PROPOSED METSIMATALA CONCENTRATING SOLAR POWER (CSP) PROJECT, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

Produced for:

Metsimatala CSP Solar Energy Pty (Ltd)

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- March 2016 -

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Lourens du Plessis from MetroGIS (Pty) Ltd undertook the visual assessment in his capacity as a visual assessment and Geographic Information Systems specialist. 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, State of the Environment Reports and Environmental Management Plans.

Lourens 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 utilise the principles and recommendations stated therein to successfully undertake visual impact assessments. Although the guidelines have been developed with specific reference to the Western Cape province of South Africa, the core elements are more widely applicable (i.e. within the Northern Cape Province).

Enviroworks appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment. Neither the author, nor MetroGIS will benefit from the outcome of the project decision-making.

1. INTRODUCTION

Metsimatala CSP Solar Energy Pty (Ltd) is proposing the establishment of a 150MW Concentrated Solar Power (CSP) Facility within the Tsantsabane Local Municipality within the ZF Mgcawu District Municipality in the Northern Cape Province. The proposed site identified for the facility is located approximately 22km north-east of Postmasburg.

The CSP facility is proposed to be developed in a single phase and will be referred to as the Metsimatala CSP project. Detailed site plans and layouts are not available yet, but two solar technology alternatives were considered for the Metsimatala CSP project.

Alternative 1 (Preferred): Parabolic Trough System

The Parabolic Trough System's visual characteristics are as follows:

- Large rectangular u-shaped (parabolic) mirrors are arranged and connected in long rows facing the sun and aligned on a north-south axis. Many parallel rows of connected mirrors are placed on mobile pivoting systems enabling them to continuously track the movement of the sun from east to west throughout the day to optimise the solar radiation they receive.
- The associated infrastructure is mounted near or on the ground and are not expected to exceed a height of 5m above ground level.

Figure 1: A typical example of a Parabolic Trough System.

Alternative 2: Solar Tower System
The Solar Tower System's visual characteristics are as follows:

- Multiple large slightly curved mirrors called heliostats (made of glass and steel) are arranged adjacent to each other in rows facing the sun and aligned on a north-south axis. Many parallel rows of mirrors are placed on mobile pivoting systems enabling them to continuously track the movement of the sun from east to west throughout the day to optimise the solar radiation they receive.
- A receiver tower is constructed at a pre-determined position in front of the sea of mirrors and the heat of the sun is reflected off the mirrors and concentrated to a specific focussed receiver point position on the receiver tower.
- The heliostats may have dimensions of up to 12m x 12m and the receiver can be mounted on a tower structure varying between 100m to 195m above ground level.

Figure 2: An example of a Solar Tower System.

Ancillary infrastructure (for both alternatives) may include:

- A new on-site substation and power line to evacuate the power from the facility into the Eskom grid at the Manganore 132kV substation located approximately 25km north-west of the site.
- Cabling between the project components, to be lain underground where practical.
- Internal access roads and fencing.
- Workshop area for maintenance, storage, and offices.

Solar energy generation is generally considered to be an environmentally friendly electricity generation option and the construction phase of the proposed facility is expected to be 18 months to 2 years whilst the lifespan of the facility is typically 30 years.

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact.

The study area for the visual assessment encompasses a geographical area of 180km^2 (the extent of the maps) and includes a 6km buffer zone from the proposed development area. It includes the towns/settlements of Metsimatala, Groenwater and Jenn-Haven, a section of the R385 main road as well as a secondary (local) road.

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 from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

The methodology utilised to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included 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 Metsimatala CSP Project.

4. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed CSP Project include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the R384 and the local road traversing near the proposed facility.

- The visibility of the facility to, and potential visual impact on observers residing in towns/settlements and homesteads (farm residences) located within close proximity of the site.

- Potential cumulative visual impacts (or alternately, consolidation of visual impacts) with specific reference to the existing power line infrastructure traversing the development site, the mining activities and railway line infrastructure within the region.

