PROPOSED VREDE SOLAR PHOTOVOLTAIC FACILITY, FREE STATE PROVINCE

VISUAL IMPACT ASSESSMENT

Produced for:

Mainstream Renewable Power Developments (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
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- April 2021 -

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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.

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Vrede Solar Photovoltaic (PV) Facility. 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 NASA in the form of a 30m SRTM (Shuttle Radar Topography Mission) elevation model.

Visual Impact Assessment (VIA)

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

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

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

The following VIA-specific tasks were undertaken:

- **Determine potential visual exposure**

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

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

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

- **Determine visual distance/observer proximity to the facility**

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

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

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

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

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

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

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

- **Determine the visual absorption capacity (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 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

South Africa Mainstream Renewable Power Developments (Pty) Ltd is proposing the construction and operation of the 100MW Vrede Solar Photovoltaic (PV) Facility and Battery Energy Storage System (BESS), near the town of Kroonstad in the Moqhaka Local Municipality (Fezile Dabi District) of the Free State Province of South Africa (see **Figure 1**).

The proposed development traverses two farm portions namely:

- Remaining extent of the farm Vrede No. 1152 (F02000000000115200000).
- Portion 1 of the farm Uitval No. 1104 (F02000000000110400001).

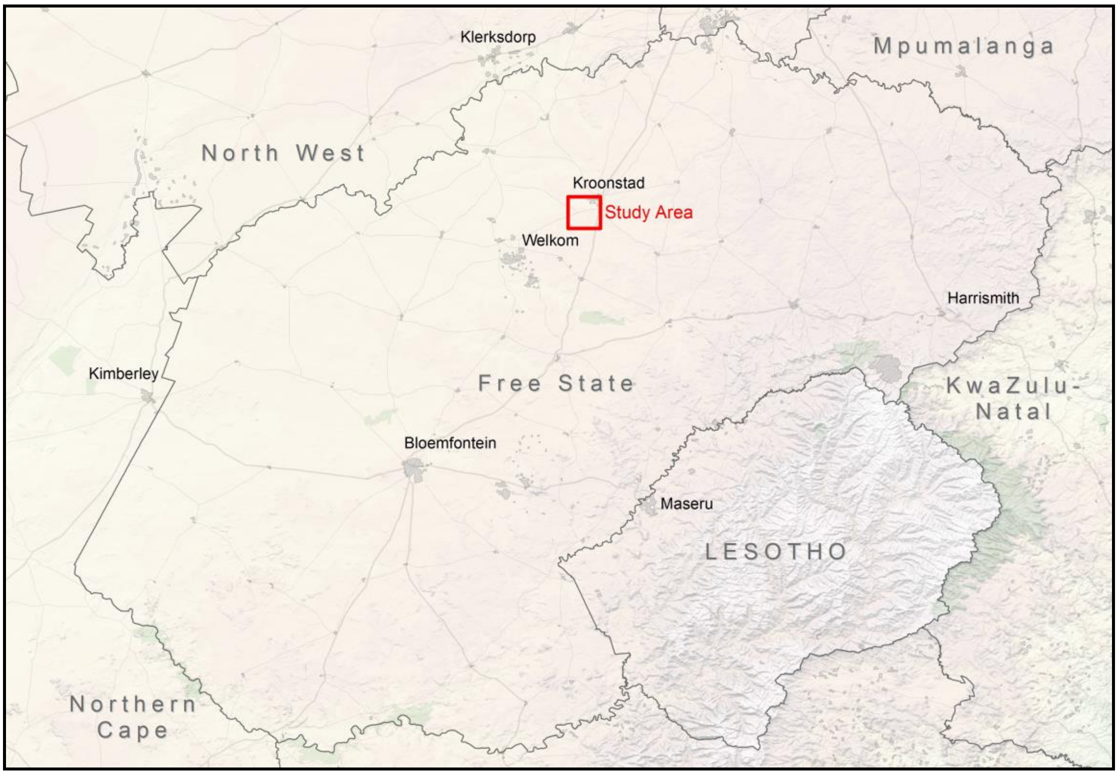


Figure 1: Regional locality of the proposed project area.

The proposed project will have a contracted capacity of up to 100MW, and will make use of PV solar technology for the generation of electricity. The project will comprise a solar field with the following key infrastructure and components:

- Solar Arrays:
  - Solar Panel Technology - Mono and/or Bifacial Photovoltaic (PV) Modules;
  - Mounting System Technology – single axis tracking, dual axis tracking or fixed axis tracking PV;
  - Underground cabling (up to 33kV);
  - Centralised inverter stations or string inverters; and
  - Power Transformers.
- Building infrastructure:
  - Offices;
  - Operational control centre;
  - Operation and Maintenance Area / Warehouse / workshop;
  - Ablution facilities;
  - Battery Energy Storage Facility; and

    - Substation building.

- Electrical infrastructure:
    - 33/132kV onsite substation including associated equipment and infrastructure; and
    - Underground cabling and overhead power lines (up to 33kV).

- Associated infrastructure:
    - Access roads and internal gravel roads;
    - Fencing and lighting;
    - Lightning protection
    - Permanente laydown area;
    - Temporary construction camp and laydown area;
    - Telecommunication infrastructure;
    - Storm water channels; and
    - Water pipelines.

The proposed grid connection infrastructure will comprise of:

- The Vrede Solar PV Facility will include an on-site facility substation to facilitate the connection between the solar PV facility and the Eskom electricity grid. A 33/132kV onsite substation including associated equipment and infrastructure will be required, comprising a footprint of up to approximately 300 x 500 (~15 ha) including the following:
    - Temporary and permanent laydown areas
    - & M Building
    - Power lines (primary and secondary);
    - Ground wires and overhead lines
    - Transformers (various)
    - Circuit breaker
    - Lightning arrester
    - Control building
    - Security fencing

- Distribution power line:
    - Two alternative routes are being considered for the Vrede Grid Connection solution. Both alternatives for the Vrede Grid Connection will loop into the Kroonstad Municipality – Kroonstad SW STN 1 132kV power line, to connect to the national grid. The assessment of the grid connection infrastructure will consider a corridor with a width of up to 260m.

The grid connection infrastructure will be applied for under a separate environmental approval process.

