ILANGA SOLAR THERMAL POWER PLANT AS PART OF THE FUTURE KAROSHOEK SOLAR VALLEY PARK

VISUAL ASSESSMENT

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

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 modelling 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 Ilanga Solar Thermal Power Plant. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

1. INTRODUCTION

Ilangalethu Solar Power (Pty) Ltd (Ilanga CSP1) is proposing the establishment of a Solar Thermal Power Plant (STPP) on a site about 30 km east of Upington within the Siyanda District Municipality in the Northern Cape Province.

Ilanga CSP1 intends to utilise parabolic trough technology with a generating capacity of up to 125MW within a footprint of about 4.84 km^2. Solar energy generation is generally considered an environmentally friendly electricity generation option.

The proposed STPP will consist of two functional elements which includes a Solar Field (consisting of parabolic troughs), and a Power Block.

Parabolic troughs are curved, mirrored troughs which reflect direct solar radiation onto a glass tube containing a fluid (also called a receiver, absorber, or collector) running the length of the trough, and positioned at the focal point of the reflectors.

A preliminary layout of the primary STPP infrastructure is shown on **Figure 1**, and includes the following:

- *The solar field* - this will comprise multiple loops of parabolic troughs which serve to receive and concentrate the solar radiation.
- *The power block* - comprising a conventional steam turbine generator.

The layout of supplementary infrastructure has not been finalised, but will include the following:

- *Water related infrastructure* - including a water extraction point, pump set, sand filter, still basin and coffer dam on the Farm Annashoek (which has existing water use rights) as well as water supply pipelines; water treatment works and reservoirs. The project developer does not own the proposed development site located on the farm Annashoek at present, but has the option to purchase the farm which will include these existing water rights.
- *Power evacuation* – the proposed 132 kV overhead power line is proposed to loop into and out of the existing Gordonia-Garona 132 kV line to the north of the site. This will necessitate the construction of two power lines. It is proposed that these power lines follow the same alignment as the main water supply pipeline and access road (along the existing main access road to the farm Annashoek), and will necessitate the crossing of the Orange River in the vicinity of the water abstraction point.
- *Associated infrastructure* – this will include internal access roads; storerooms, accommodation, waste storage facilities etc.

The power line, access road and pipeline to the site will all follow the same route, which is along the existing main access road to the farm Annashoek. Refer to **Map 1.**

Alternatives being considered relate to the technology which could be implemented - that is the CSP facility with storage or without storage. These options are essentially the same, expect for the option with storage requiring a slightly larger footprint. No discernable difference is evident on the scale on which the VIA is undertaken. This visual assessment is therefore relevant for both alternatives.

The construction phase of the proposed facility is expected to be 24 to 30 months whilst the lifespan of the facility is typically 40 years.

