential Impact</td><td colspan="2">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.</td></tr>
<tr><td>Activity/Risk Source</td><td colspan="2">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.</td></tr>
<tr><td>Mitigation: Target/Objective</td><td colspan="2">Optimal planning of infrastructure to minimise the visual impact.</td></tr>
<tr><td>Mitigation: Action/control</td><td>Responsibility</td><td>Timeframe</td></tr>
<tr><td>Use anti-reflective panels and dull polishing on structures.</td><td>Project proponent / contractor</td><td>Early in the planning phase.</td></tr>
<tr><td>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.</td><td>Project proponent / contractor</td><td>Early in the planning phase.</td></tr>
<tr><td>Retain and maintain natural vegetation immediately adjacent to the development footprint/servitude.</td><td>Project proponent/ design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>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.</td><td>Project proponent/ design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>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.</td><td>Project proponent/ design consultant</td><td>Early in the planning phase.</td></tr>
<tr><td>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:
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.</td><td>Project proponent / design consultant</td><td>Early in the planning phase.</td></tr>
</table>

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 13: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed 75MW 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 north 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 14: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed 75MW 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 15: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed 75MW 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 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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