The 100MW Solar PV Facility will take approximately 18 - 24 months to construct and the operational lifespan of the facility is estimated at 20 years.

The proposed position of the Vrede Solar PV Facility 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.

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 Vrede Solar 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 assessment encompasses a geographical area of approximately 341km² (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 proposed development footprint.

The study area includes the town of Kroonstad, a number of homesteads or farm residences, the Kroonstad Municipal Substation, existing distribution and transmission power lines, and sections of the N1 national, the R34 arterial and R713 main roads.

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

- The visibility of the facility to, and potential visual impact on, observers travelling along the arterial and secondary roads within the study area.
- The visibility of the facility to, and visual impact on residents of homesteads 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 (e.g. the Boslaagte Private Nature Reserve and Lechwe Lodge).
- 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 with specific reference to the construction of the Vrede Solar PV Facility and the Rondavel Solar PV Facility approximately 4.2km north-east of the site.
- 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 travel hazard.
- 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 potentially constitute a significant visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

4. RELEVANT LEGISLATION AND GUIDELINES

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

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

5. THE AFFECTED ENVIRONMENT

The project is proposed on a site on the remaining extent of the farm Vrede 1152 and Portion 1 of the farm Uitval 1104, located approximately 11.5km from the Kroonstad central business district (at the closest). These farms have a surface area of 538ha, but the identified development area (project site) is approximately 271ha. The ultimate development footprint, including the PV modules, internal roads, buildings and other associated infrastructure will be approximately 214ha (i.e. 70% of the development area assessed in this visual assessment). The footprint of the battery storage area will be 2ha and the on-site substation 1ha.

The entire proposed Solar PV Facility project is located in a rural area, currently zoned as agriculture, at a distance of approximately 9km from the Kroonstad Municipal 132/66kV Substation (at the closest).

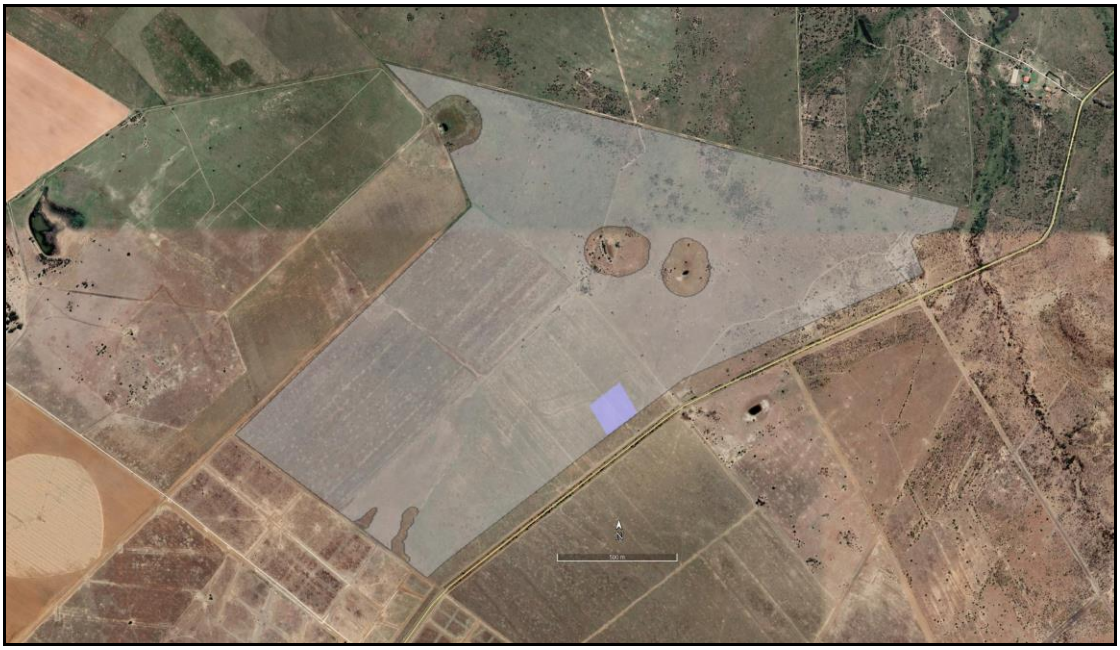


Figure 6: Aerial view of the proposed development area (white) and substation position (blue).

Topography, hydrology and vegetation

The study area occurs on land that ranges in elevation from 1,318m (in the north) to 1,459m in the south. The proposed development site itself is located at an average elevation of 1,423m above sea level. The general slope of the study area is even (flat), although the site traverses across a weak ridge that spans in a south-easterly to north-westerly direction. The region is generally referred to as the *Highveld* with the terrain morphology described as *plains* and *slightly irregular undulating plains and hills*.

The Vals River is the only perennial river within the study area. There are a number of non-perennial streams of which the *Blomspruit* is the most prominent. This stream and a number of other smaller streams in closer proximity to the project site feed into the Vals River, north of the site. Further to the aforementioned drainage lines the most prominent hydrological features are the man-made farm dams occurring throughout the study area.

The natural land cover within the study area is predominantly grassland interspersed with open woodland, with wetlands in the lower lying reaches of the drainage lines mentioned above. The site itself is a combination of natural grassland and woodland (eastern section), and old farm lands to the west. Large tracts of the study area have been transformed by dryland agriculture (primarily maize farming) as well as irrigated crop farming (crop circles).

The entire study area is located in the *Dry Highveld Grassland Bioregion* and the dominant vegetation type is described as *Central Free State Grassland*. The most transformed part of the study area, to the south-west, is known as *Vaal-Vet Sandy Grassland.*

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

Land use and settlement patterns

The study area has a rural and predominantly natural character and the main land use activity, outside of the Kroonstad city limits, is maize farming. The region is similarly sparsely populated outside of the Kroonstad urban centre, with a population density of less than ten people per km^2. Farm residences, or homesteads, dot the landscape at an irregular interval. These homesteads are generally located at great distances from each other (i.e. more than 2.5km apart).

The development area is easily accessible from the N1 national road via the R34 arterial road, the Hennenman road and the S172 secondary (gravel) road.