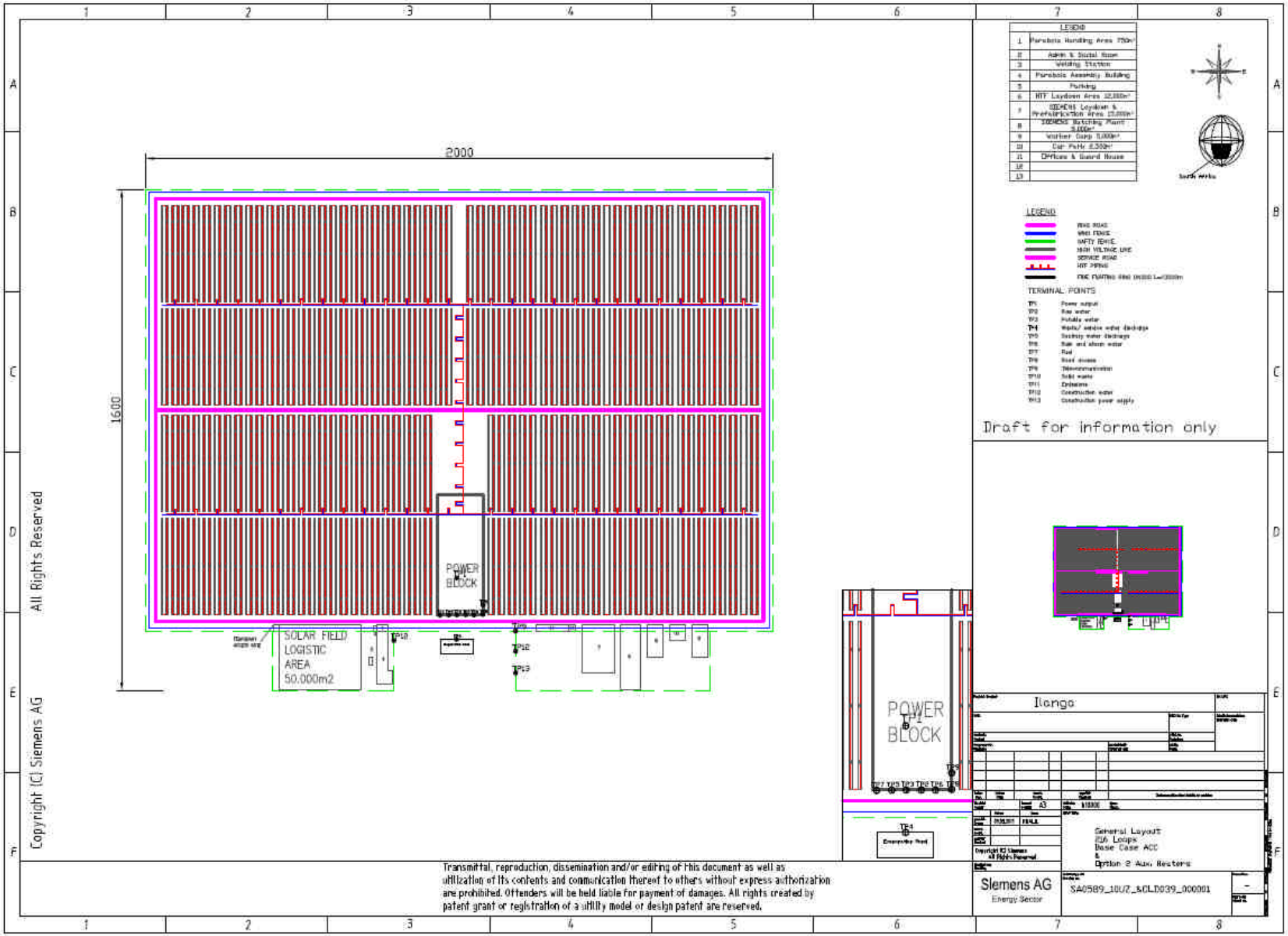
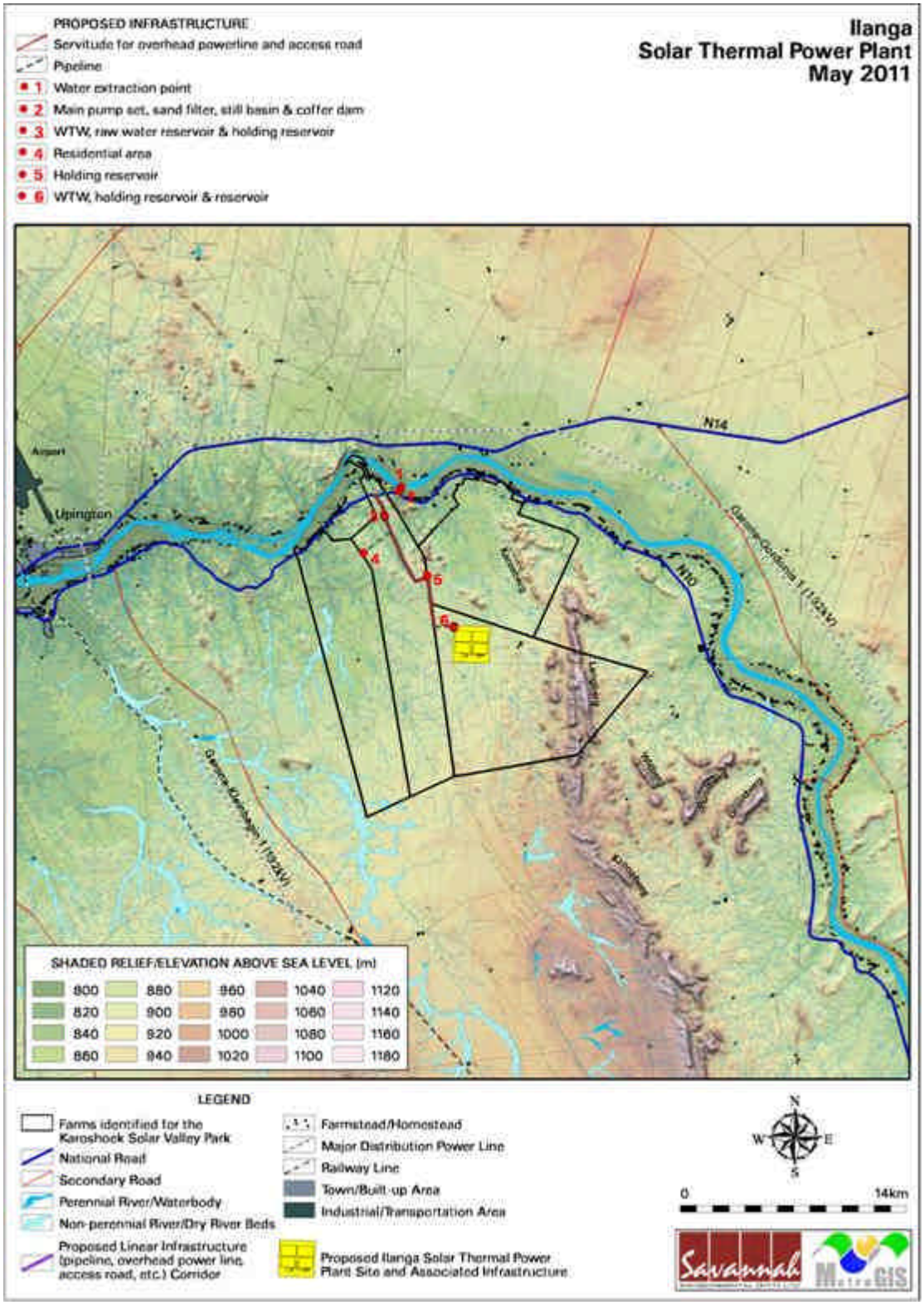


Figure 1: Proposed Layout of the STPP.



Map 1: Locality map and proposed layout of the facility showing the proposed Plant site as well as shaded relief (topography and elevation above sea level).

2. SCOPE OF WORK

The study area for the visual assessment encompasses a geographical area of 1024km² (the extent of the maps displayed below) and includes a minimum 16km buffer zone from the proposed development area.

The broader study area includes the town of Upington and a number of settlements and homesteads, mainly concentrated along the banks of the Orange River. Industrial infrastructure within the study area includes the Upington Airport, several transmission and distribution powerlines as well as a number of distribution substations.

The N14 and N10 national roads (to the north and south of the river respectively) and a few secondary roads traverse the study area.