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

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

- The visual absorption capacity of natural or planted vegetation and man-made topographical features.

- Potential visual impacts associated with the construction phase.

- The potential to mitigate visual impacts.

It is envisaged that the issues listed above may constitute a significant visual impact at a local and/or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

5. THE AFFECTED ENVIRONMENT

The identified site for the proposed CSP Project is situated north of the R385 main road on portions (parts of) the following farms:

- Remaining Extent, Farm Groenwater No 453
- Portion 4, Farm Groenwater No 453
- Portion 5, Farm Groenwater No 453

These farms are all owned by the Groenwater Communal Property Association.

Land use and settlement patterns

The primary activity in the region is mining, cattle and sheep farming, and small scale cultivation occurs on some farms in the area. Agricultural potential is low due to dry climatic conditions.

The population density in the area is very low. Small towns and villages in the region are mainly associated with mining activity. Metsimatala village is situated adjacent (east) of the CSP site. The only farmstead in close proximity to the CSP is Groenwater, less than 1km south of the site.

The R385 arterial road, passing south of the site, is a main transportation route between Kimberley and Upington, and can be regarded as a tourist access route. Another transportation link is the secondary road traversing approximately 2km east and north of the CSP site. A railway line and Groenwater siding is located almost 3km east of the site.

Figure 3: View of the CSP site, looking north from the R385 main road.

Existing infrastructure within the region includes a 132kV power line transecting the study area from north-west to south-east. Mining activity within the larger region includes asbestos mining, mainly at Lime Acres (south-east) of the study area.

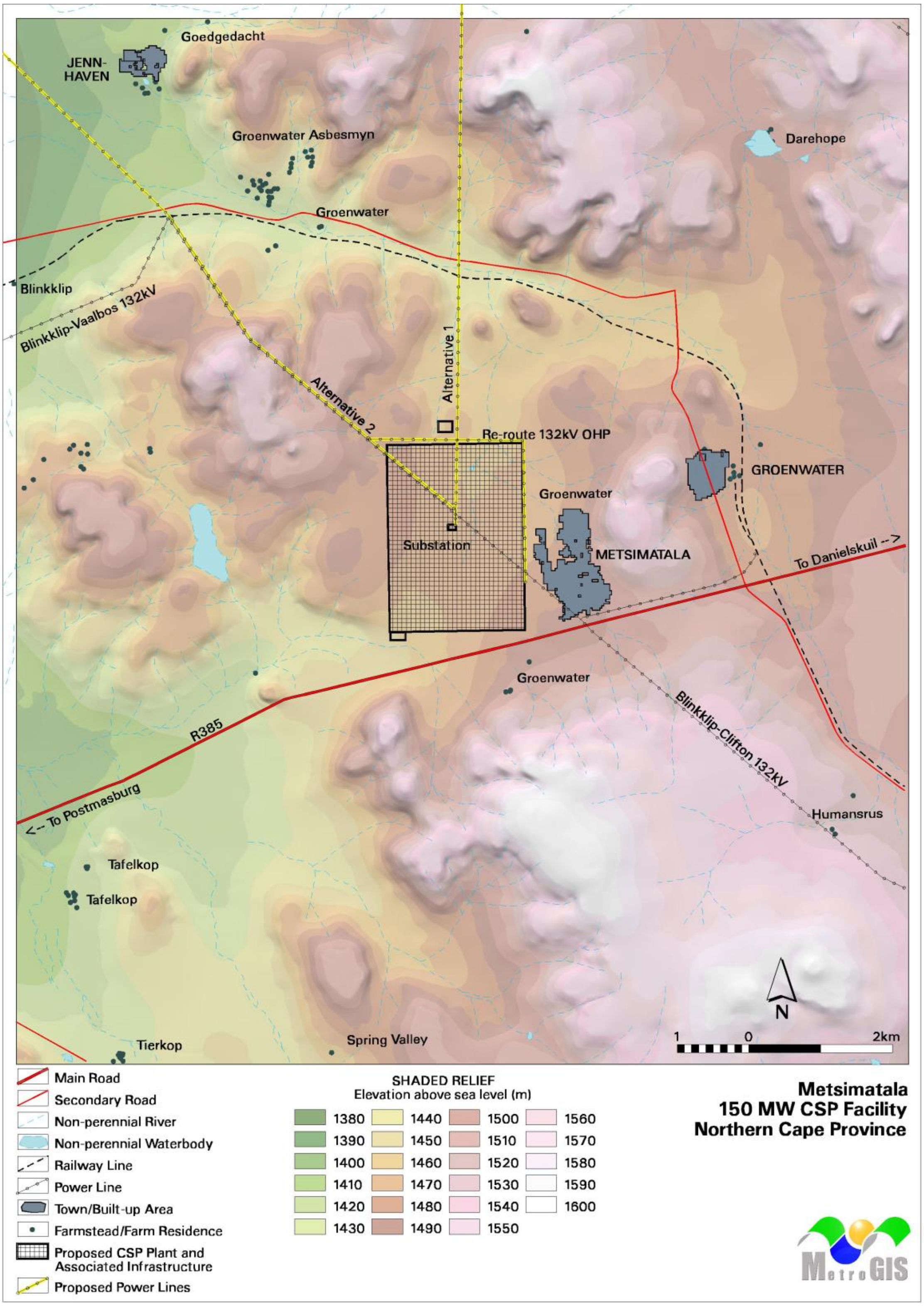
There are no formally protected areas (conservation) within the study area and the region is not considered to be a major tourist end-destination. No tourist attractions or facilities were identified within close proximity to the proposed CSP site.

