PROPOSED PRIESKA SOLAR ENERGY FACILITY

ON A SITE NEAR PRIESKA IN THE NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

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MAPS

Map 1: Location of the proposed facility indicating shaded relief (topography and elevation above sea level) of the study area.

Map 2: Broad land cover and land use patterns of the study area.

Map 3: Preliminary visibility analysis, indicating the potential visibility of the facility from surrounding areas.

MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in association with V&L Landscape Architects.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

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

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

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the proposed Prieska Solar Energy Facility. Neither the author, MetroGIS nor V&L will benefit from the outcome of the project decision-making.

1. INTRODUCTION

Jouren Solar (Pty) Ltd is proposing the establishment of a solar energy facility and associated infrastructure on a site located approximately 30km north east of the town of Prieska within the Siyathemba Local Municipality of the Northern Cape Province.

A locality map indicating the proposed development site is shown on **Map 1**.

The facility is proposed to include several arrays of photovoltaic (PV) solar panels and/or Concentrating Photovoltaic (CPV) solar panels with a generating capacity of approximately 75 Megawatts of electricity and includes the following associated infrastructure:

- An on-site inverter to step up the power;
- A substation to facilitate the connection between the solar energy facility and the Eskom electricity grid;
- A loop-in and loop out power line to connect into the existing Burchell / Mooidraai 1 132kV power line which traverse the site;
- Internal access roads and
- A workshop area for maintenance and storage.

Photovoltaic (PV) technology uses the light energy of the sun to generate electricity though the photovoltaic effect. Individual PV cells are made up of a semiconductor material (such as silicone), which absorbs solar radiation and energises their electrons to produce energy.

The PV cells are linked together to form a PV panel, and an inverter is used to convert the electricity from direct current into alternating current. This alternating current is then fed into the grid.

CPV technology makes use of concentrating lenses to focus sunlight on tiny, highly efficient, multi junction solar cells. The use of the multi-junction cells renders the efficiency of this system much higher than that of conventional solar cells.

Solar energy generation is considered to be environmentally friendly electricity generation option.

2. SCOPE OF WORK

The project is proposed on Portion 3 of the farm Holsloot 47 and covers a total area of approximately 31km^2. The extent of the broader site is larger than the space that will be required for the facility's actual development footprint, however. Therefore, the PV panels and the associated infrastructure can be appropriately placed within the boundaries of the broader site while aiming to avoid any environmental sensitivities identified through the EIA process.

The scope of work for the proposed facility includes a scoping level visual assessment of the issues related to the potential visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment.

The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 2600km² (the extent of the analysis maps displayed below) and includes a minimum 16km buffer zone from the proposed site boundary.

3. METHODOLOGY

The study was undertaken using Geographic 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 20m interval contours supplied by the Surveyor General.

The procedure utilised to identify issues related to the visual impact includes the following activities:

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

This report (scoping report) sets out to identify the possible visual impacts related to the proposed facility.

4. THE AFFECTED ENVIRONMENT

Regionally, the proposed site for the proposed Prieska Solar Energy Facility is located approximately 30km north east of Prieska, 93km south west of Douglas, and some 105km west of Hopetown in the Northern Cape Province.

The study area occurs on land that ranges in elevation from about 950m above sea level (a.s.l.) along the Orange River, to about 1400m a.s.l. in the mountains in the north west and south west.

The topography consists of *Plains* in the central and eastern part of the study area, and *Hills* in the north west and south west. These hills form part of the *Asberge* and the *Doringberge* respectively. The terrain of the site and immediate surrounds it is flat, located on the plains. Refer to **Map 1**.

The most significant hydrological features is the Orange River, which meanders across the study area from the north east to the west. A number of non-perennial tributaries flow from the north west and south east, joining with the Orange River along it course. The site is located approximately 5km from the Orange River at its closest point.

The broader study area is situated within the *Orange River Broken Veld* vegetation type[1].

Land cover consists primarily of *thicket* (concentrated in the north and east), interspersed with *shrubland* (concentrated in the west and south). The area along the river is dominated by *cultivated land*, and some very small patches of *woodland* are dotted throughout the study area, as well as on the proposed site. A *plantation* appears to be present to the west of the site. Refer to **Map 2**.

This semi arid region receives between 185mm and 248mm of precipitation per annum and is therefore greatly devoid of any rain fed agriculture or cultivation. Sheep, goat and game farming occur throughout the region at a less intensive scale.

The site location can be described as remote due to its considerable distance from any major metropolitan centers or populated areas. The study area is sparsely populated (approximately 1,4 persons per km^2), with the highest concentration of people living in towns such as Prieska.