The scope of work for this assessment includes the determination of the potential visual impacts of the proposed facility and associated infrastructure in terms of nature, extent, duration, magnitude, probability, and significance of the construction and operation of the proposed infrastructure.

In this regard, specific issues related to the visual impact were identified during the Scoping phase, and verified during a site visit to the affected environment. These issues related include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the national (N14 and N10) and secondary roads within the study area.
- The visibility of the facility to, and visual impact on settlements and 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 (N10 and N14) and potential tourist activities and destinations (i.e. along the Orange River).
- The potential visual impact of the construction of ancillary infrastructure within the facility footprint.
- The potential visual impact of the construction of ancillary infrastructure beyond the facility footprint 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.
- Potential visual impacts associated with the construction phase.
- Potential cumulative visual impacts, specifically in context of a number of PV and CSP facilities which have been approved within the region. These include the Eskom, Khi and Abengoa, amoungst others.
- The visual absorption capacity of the natural vegetation (if applicable).
- 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.

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.

Site visits were undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

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

- The creation of a detailed digital terrain model (DTM) 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 (visual impact assessment) sets out to identify and quantify the possible visual impacts related to the proposed facility, including related infrastructure, as well as offer potential mitigation measures, where required.

The following methodology has been followed for the assessment of visual impact:

- **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 the proposed solar facility and associated infrastructure were not visible, no impact would occur.

  Viewshed analyses of the proposed solar facility and the related infrastructure, based on a 20 m interval digital terrain model of the study area, indicate the potential visibility.

- **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 each type of structure.

  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.

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 negative visual perception of the proposed 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 solar 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 natural vegetation**

  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 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 natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, 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 were further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to judge the severity of each impact.

4. THE AFFECTED ENVIRONMENT

The proposed site for the development of the STPP includes the following farms:

- Portion 0 of farm Karos 959;
- Portion 3 of farm Annashoek 41;
- Portion 2 of farm Matjesrivier 41 and
- Portion 0 of farm Zandemm 944.

The above site comprises a total area of about 26 000ha, but the actual development will be limited to an area of about 4.84 km^2(refer to Figure 1 for the layout of the proposed STPP).

Regionally, the site is located about 30km east of Upington within the Northern Cape Province. Although it is not on the Orange River itself, the site is quite close, lying to the south of the river, just beyond the river valley.

The N10 national road runs along the northern boundary of the site, traversing it for a small portion. A number of secondary roads form links between this road and the N14 north of the river. These are located to the west and east of the site. Refer to **Map 1**.

The study area occurs on land that ranges in elevation from 800m (at the Orange River) to 1180m (at the top of the nearby koppies). The terrain surrounding the farm is predominantly flat with an even slope towards the Orange River valley that forms the most distinct hydrological feature in the region.

Due to this flat topography, the area, particularly south of the river, is characterised by the occurrence of many non-perennial drainage lines and pans.

The dominant topographical unit or terrain type of the region is relatively homogenous and is described pre-dominantly as *lowlands with hills, dune hills* and *irregular or slightly irregular plains*.

Relatively prominent low hills and koppies occur in the south-east of the study area. Some isolated koppies also occur randomly in the north west of the study area. The Orange River meanders from the south east, and then curves toward the west.

The river has, to a large degree, dictated the settlement pattern in this arid region by providing a source of permanent water for the cultivation of grapes. This and the associated production of wine is the primary agricultural activity of this district. Cattle and game farming practises also occur at a less intensive degree.

The majority of the study area is sparsely populated (less than 10 people per km^2) and consists of a landscape of wide-open spaces and very little development. The scarcity of water and other natural resources has dictated the settlement patterns of this region.

Tourism is not well developed within the study area, but some destinations exist along the river and in Upington.

The population distribution is primarily concentrated in and around small towns along the Orange River. Farming homesteads dot the countryside at irregular intervals.

The study area has a rural character with little development outside of Upington. Exceptions occur where powerlines traverse the study area. These include the Garona-Gordonia 1 132kV line to the north east of the site and the Garona-Kleinbegin 1 132kV line to the west of the site.

Vegetation cover in this semi-desert region is primarily *shrubland, thicket, and bushland* with isolated pockets of *grassland*, and *agricultural fields* occurring along the Orange River. Refer to **Map 2.**

There are no formally protected areas within the study area.[1]