The only protected area in the study area borders the proposed development area to the north. This is the Boslaagte Private Nature Reserve (farm Oshoek 47) that includes the Lechwe Lodge. This is the only tourist facility or destination identified within the study area (excluding Kroonstad itself). This lodge functions as a venue that can accommodate up to 300 people and provides overnight lodging.

In spite of the rural and natural character of the study area, there is a large number of overhead power lines associated with the Kroonstad Municipal Substation. These include:

- Kroonstad Municipal/Theseus 1 132kV
- Serfontein Traction/Virginia Terminal 1 88kV
- Kroonstad Municipal/Kroonstad SW Station 1 132kV

The former two power lines traverse east of the proposed project site at a distance of approximately 1.5km (at the closest).

Other than these power lines there is also a railway line crossing the study area to the industrial area west of the Kroonstad CBD.

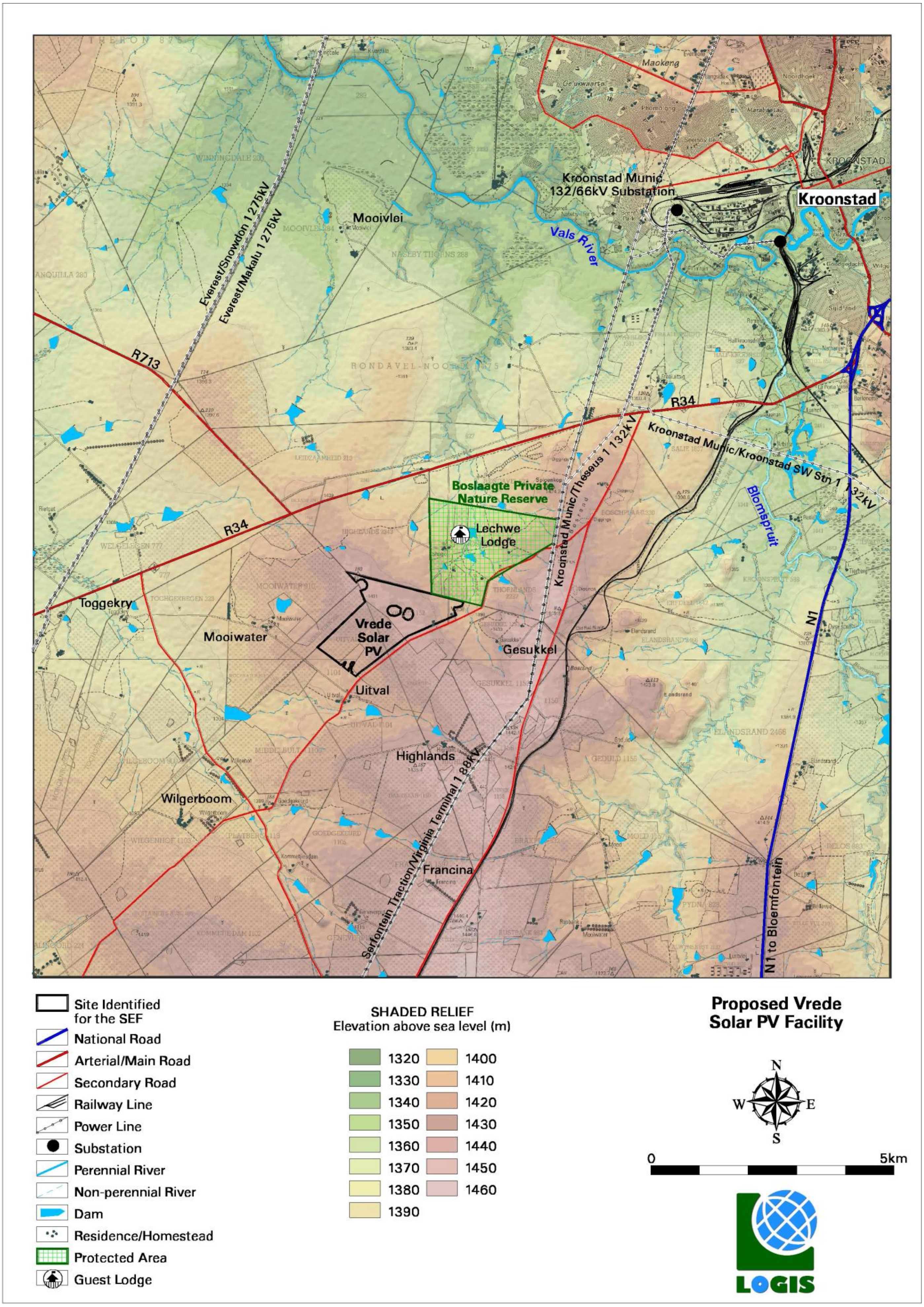
The photographs below aid in describing the general environment within the study area and surrounding the proposed Vrede Solar PV Facility[2].

[2] Sources: DEAT (ENPAT Free State), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2020_Q2 and SAPAD2019-20 (DEA).