A number of homesteads and settlements are present within the study area. These include *Rooisloot, Taaibos, Ratelpan, Annexdraai, Diepfontein, Diepfontein 2, Rooidam, Johnsonspan* and *Herbou*, which all occur within a 16km radius of the proposed facility.

It is uncertain whether all of the potentially affected farmsteads are inhabited or not. It stands to reason that farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the

[1] Department of Environmental Affairs and Tourism, 2001. *Environmental Potential Atlas for the NorthernCape Province (ENPAT NorthernCape)*

future. For this reason, the author of this document operates under the assumption that they are all inhabited.

The R357 and R369 arterial roads intersect on the site. These roads are regional connectors leading to Douglas and Hopetown respectively. Other connectors include the R313 in the west of the study area, leading to Niekerkshoop in the north and Britstown in the south. Other than these main roads, a limited number of secondary roads cross the study area.

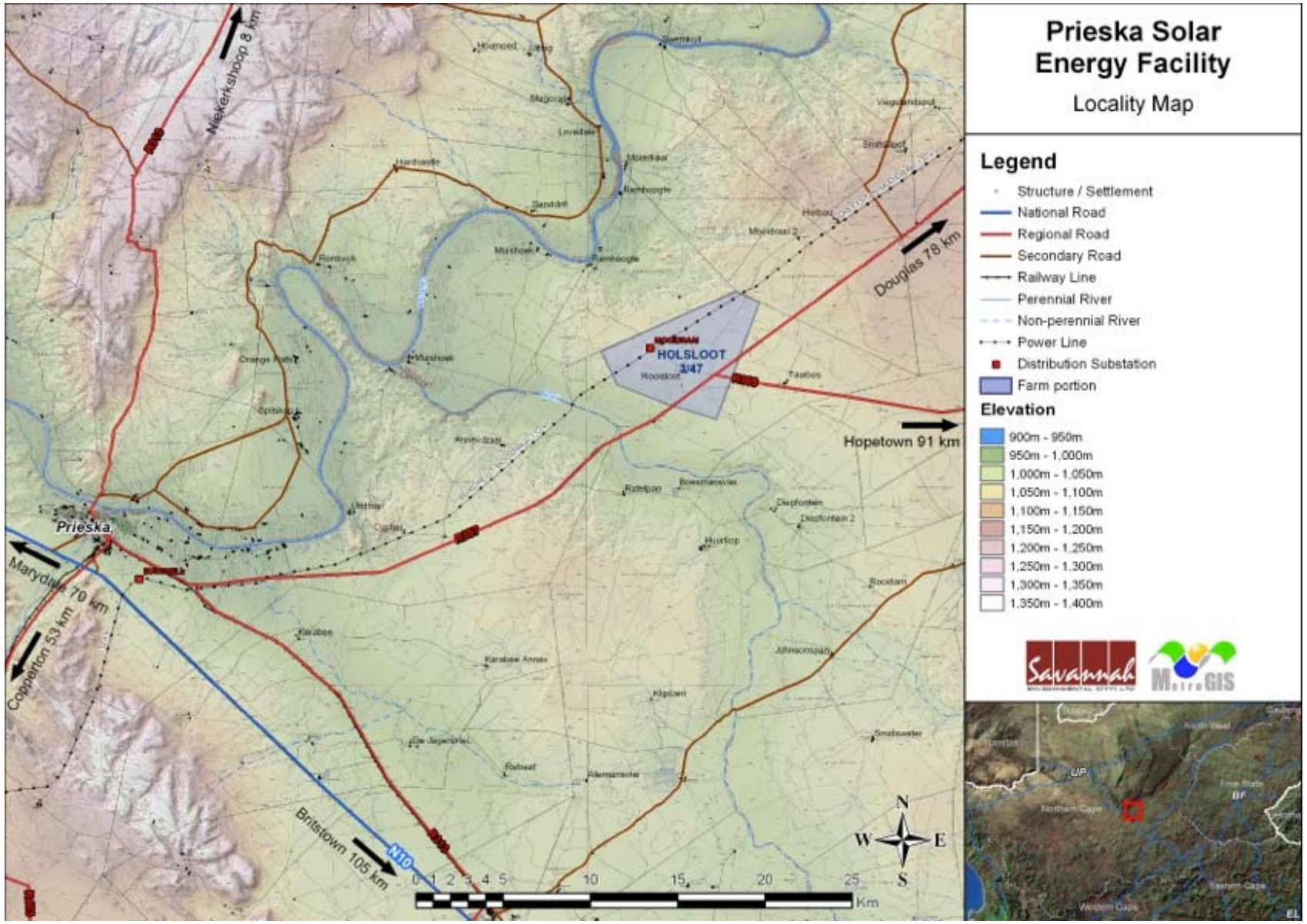
Other infrastructure includes the Burchell / Mooidraai 1 132kV power line, which traverses the study area (and the site) from the south west to the north east, and two substations. One of these, namely the Moodraai Substation is located on the proposed site.