Topography, vegetation and hydrology

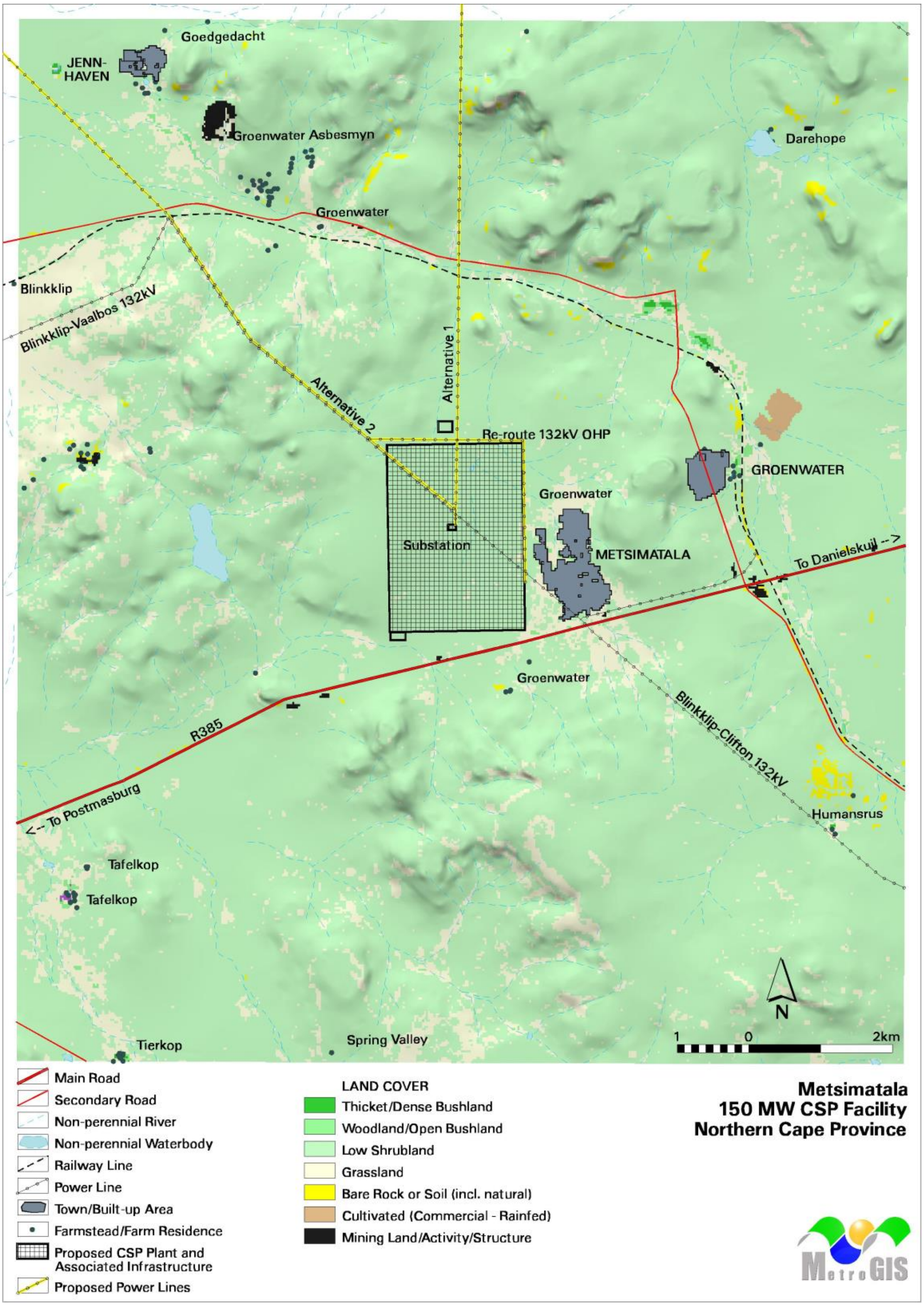
The topography is generally undulating, with the CSP site located on flat land between a range of two north-south lying ridges. Vegetation is described as *Olifantshoek Plains Thornveld,* consisting of thicket, bush clumps and low shrubland. Views of the landscape are characterised by open vistas with ridges prominent on the skyline (refer to the photograph in **Figure 3**). The elevation above sea level varies between 1380m (in the north-west) to 1600m on top of the ridge located south of the site.