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

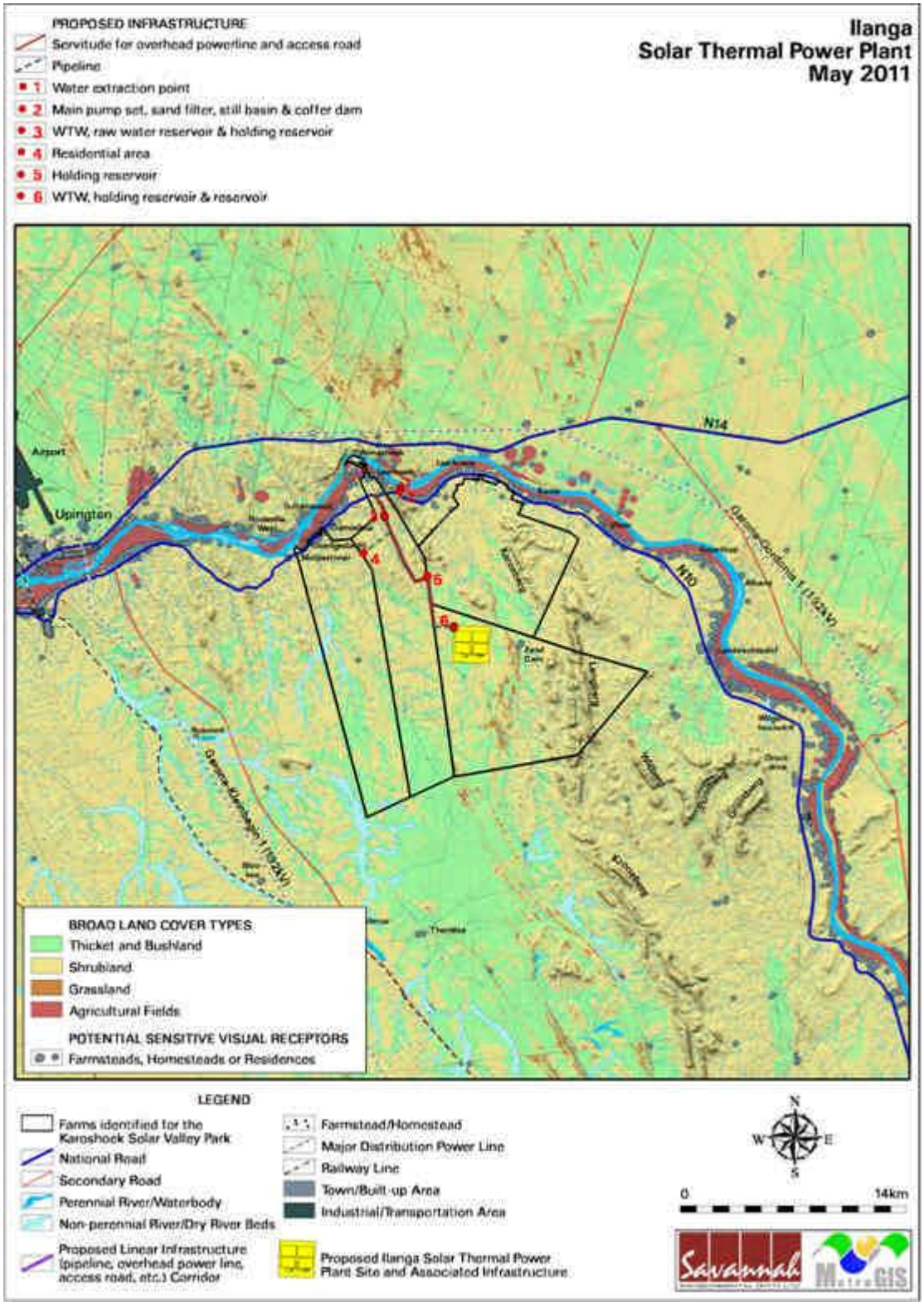
The photographs below show the area identified for the proposed STPP and give an indication of the visual quality of the receiving environment.

Figure 2: Typical natural vegetation cover of the area north of the proposed site.

Figure 3: Agricultural land to the north of the proposed STPP (i.e. land between the N14 and the Orange River, east of Upington).

Figure 4: Typical homestead in the area south of the proposed STPP.

Figure 5: Photograph showing the dominantly flat topography of the region.



Map 2: Land types and vegetation cover of the broader study area.

5. RESULTS

5.1 Potential visual exposure

The result of the visibility analysis for the proposed STPP and ancillary infrastructure is shown on **Map 3**.

The analysis was undertaken from actual positions as set out within the provisional layout of the facility. Separate viewsheds have been generated for the primary infrastructure (i.e. the solar field and the power block), set at 12m above average ground level and for the over head powerline, set at 20m above average ground level. Both these are considered to be worst case scenario's.

The STPP:

The colour shading on the viewshed analysis indicates areas from which the proposed STPP would be visible.

It is clear from the analysis that the STPP would be visually exposed to a large area, but that the actual visually exposed areas are quite contained in extent. These areas lie predominantly within the site itself, and to the immediate west and south west.

Other areas of potential visual exposure lie further afield, north of the Orange River and within the low hills in the north west (also beyond the Orange River). The former are very flat visually exposed areas, but the latter low hills offer some visual protection for areas lying further to the north west.

The low hills within and to the east of the site also shield the region further east from potential visual exposure. The west facing slopes of these hills will, however, be visually exposed.

The Orange River valley is, for the most part, shielded from potential visual exposure by virtue of its topography. The exception is a zone on the northern bank of the river, north west of the site.