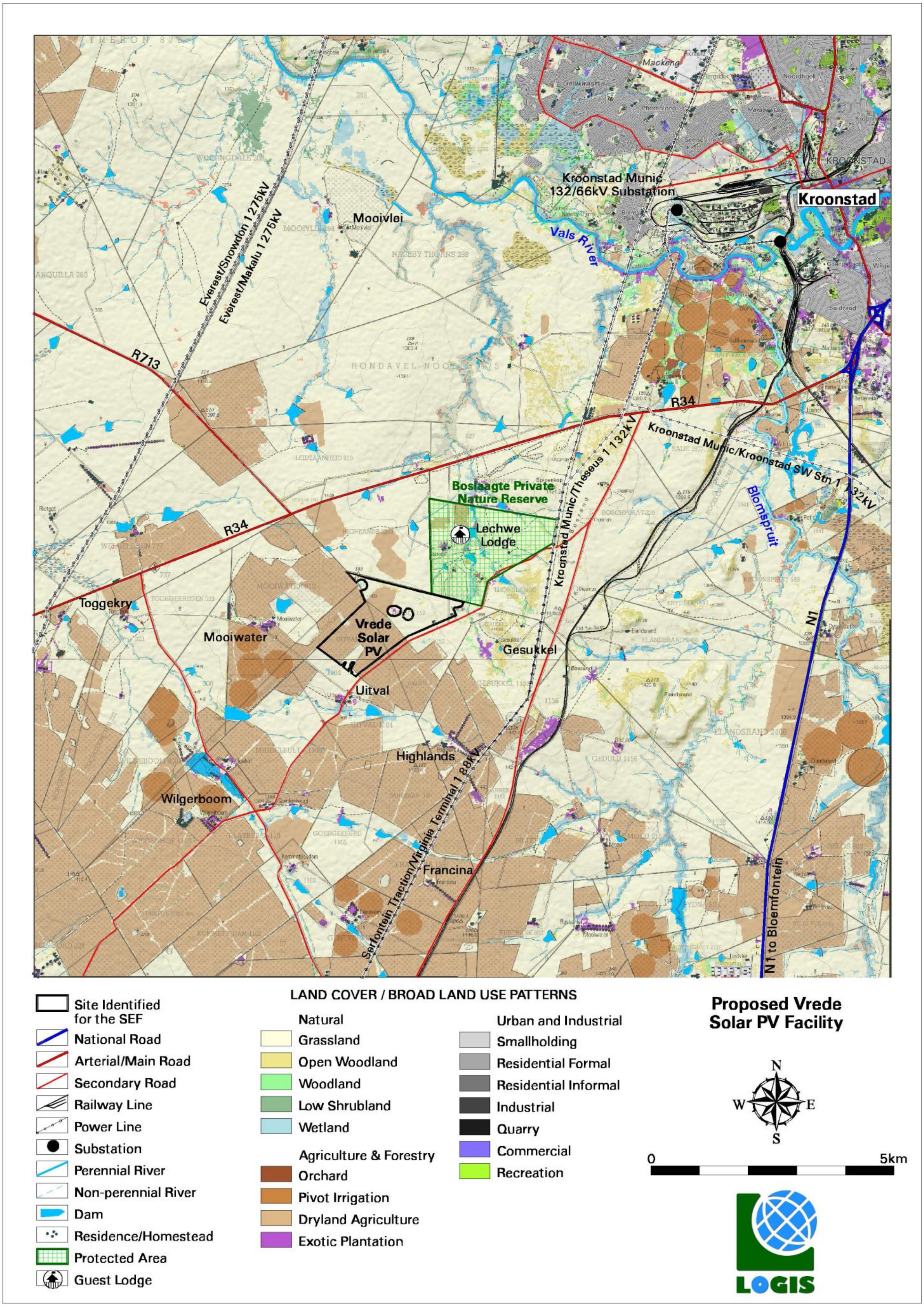
Figure 7: The project site as seen from the S172 secondary road.

Figure 8: Lechwe Lodge. (*Photo*: *Jan Venter*).

Figure 9: Access road to the Vrede development 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 129 vantage points within the proposed development site at an offset of respectively 2.5m and 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) and BESS associated with the facility.

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

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

Results

The core area of potential visual exposure is primarily contained within a 1km radius of the proposed development site. The facility is expected to be very visible from the S172 secondary road within this zone and may potentially be visible from parts of the Boslaagte Private Nature Reserve.

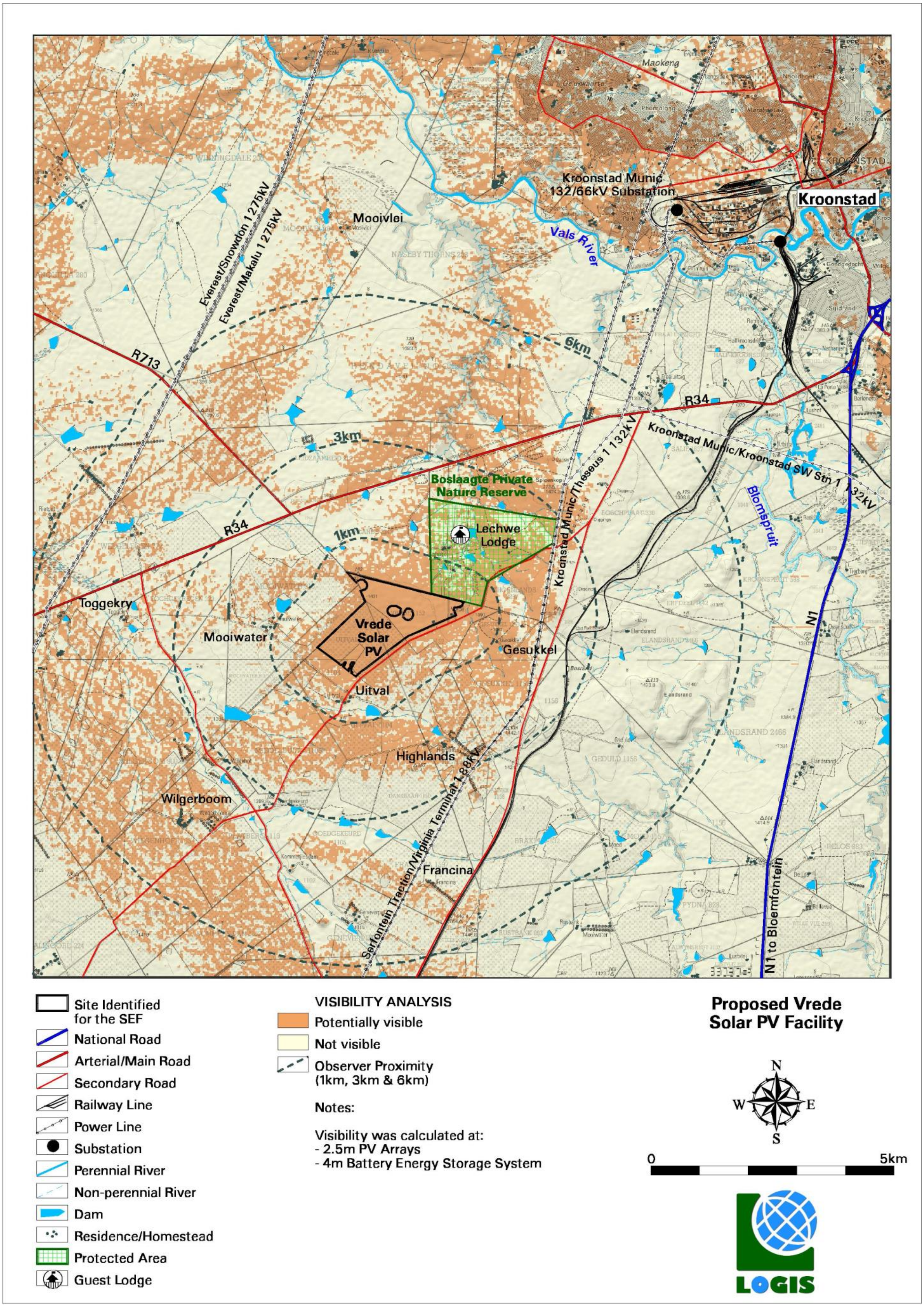
Within a 1 – 3km radius the facility may be visible from the Lechwe Lodge, and the Mooiwater, Gesukkel and Highlands homesteads. It may also be visible from a short section of the R34 arterial road.