Visual absorption capacity of the environment is relatively low, due to the sparse vegetation cover and open vistas. The undulating topography and occurrence of hills and ridges is effective to contain visual exposure mostly within 3km in respect of structures 5m and lower in height.

No major perennial rivers are present and the *Groenwaterspruit* and a number of non-perennial pans are the most prominent hydrological features within the study area. Other water bodies include man-made dams, primarily located at farmsteads. Refer to **Maps 1** and **2**.



Map 1: Shaded relief map (indicating the location of the proposed facility and the topography and elevation above sea level) of the broader study area.



Map 2: Land cover/land use map.

6. VISUAL EXPOSURE/VISIBILITY

The result of the preliminary viewshed analyses for the proposed facility is shown on the map below (**Map 3**).

The visibility analyses were undertaken at three different heights above ground level, in order to simulate the technology alternatives, and to indicate the prominence of the structures within the landscape.

- Parabolic trough system - 5m agl.
- Solar tower system – 100m agl.
- Solar tower system – 195m agl.

Note: In the absence of more detailed design information, two different heights above ground level were used for the tower system. The height of the tower and the placement of the receiver are dependent on the scale of the facility.

The initial viewshed analyses were undertaken from a number of vantage points within the proposed development area at the offsets indicated above.

It must be noted that the Digital Terrain Model (DTM) utilised for the viewshed analyses do not include the effect of vegetation cover and built structures. These features may influence the visual exposure of the CSP facility to some degree.

The viewshed analyses will be further refined once a preliminary and/or final layout of the CSP facility is completed and will be regenerated for the actual position of the infrastructure on the site, and per structure position (and actual proposed technology) during the EIA phase of the project.

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

General

It is evident from the preliminary viewshed analyses that the proposed solar tower technology (100m to 195m) would have a much larger area of visual exposure compared to the much reduced vertical dimensions of the parabolic trough technology. The solar tower is expected to be visible from a large portion of the study area, even if the maximum height is contained at 100m above ground level. It is expected that the heliostats, generally much larger than the parabolic troughs, would further contribute to the increased area of exposure.