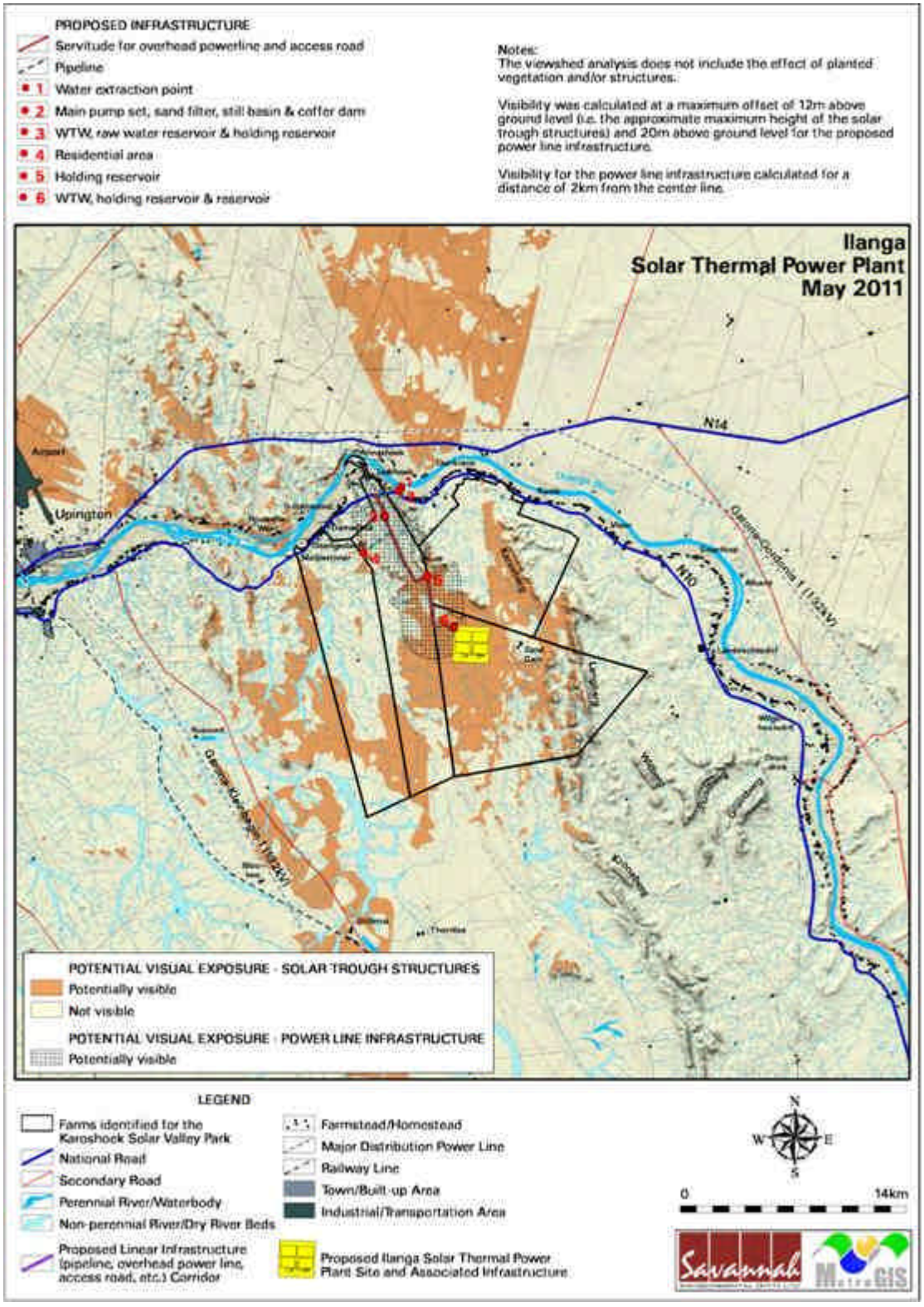
Ancillary infrastructure:

Some ancillary infrastructure, including the access road, water extraction point, pump set, sand filter, still basin, coffer dam, water supply pipeline, water storage reservoirs and the power lines will be established along the same alignment. This infrastructure will fall within, and be covered by the viewshed of the powerline.

The cross hatch shading on the viewshed analysis indicates areas from which the proposed overhead power line would be visible. The viewshed has been calculated for a distance of 2km on either side of the power line. This analysis indicates an almost uninterrupted band of visual exposure for the full 2km width of the viewshed. This includes a section of the Orange River and a number of river-side settlements and homesteads.

Other ancillary infrastructure (i.e. internal access roads; storerooms, waste storage facilities etc) will be located within the development footprint and thus fall within, and be covered by the viewshed of the STPP.

No specific viewshed for the accommodation facility has been generated, as the nature and scale of this component does necessitate such.



Map 3: Potential visual exposure of the proposed STPP.

5.2 Visual distance / observer proximity

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 boundary lines of the farms) are shown on **Map 4** and are as follows:

- 0 - 4 km - Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.

- 4 - 8 km - Medium distance views where the facility would be easily and comfortably visible and constitute a high visual prominence.

- 8 - 16 km - 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 16 km - Long distance view where the facility would still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the facility.