Within a 3 – 6km radius the visual exposure is largely restricted to higher lying areas south-west and north of the site. The facility may be visible from the Francina, Wilgerboom and Toggekry homesteads and may also be visible from the R713 main road. Other than these receptors, most of the visual exposure will be relatively scattered within vacant open space.

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. Further to this, most of these areas are not inhabited and generally devoid of observers.

Conclusion

In general terms it is envisaged that the structures, where visible from shorter distances (e.g. less than 3km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a moderate to high visual impact. The incidence rate of sensitive visual receptors is however expected to be quite low, due to the generally remote location of the proposed development and the low number of potential observers. This statement needs to be confirmed during the EIA phase of the project and the potential visual impacts must be investigated in terms of their nature, extent, duration, magnitude, probability and significance.



Map 3: Viewshed analysis of the proposed PV facility.

6.2. Potential cumulative visual exposure

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In practice the terms 'effects' and 'impacts' are used interchangeably.

Cumulative visual impacts may be:

- Combined, where the PV arrays of several SEFs are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various SEF's PV arrays; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of wind turbines.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the SEF development on the landscape and visual amenity is a product of:

- The distance between individual SEFs (or PV arrays);
- The distance over which the PV arrays are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the SEFs themselves; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed development will result in any unacceptable loss of visual resource considering all the projects existing and proposed in the area.

The study area may ultimately encompass two solar energy facilities, namely the proposed Vrede Solar PV Facility and the Rondavel Solar PV Facility. The two PV facilities are located approximately 4.2km apart, respectively immediately south-west of the Boslaagte Private Nature Reserve and north-east of this reserve. The landscape is relatively homogenous for both PV facilities, resulting in very similar viewshed patterns.

Map 4 indicates the potential cumulative visual exposure of the two solar energy facilities. A visibility analysis of the PV facilities was undertaken from a representative number of vantage points per development footprint at 4m above ground level.

The results of these two analyses were merged in order to calculate the combined (cumulative) visual exposure of the PV infrastructure (indicated in red), compared to the visual exposure of the two facilities individually (indicated in blue and green).

Results

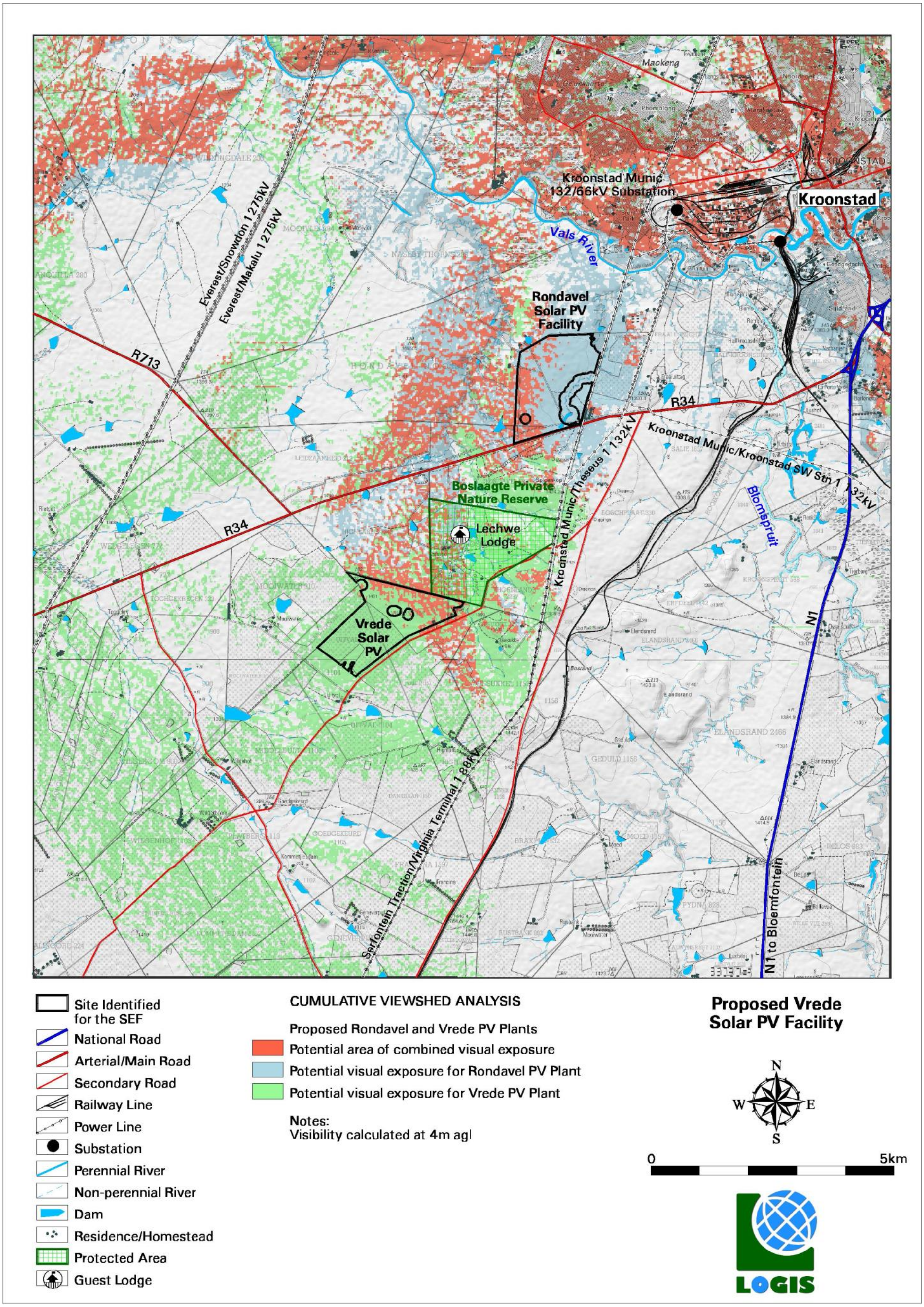
It is expected that higher-lying terrain (i.e. more elevated vantage points) would overall be most exposed to solar energy facility infrastructure within the study area. It should be noted that the combined observation of both facilities may be from relatively long distances, e.g. from outlying areas of Kroonstad, with one facility appearing in the foreground and the other further in the background.