There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character. Settlements, where these occur, are very limited in extent and domestic in scale.

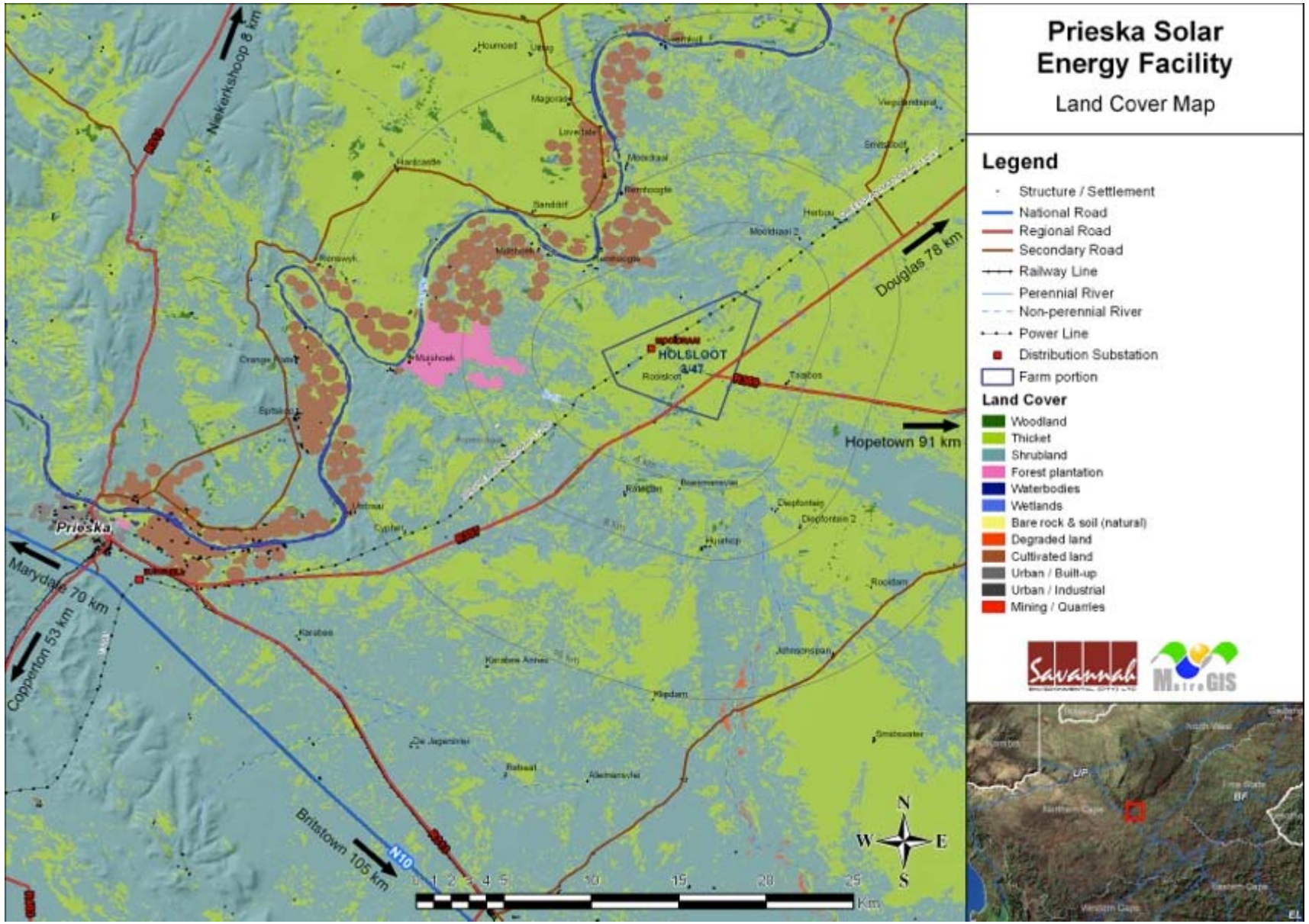
The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

This study area is not known as a tourist destination, but the various connectors discussed above do give access to the area between Prieska and Vioolsdrif, which is known by some as the 'Rock Garden Route'. Here the rare *halfmens* and succulents of the *Lithops* family can be found

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



Map 1: Location of the proposed facility indicating shaded relief (topography and elevation above sea level) of the study area.