5.3. Viewer incidence / viewer perception

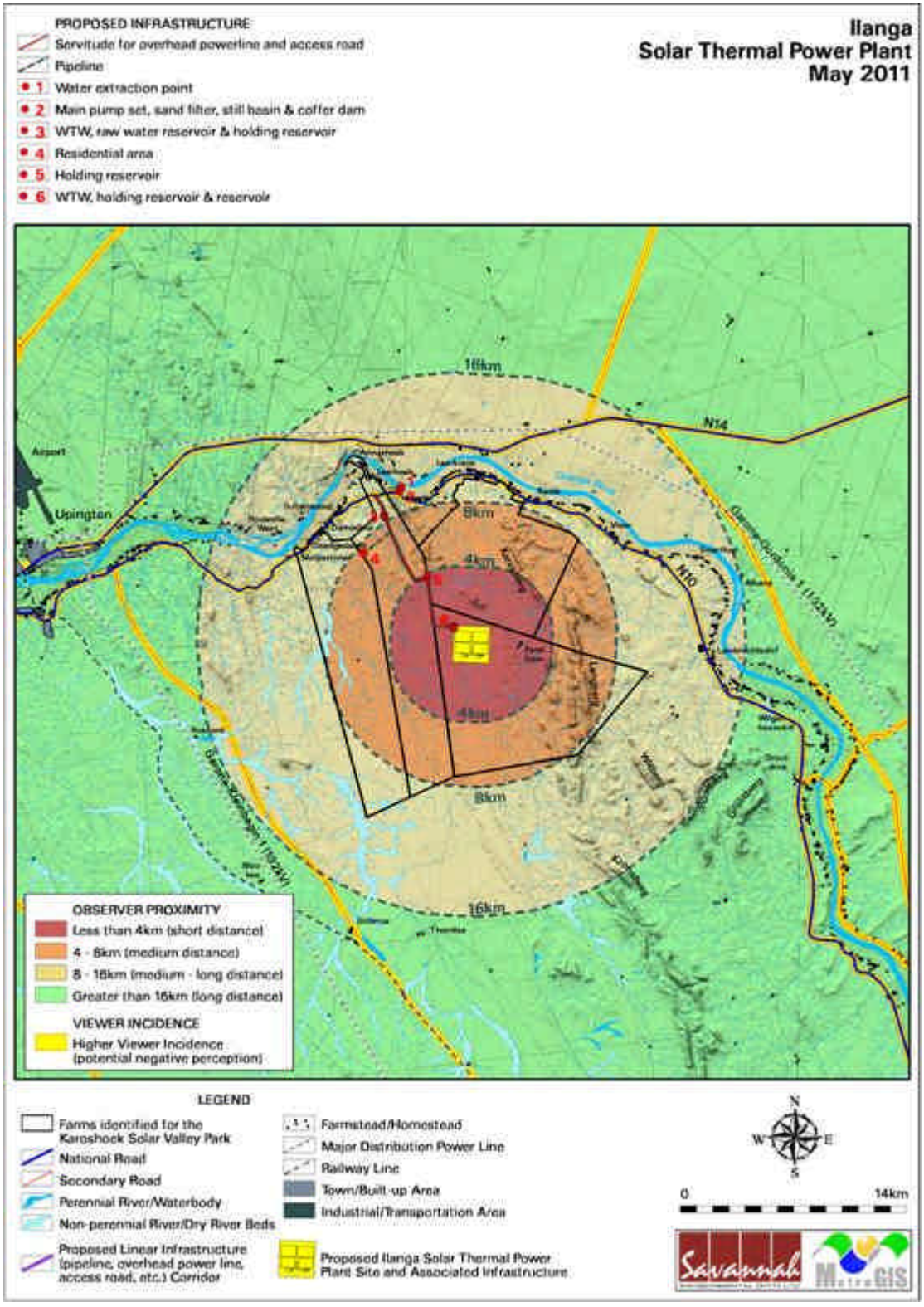
Refer to **Map 4**. Viewer incidence is calculated to be the highest along the national roads (i.e. the N10 and N14) as well as the secondary roads within the study area. Commuters and tourists using these roads could be negatively impacted upon by visual exposure to the STPP and ancillary infrastructure (i.e. specifically the power lines).

Tourists travelling through the area are seen as possible sensitive visual receptors upon which the construction of the proposed facility could have a negative visual impact.

Other than along the above roads, viewer incidence within a 16km radius of the proposed STPP is concentrated in the significant number of homesteads and settlements along the Orange River.

The severity of the visual impact on the above receptors decreases with increased distance from the proposed facility. It should in fact be noted that many of the receptors above occur more than 8km from the proposed facility.

The remaining areas beyond 16km consist predominantly of vacant natural land (grazing) and very sparsely scattered homesteads. The highest concentration of potential observers is in Upington, which lies more than 20km from the site. It is not likely, however, that the facility will be visible from this distance.



Map 4: Observer proximity to the proposed Plant and areas of high viewer incidence.

5.4. Visual absorption capacity

The vegetation present in the study area surrounding the facility (predominantly *Shrubland)* is expected to have a low Visual Absorption Capacity (refer to figures 3, 4 and 5 in this respect.). Where *Thicket and Bushland* occurs, the VAC may be somewhat higher (refer to figure 1). However, these areas have not been mapped, and a low to negligible VAC is assumed for the entire study area.

The visual impact index calculated therefore represents a worst case scenario.

5.5. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed STPP are displayed on **Map 5**. 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 in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence, and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