In the case of the Boslaagte Nature Reserve, the PV facilities may both be visible from certain areas, potentially resulting in successive cumulative visual impacts.

Along the R34 arterial road the visual exposure may be sequential, i.e. where one facility is visible from a specific section of the road with the other facility later on along another section of road. These observations will however be in transit, potentially negating the cumulative visual impact to some degree.

Conclusion

The above statement should however not distract from the fact that there may ultimately be solar energy generation structures and ancillary infrastructure (e.g. overhead power lines) within an area that currently have limited built structures besides the existing power lines and railway line. The cumulative visual exposure may potentially be most prominent from the R34 arterial road and from some sections of the Boslaagte Nature Reserve.



Map 4: Cumulative viewshed analysis.

6.3. 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 100MW) and downwards for smaller plants (e.g. smaller infrastructure associated with power plants with less generating capacity such as the 100MW 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 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 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.

6.4. 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. Travellers using these roads may be negatively impacted upon by visual exposure to the PV facility.

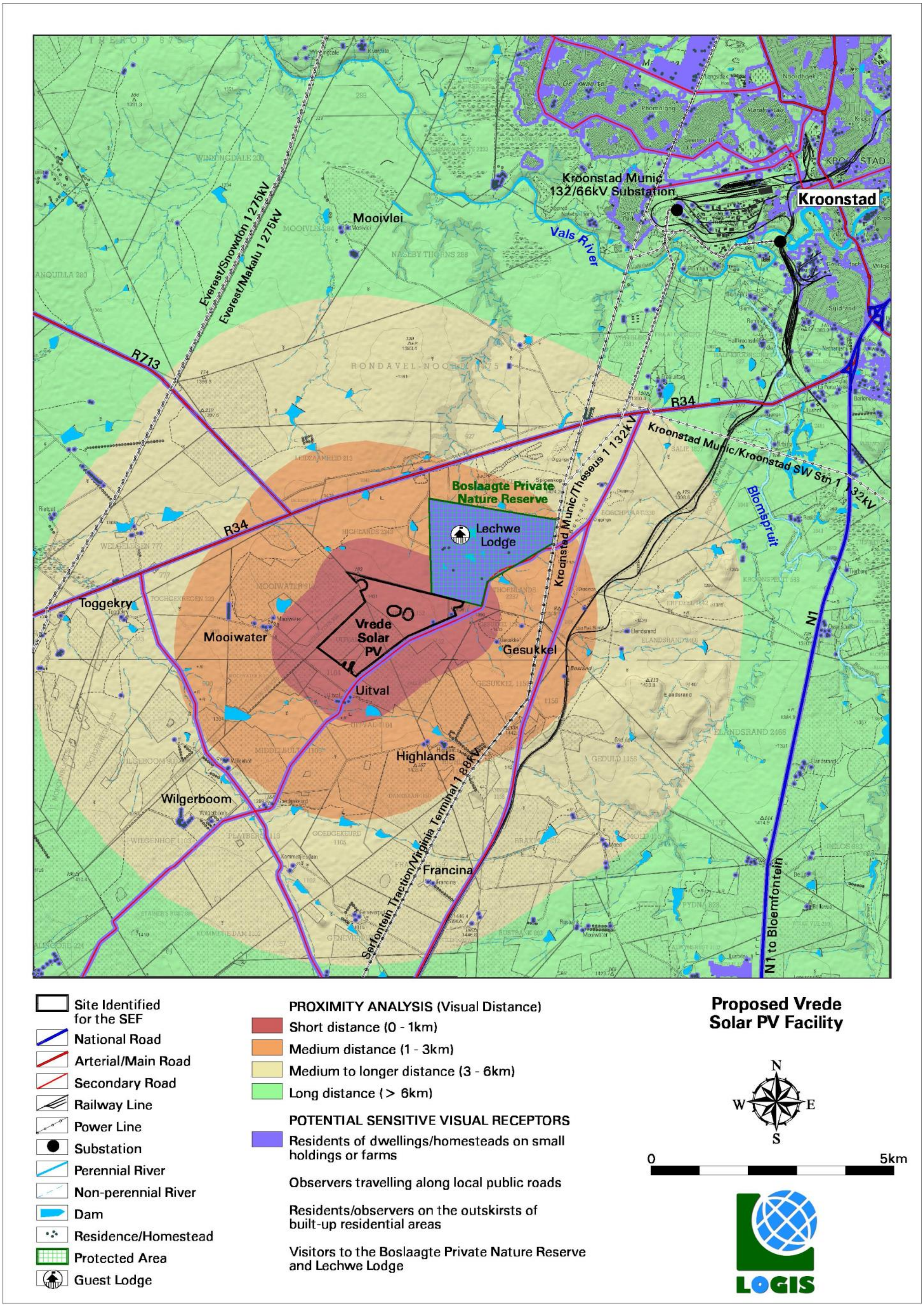
Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the solar energy facility, would generally be negative.

Due to the generally remote location of the proposed PV facility, there are only a few potential sensitive visual receptors located within a 6km radius of the proposed facility. These are residents of, or visitors to:

- Uitval
- Mooiwater
- Gesukkel
- Highlands
- Francina
- Wilgerboom
- Toggekry

The Boslaagte Nature Reserve, Lechwe Lodge and other facilities (e.g. lookout points and residences) on this reserve are also flagged as potential sensitive visual receptor sites.

Refer to **Map 5** below.