Map 2: Broad land cover and land use patterns of the study area.

5. POTENTIAL VISUAL EXPOSURE

The result of the initial viewshed analyses for the proposed Prieska Solar Energy Facility is shown on **Map 3**.

It is expected, from a visual impact perspective, that the PV and / or CPV panels would constitute the highest potential visual impact of the solar energy facility, therefore, the viewshed analysis for the facility was undertaken from a number of provisional positions at an offset of 3m above average ground level (i.e. the approximate maximim height of the proposed PV panels).

This was done to determine the general visual exposure of the area under investigation, simulating the proposed primary infrstructure associated with the facility. It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed solar panels, therefore signifying a worst-case scenario.

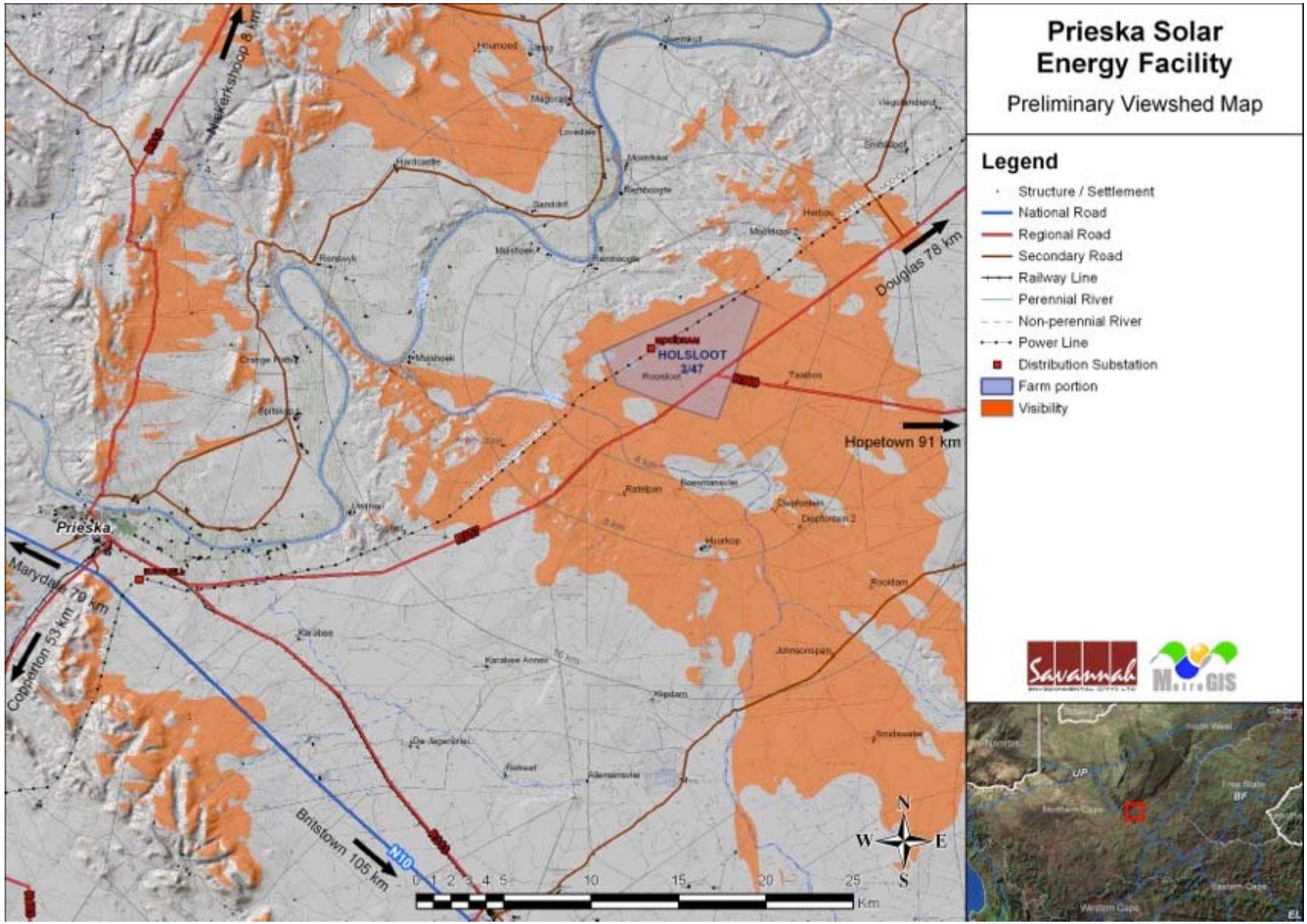
Map 3 indicates areas from which the proposed solar energy facility could potentially be visible as well as proximity offsets from the proposed development area.