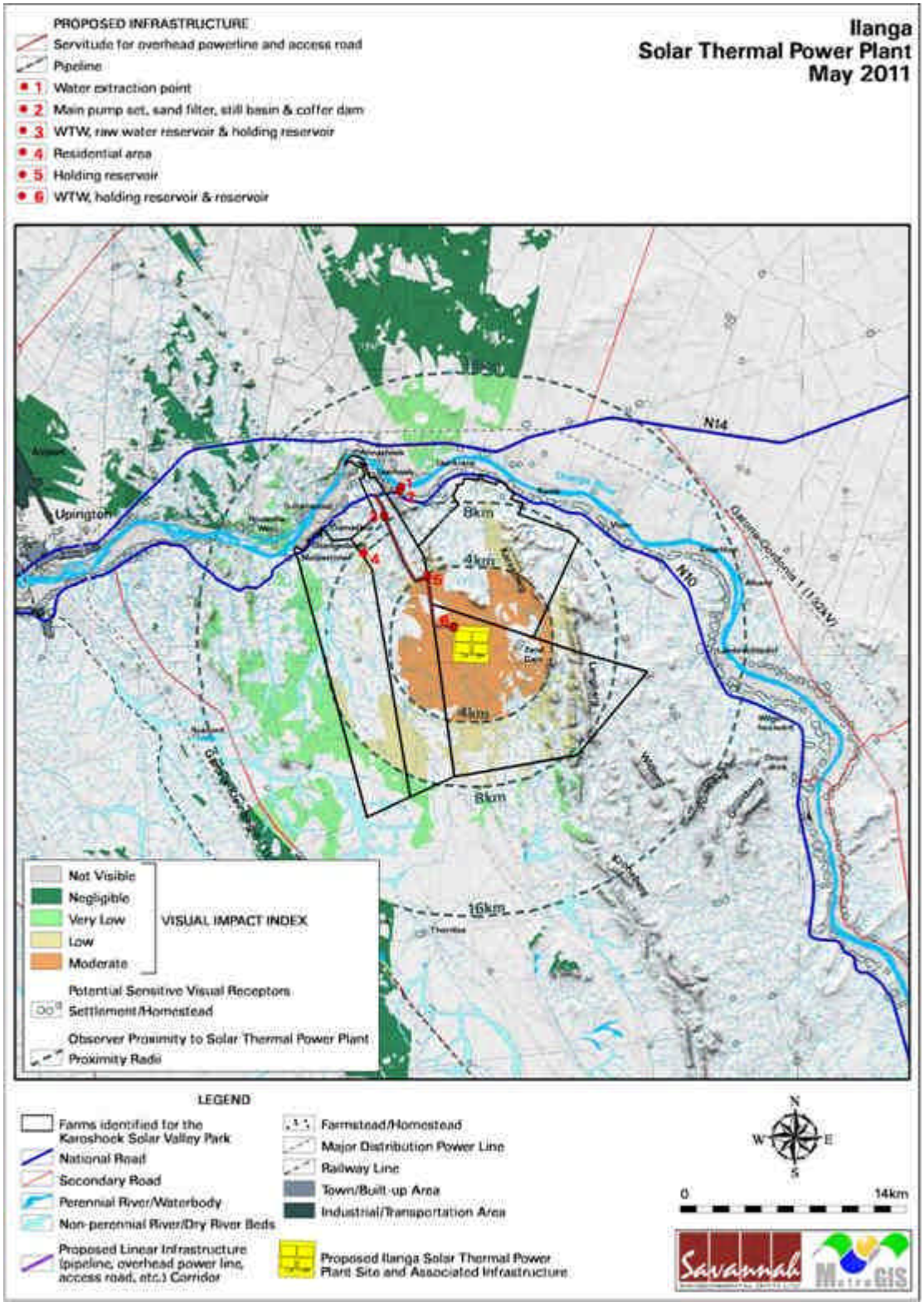
The visual impact index map (Map 5) represents the anticipated visual impact for the STPP and ancillary infrastructure located within the development footprint, and does not address that of the proposed powerline.

The map indicates a core area of potentially **moderate** visual impact within a 4km radius of the proposed STPP. No infrastructure or settlements lie within this area.

Potential areas of **low** visual impact lie between 4km and 8km from the proposed STPP. No infrastructure or settlements will be affected.

Between the 8km and 16km radius, areas of **low** visual impact include a very short stretch of the N14 (north of the Orange River), and the secondary road south east of the site. In addition, a number of homesteads (Rouxville West) along the Orange River, to the north west of the site, will potentially be exposed to low visual impact. Remaining areas between 8km and 16km from the site will be exposed to very low visual impact.

Visual impact beyond 16km, including the eastern outskirts of Upington, is likely to be negligible.



Map 5: Visual impact index of the proposed STPP.

5.6 Visual impact assessment: methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see Chapter 2: 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 near the proposed solar facility) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very high = 5), local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)
- **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 (= 1), low (= 2), medium/moderate (= 3), high (= 4) and very high (= 5)
- **Probability** - none (= 0), improbable (= 1), low probability (= 2), medium probability (= 3), high probability (= 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)

*Please note that due to the declining visual impact over distance, the **extent** (or spatial scale) rating is reversed (i.e. a localised visual impact has a higher value rating than a national or regional value rating). This implies that the visual impact is highly unlikely to have a national or international extent, but that the local or site-specific impact could be of high significance.*

5.7 Visual impact assessment: primary impacts

5.7.1 The STPP

Potential visual impact on users of national and secondary roads within the region.

Potential visual impact on users of major and secondary roads within the region is expected to be of **low** significance. There is no mitigation for this impact during the operational phase.

The table below illustrates this impact assessment.

Table 1: Impact table summarising the significance of visual impacts on users of national and secondary roads within the region.

Nature of Impact: Potential visual impact on users of national and secondary roads within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive, neutral or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitude.		
Cumulative impacts: The construction of the STPP and associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of a number of PV and CSP facilities approved within the region, as well as the existing power line infrastructure already present in the area, albeit limited in extent and scale.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

Potential visual impact on residents of settlements and homesteads within the region.

The visual impact of the proposed facility on settlements and homesteads within the region is expected to be of **low** significance. There is no mitigation for this impact during the operational phase.

The table below illustrates this impact assessment.

Table 2: Impact table summarising the significance of visual impacts on residents of settlements and homesteads within the region.

Nature of Impact: Potential visual impact on residents of settlements and homesteads within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitude.		
Cumulative impacts: The construction of the STPP and associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of a number of PV and CSP facilities approved within the region, as well as the existing power line infrastructure already present in the area, albeit limited in extent and scale.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7.2 Ancillary infrastructure

Potential visual impact of ancillary infrastructure within the STPP footprint on sensitive visual receptors.

Ancillary infrastructure to be located within the STPP footprint includes the internal access roads; storerooms, accommodation, waste storage facilities etc.

Although no dedicated viewshed has been generated for the infrastructure, it is expected that the area of potential visual impact will lie within that of the STPP.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **low** significance. There is no mitigation for this impact during the operational phase.

Table 3: Impact table summarising the significance of visual impact of ancillary infrastructure within the STPP footprint on sensitive visual receptors.