Map 5: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

The broader study area is located within the Dry Highveld Grassland Bioregion characterised by predominantly large open plains with grassland and bare soil in places, but also sections with woodland. Where natural grassland occurs, the Visual Absorption Capacity (VAC) will be low, especially due to the low occurrence of urban development and the low height of the vegetation cover. This is illustrated in **Figure 10** below, where the grassland section to the left has a low VAC, i.e. long distance views are possible.

Where woodland is present the VAC is high (e.g. to the right of the photograph) obstructing long distance views and largely shielding the observer from the PV facility structures. The study area therefore has a combined low and high VAC. This prompts the importance of retaining the natural vegetation, especially woodland, surrounding the development footprint in order to insure maximum shielding of the PV facility structures from potential sensitive visual receptors.

Figure 10: Grassland (low VAC) and woodland (high VAC) within the study area.

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 plant may experience visual impacts of **very high** magnitude. 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 may have a visual impact of **very high** magnitude on the following observers:

Observers travelling along the:

- The S172 secondary road

Residents of/or visitors to:

- The Boslaagte Nature Reserve and Lechwe Lodge
- Uitval
- Vrede

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

Observers travelling along the:

- The R34 arterial road

Residents of/or visitors to:

- Mooiwater
- Gesukkel
- Highlands

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

Observers travelling along the:

- The R713 arterial road

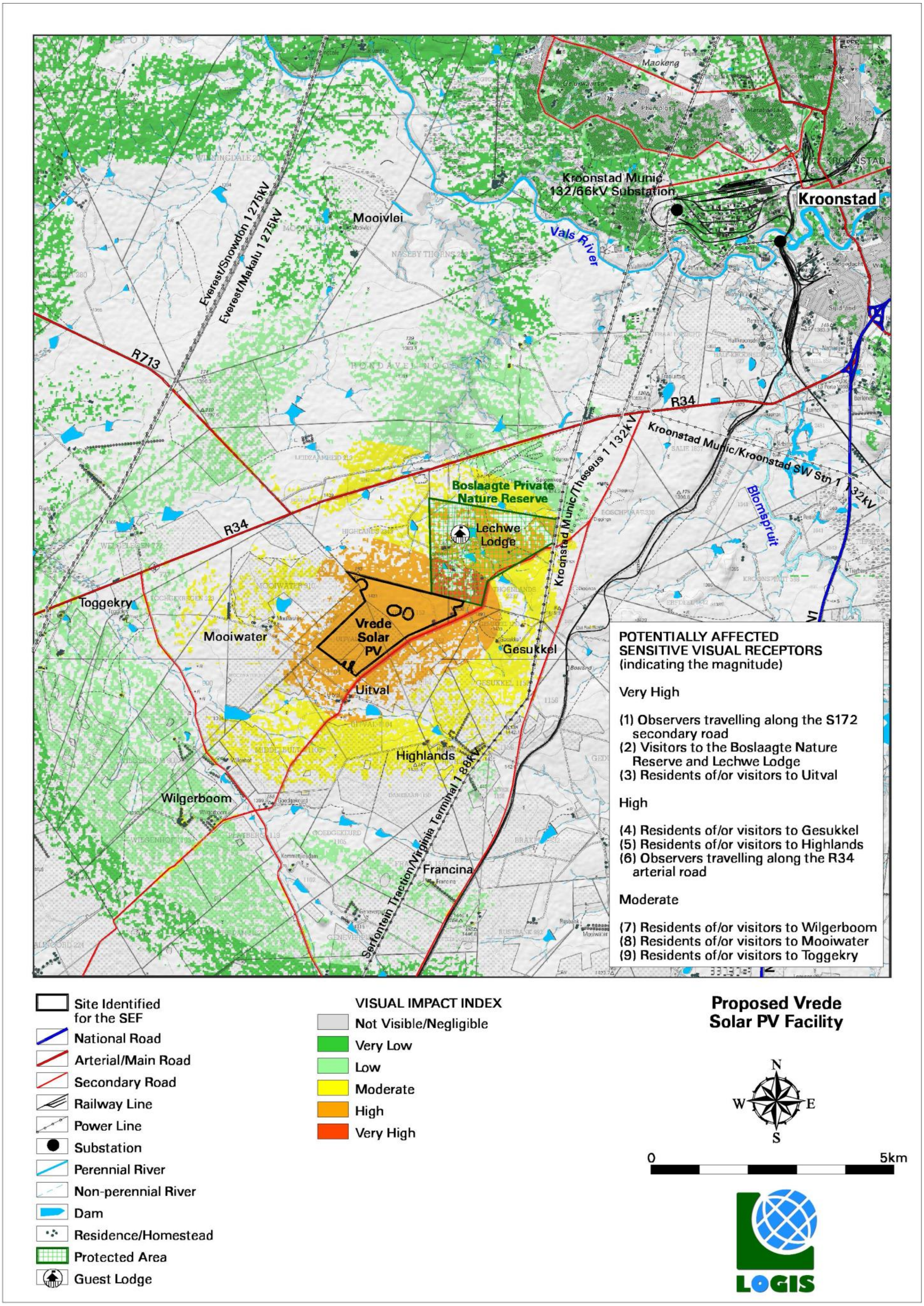
Residents of/or visitors to:

- Francina
- Wilgerboom
- Toggekry

Notes:

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

The location of Vrede on the farm identified for the Vrede PV facility reduces the probability of this impact occurring i.e. it is assumed that the residents are supportive of the PV SEF development.



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** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[3].
- **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)[4].
- **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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[3] Local = within 1km of the development site. Regional = between 1-3km (and potentially up to 6km) from the development site.

[4] 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 Vrede PV facility are assessed below.

6.8.1. Construction impacts

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 the area.

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

Table 2: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed 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	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(40)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation immediately adjacent to the development footprint. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction phase. ➢ Plan the placement of 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. Potential visual impact on sensitive visual receptors located within a 1km radius of the PV facility structures.

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

Observers travelling along the:

- The S172 secondary road

Residents of/or visitors to:

- The Boslaagte Nature Reserve and Lechwe Lodge
- Uitval

The PV facility is expected to have a **moderate** visual impact (significance rating = 36) on observers traveling along the S172 secondary road and residents of homesteads within a 1km radius of the operational PV structures, after mitigation.