0 - 1km (short distance)

Theoretical visibility within a 1km radius of the proposed site mainly includes the Groenwater farm itself, a section of the R385 main road, the Groenwater farm residence and the Metsimatala settlement. It is expected that the proposed project infrastructure, regardless of the chosen solar technology, would be highly visible and prominent within this zone.

1 – 3km (short to medium distance)

The area of potential visual exposure becomes interrupted within this zone due to the hills surrounding the CSP site. The core area of visual exposure for the parabolic trough technology is largely contained within a 3km radius of the site. The solar tower is expected to still be highly visible within this zone. This area is generally devoid of sensitive visual receptors, except for sections of the R385 main road and the secondary road. The Groenwater settlement, located beyond a hill to the east of the site, is not expected to be exposed to the proposed CSP facility.

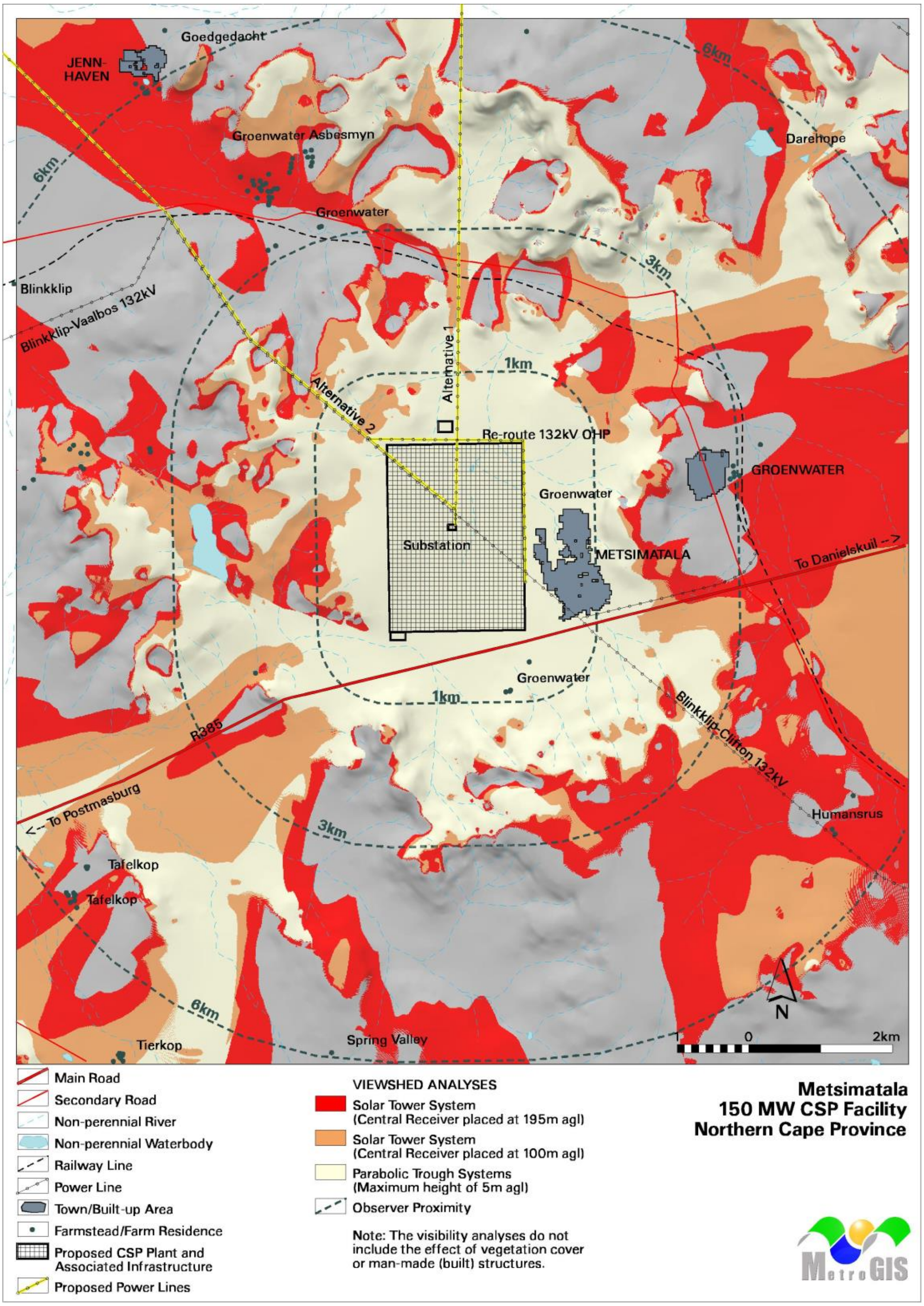
3 – 6km (medium to long distance)
The intensity of visual exposure is expected to diminish beyond a 3km radius from the proposed development site. It is mainly the solar tower structures that may be visible from farmsteads and roads within this zone.