The proposed facility will have a core area of potential visual exposure on the project site itself, and within an area extending about 3km to the north and west, 10km to the east and some 15km to the south. The hilly topography to the immediate north west of the site, and the incised river valley beyond, result in a significant visually screened area to the north west of the site.

Overall, the zone of potential visual exposure therefore extends mainly to the south east (i.e. up to a distance of more than 16km). Further afield, an area of potential visual exposure lies in the far north west of the study area and to a lesser extent to the far south west.

Potential sensitive visual receptors within this visually exposed zone include users of the main and secondary roads, especially to the north east, east and south west, and residents of agricultural homesteads and settlements. These include *Rooisloot, Taaibos, Ratelpan, Annexdraai, Diepfontein, Diepfontein 2, Rooidam, Johnsonspan* and *Herbou*, which all occur within a 16km radius of the proposed facility.

The town of Prieska lies 30km from the proposed site, and will not be visually exposed to the proposed facility.



Map 3: Potential visual exposure of the proposed facility.

6. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

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

- The visibility of the facility from, and potential visual impact on observers travelling along main roads (i.e. the R357, the R369 and the R313) and secondary roads in close proximity[2] to the proposed facility and within the region[3].

- The visibility of the facility from, and potential visual impact on residents of homesteads and settlements in close proximity to the proposed facility and within the region.

- The potential visual impact of ancillary infrastructure (i.e. the inverter, substation, power line, internal access roads and workshop area) on observers in close proximity to the proposed facility.

- The potential visual impact of the proposed facility on the visual quality of the landscape and sense of place region.

- The potential visual impact of the proposed facility on low level tourist access routes (i.e. the R357, the R369 and the R313) within the region.

- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.

- Potential visual impacts associated with the construction phase on observers in close proximity to the proposed facility.

- The potential cumulative visual impact of the proposed facility in relation to other infrastructure and built forms.

- Potential residual visual impacts after the decommissioning of the proposed facility.

- 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.

These anticipated visual impacts should be assessed in further detail during the EIA phase of the project as this report is only focused on defining the potential visual exposure of the proposed development and identifying the potential issues associated with the visibility of the development.

[2] For the purpose of this study, close proximity is considered to be within 4km of the proposed facility. This would be a medium distance view where the structures would be easily and comfortably visible and constitutes a high visual prominence.

[3] For the purpose of this study, the region is considered to be beyond the 4km radius of the proposed facility. This would be a longer distance view where the facility would become part of the visual environment, but would still be visible and constitutes a medium to low visual prominence.

7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the proposed Prieska Solar Energy Facility will have a visual impact on potentially sensitive visual receptors especially within (but not restricted to) a 4km radius of the proposed project development site.

Such visual receptors include people travelling along main and secondary roads and those residing within the farming homesteads and settlements.

There are no formally protected or conservation areas present within the study area, but the greater environment has a vast, undeveloped and rugged character. Settlements, where these occur, are limited in extent and domestic in scale. The greater environment with its wide open, undeveloped landscapes is considered to have a high visual quality.

This area itself is not known as a tourist destination, but the various connectors discussed above do give access to the area between Prieska and Vioolsdrif, which is known by some as the 'Rock Garden Route'.

It is therefore recommended that the severity of the potential visual impact be assessed in further detail in the EIA phase. Additional spatial analyses must be undertaken in order to create a visual impact index that will further aid in determining potential visual impact.

Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine visual impact and ultimately the significance of the visual impact. In this respect, the proposed Plan of Study for EIA is as follows:

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

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

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

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

  The proximity radii (calculated from the boundary lines of the farm selected for the facility) are as follows:

  - 0 - 4km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
  - 4 - 8km. Medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
  - 8 - 16km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.

- Greater than 16km. Long distance view of the facility where the facility could potentially still be visible, though not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

- **Determine viewer incidence / viewer perception**

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

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

- **Determine the Visual Absorption Capacity of the environment**

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

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

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

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

- **Determine the Visual Impact Index**

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

The above exercise should be undertaken for the core solar energy facility as well as the ancillary infrastructure, as these structures (i.e. the inverter, substation, power line, internal access roads and workshop area) are envisaged to have varying levels of visual impact at a more localised scale.

The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

In addition, cumulative visual impact should be addressed, as well as suggested mitigation measures for all identified impacts (if any).

8. REFERENCES / DATA SOURCES

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