The PV facility is expected to have a moderate visual impact on observers at the Boslaagte Nature Reserve, provided that vegetation cover within the north-eastern restricted area is not removed. Failing this the visual impact may be high.

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

Nature of Impact: Visual impact on observers travelling along the S172 secondary road and residents at homesteads within a 1km radius of the PV facility structures		
	Without mitigation	**_With mitigation_**
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very High **(10)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(48)**	Moderate **(36)**
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. 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.		

6.8.3. 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:

Observers travelling along the:

- The R34 arterial road

Residents of/or visitors to:

- Mooiwater
- Gesukkel
- Highlands

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

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

<table>
<tr><td colspan="3">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</td></tr>
<tr><td></td><td>Without mitigation</td><td>With mitigation</td></tr>
<tr><td>Extent</td><td>Regional (3)</td><td>Regional (3)</td></tr>
<tr><td>Duration</td><td>Long term (4)</td><td>Long term (4)</td></tr>
<tr><td>Magnitude</td><td>High (8)</td><td>Moderate (6)</td></tr>
<tr><td>Probability</td><td>Probable (3)</td><td>Probable (3)</td></tr>
<tr><td>Significance</td><td>Moderate (45)</td><td>Moderate (39)</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">Yes, best practice mitigation measures are recommended.</td></tr>
<tr><td colspan="3">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.</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>

6.8.4. 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 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 facility.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning & operation: ➢ Shield the sources of light by physical barriers (walls, vegetation, or the structure itself). ➢ Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights. ➢ Make use of minimum lumen or wattage in fixtures. ➢ Make use of down-lighters, or shielded fixtures. ➢ Make use of Low Pressure Sodium lighting or other types of low impact lighting. ➢ Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

6.8.5. Solar glint and glare impacts

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

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

The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relative close proximity to the source (e.g. residents of neighbouring properties), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway). The Federal Aviation Administration (FAA) of the United States of America have researched glare as a hazard for aviation pilots on final approach and may prescribe specific glint and glare studies for solar energy facilities in close proximity to aerodromes (airports, airfields, 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 100MW PV facility).

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

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

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

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

6.8.6. Ancillary infrastructure

On-site ancillary infrastructure associated with the PV facility includes smaller substations (inverters), 33kV cabling between the PV arrays, meteorological measurement station, internal access roads, workshop, office buildings, etc.

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

Table 7: Visual impact of the ancillary infrastructure.

Nature of Impact: Visual impact of the ancillary infrastructure during the operation phase on observers in close proximity to the structures.

	Without mitigation	*With mitigation*
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(20)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/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.		

6.9. 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 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 8: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	*With mitigation*

Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(22)**	Low **(22)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: <u>Planning:</u> ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. <u>Operations:</u> ➢ Maintain the general appearance of the facility as a whole. <u>Decommissioning:</u> ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain.		

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

The study area may ultimately encompass two solar energy facilities, namely the proposed Vrede and the Rondavel PV facilities. The construction of both these renewable energy facilities may increase the cumulative visual impact of industrial type infrastructure within the region.

The anticipated cumulative visual impact of the two 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 sites.

Table 10: The potential cumulative visual impact of the solar energy facilities on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of the solar energy facilities 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	Local **(2)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	High **(8)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(36)**	Moderate **(45)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**

<table>
<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>

6.10. 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 (especially woodland vegetation types) 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, and offer a visual buffer zone between the PV plant and potential sensitive visual receptors.

- 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:

  - 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.

- 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 100MW Vrede PV facility and its associated infrastructure, may have a visual impact on the study area, especially within (but not restricted to) a 1 - 3km radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility.

The combined visual impact or cumulative visual impact of the Vrede and Rondavel solar energy facilities is expected to increase the area of potential visual impact within the region. The intensity of visual impact to exposed receptors, especially those located within a 3km radius, is expected to be greater than it would be for a single solar energy facility. It is however still more preferable that these renewable energy developments are concentrated within this area rather than being spread further apart.

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 and the remote location of the project infrastructure. There are a very limited number of potentially sensitive visual receptors within a 6km radius of the PV facility, although the possibility does exist for visitors to the region to venture in to closer proximity to the solar power generating structures. These observers may consider visual exposure to this type of infrastructure to be intrusive.

Potential mitigation factors for the 100MW PV facility include 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. 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 PV facility 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 100MW PV facility is that the visual environment surrounding the site, especially within a 1 - 3km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e. a minimum of 20 years).

This impact is applicable to the individual PV facility and to the potential cumulative visual impact of the facility in relation to the proposed Rondavel PV facility, where the combined frequency of visual impact may be greater. The potential area of cumulative visual exposure is however still deemed to be within acceptable limits, considering their relative 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 that may be mitigated to **low**.

- The PV facility is expected to have a **moderate** visual impact on observers traveling along the S172 secondary road and residents of homesteads within a 1km radius of the operational PV structures, after mitigation.

- The PV facility is expected to have a **moderate** visual impact on observers at the Boslaagte Nature Reserve, provided that vegetation cover within the north-eastern restricted area is not removed. Failing this the visual impact may be high.

- The PV Facility is expected to have a **moderate** visual impact within the region (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 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 two 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 sites.

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 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 tables overleaf.

Table 11: Management programme – Planning.

<table>
<tr><td colspan="3">OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed 100MW PV facility.</td></tr>
<tr><td>Project Component/s</td><td colspan="2">The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, transformers, meteorological metering station, security lighting, workshop, 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 3km 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>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>
<tr><td>Performance Indicator</td><td colspan="2">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.</td></tr>
<tr><td>Monitoring</td><td colspan="2">Not applicable.</td></tr>
</table>

Table 12: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed 100MW 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**
Ensure that vegetation is not unnecessarily cleared or removed during the construction phase.	Project proponent / contractor	Early in the construction phase.
Reduce the construction phase through careful logistical planning and productive implementation of resources.	Project proponent / contractor	Early in the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Project proponent / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes, etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	

Table 13: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed 100MW PV facility.		
Project Component/s	The solar energy facility and ancillary infrastructure (i.e. PV panels, access roads, meteorological metering station, 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**
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 14: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed 100MW 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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