Greater than 6km (long distance)
Visibility beyond 6km from the proposed development site is expected to be negligible and highly unlikely due to the distance between the object (development) and the observer.

Conclusion
It is envisaged that the structures, where visible from shorter distances (e.g. less than 3km), may constitute a high visual prominence, potentially resulting in a high visual impact. The visual exposure and general visual impact is expected to be higher for the much taller solar tower and heliostats, than for the much more constrained parabolic trough system.

The general absence of sensitive visual receptors mitigates the potential visual impact to a large degree. It is also further expected that the short distance observers, residents of Metsimatala and the Groenwater farmstead, are generally in favour of the development. This will further mitigate, or even negate the potential visual impact.

Observers travelling along the R385 main road may experience short term (i.e. transitionary) visual exposure where this road traverses within close proximity to the proposed CSP facility, potentially resulting in a high visual impact.



Map 3: Map indicating the potential (preliminary) visual exposure of the proposed facility.

7. CONCLUSION/RECOMMENDATIONS

The proposed Metsimatala CSP will be introducing a new type of land use into a rural environment where the sense of place can be described as quiet with tranquil views of open landscapes and distant ridges. The solar tower technology is expected to be more intrusive than the parabolic trough system. The latter technology option is therefore preferred from a visual impact perspective.

However, the fact that some components of the proposed facility may be visible does not automatically imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 3km buffer zone from the facility need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact and potential sensitive visual receptors. This exercise should be undertaken for the core facility as well as for the ancillary infrastructure, as these structures (e.g. the substation and power line) 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 this respect, the Plan of Study for the EIA phase of the project 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 CSP structures.

Proximity radii for the proposed development footprint 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 solar energy facilities.

The proximity radii (calculated from the development footprint of the CSP facility) are as follows:

- 0 – 1km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 1 - 3km. Short to medium distance view where the structures would be easily and comfortably visible and may constitute a high visual prominence.
- 3 - 6km. Medium to long 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 6km. Long distance view of the facility where the facility could potentially still be visible, though not as easily recognisable. This zone constitutes a low visual prominence for the facility.

Note: These distances may be revised once a provisional layout of the proposed facility becomes available.

- **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 (VAC) of the landscape**

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 VAC (vegetation and built structures) of the region. It is therefore necessary to verify the VAC by means of field observations and supplement it where necessary.

- **Determine the Visual Impact Index**

The results of the above analyses are merged in order to determine the areas of likely visual impact, in other words, where visual impacts are expected. 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 (e.g. the substation and power line) 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, as well as suggested mitigation measures.

8. REFERENCES/DATA SOURCES

Chief Directorate National Geo-Spatial Information, varying dates. 1:50 000 Topo-cadastral Maps and Data.

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

Department of Environmental Affairs and Tourism (DEAT), 2001. *Environmental Potential Atlas (ENPAT) for the Northern Cape Province*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*