Nature of Impact: Potential visual impact of ancillary infrastructure within the STPP footprint on sensitive visual receptors		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Construction: o rehabilitation of construction areas and servitudes. Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitudes.		
Cumulative impacts: The construction of ancillary infrastructure will increase the cumulative visual impact of disturbance due to vegetation clearing and development within the region.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

Potential visual impact of ancillary infrastructure beyond the STPP footprint on sensitive visual receptors.

Ancillary infrastructure to be located beyond the STPP footprint includes the access road, water extraction point, pump set, sand filter, still basin, coffer dam, water supply pipeline, water storage reservoirs and the power lines. It is expected that the area of potential visual impact for this infrastructure will lie within that of the power line (see map 3).

Although no actual visual impact index has been generated for the power lines, it is certain that these will be highly visible to visual receptors especially within, but not limited to, a 2km zone on either side of the proposed power lines.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance, especially on the homesteads and settlements along the Orange River (i.e. Annashoek and Leerhoek). There is no mitigation for this impact during the operational phase.

Table 4: Impact table summarising the significance of visual impact of ancillary infrastructure beyond the STPP footprint on sensitive visual receptors

Nature of Impact: Potential visual impact of ancillary infrastructure beyond the STPP footprint on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	Probable **(3)**	N/a
Significance	Moderate **(42)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Construction: o rehabilitation of construction areas and servitudes. Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitudes.		
Cumulative impacts: o The construction of the STPP and associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of a number of PV and CSP facilities approved within the region, as well as the existing power line infrastructure already present in the area, albeit limited in extent and scale. o The construction of ancillary infrastructure will also increase the cumulative visual impact of disturbance due to vegetation clearing and development within the region.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7.3. Lighting

Potential visual impact of lighting at night on sensitive visual receptors.

The area surrounding the proposed STPP has a relatively low incidence of populated places. Therefore light trespass and glare from the security and after-hours operational and security lighting will have some significance for residents in the area.

In addition, the potential lighting impact known as sky glow will be of relevance. 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. The STPP may contribute to the effect of sky glow in an otherwise dark environment.

Mitigation of this impact entails the pro-active design, planning and specification lighting for the STPP by a lighting engineer. The correct specification and placement of lighting and light fixtures will go far to contain rather than spread the light.

The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance, and may be mitigated to **low** through planning measures.

Table 5: Impact table summarising the significance of visual impact of lighting at night on sensitive visual receptors.

Nature of Impact: Potential visual impact of lighting at night on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	Moderate **(42)**	Low **(28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during operational phase?	No	No
Mitigation: Planning: o pro-active lighting design and planning. Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The addition of lighting in an otherwise dark environment will increase the cumulative visual impact of light pollution within the region.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.7.4. Construction

Potential visual impact of construction activities and accommodation on sensitive visual receptors.

No visual impact index for construction accommodation has been generated, as the nature and scale of this component does necessitate such. It is likely that this housing, which will accommodate approximately 100 people, will be visible to receptors for the duration of the construction phase.

Also during the construction period, there will be a noticeable increase in heavy vehicles utilising the N10 to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area.

In this environment, dust from construction work is also likely to represent a significant visual impact. Mitigation entails proper planning and management of the construction site to forego residual visual impacts.

The table below illustrates the assessment of this anticipated impact, which is likely to be of **moderate** significance, and may be mitigated to **low** for the duration of construction.

Table 6: Impact table summarising the significance of visual impact of construction activities and accommodation on sensitive visual receptors

Nature of Impact: Potential visual impact of construction activities and accommodation on sensitive visual receptors.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Short **(2)**	Short **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	High **(4)**	Improbable **(2)**
Significance	Moderate **(48)**	Low **(20)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated during construction phase?	Yes	N/a
Mitigation: Construction: o proper planning and management of the construction site.		
Cumulative impacts: The construction phase will temporarily increase the cumulative visual impact of disturbance due to vegetation clearing and development within the region.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.8 Visual impact assessment: secondary impacts

Potential visual impact of the proposed STPP and ancillary infrastructure on the visual character and sense of place within 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 and 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) play a significant role.

A visual 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.

Specific aspects contributing to the sense of place of this region include the rugged natural beauty of the area and the wide open vistas and expanses.

The anticipated visual impact of the STPP and associated infrastructure on the regional visual character, and by implication, on the sense of place, is expected to be **low**. There is no mitigation for this impact during the operational phase.

The table below illustrates this impact assessment.

Table 7: Impact table summarising the significance of visual impacts of the proposed STPP on the visual character and sense of place within the region

Nature of Impact: Potential visual impact of the proposed STPP on the visual character and sense of place within the region		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitude.		
Cumulative impacts: The construction of the STPP and associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of a number of PV and CSP facilities approved within the region, as well as the existing power line infrastructure already present in the area, albeit limited in extent and scale.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

Potential visual impact of the proposed STPP and ancillary infrastructure on tourist routes and tourism potential within the region.

The aesthetic appeal of the area lies in its natural features (especially the Orange River) the rural character of riverbank farms, settlements and homesteads and the undeveloped, wide open, natural spaces beyond.

These draw-cards afford the area a level of tourism potential, especially along the river, although this tourism potential has not yet been optimised. In addition, the N14 and N10 are national tourist access routes, already known and in use.

Visual intrusion through the development of industrial type infrastructure within this environment could jeopardise the area's tourism value and potential.

The anticipated visual impact of the proposed Plant on existing tourist routes, as well as on the tourism potential of the region, is expected to be **low**. There is no mitigation for this impact during the operational phase.

The table below illustrates this impact assessment.

Table 8: Impact table summarising the significance of visual impacts of the proposed STPP and ancillary infrastructure on tourist routes and tourist potential within the region.

Nature of Impact: Potential visual impact of the proposed facility of the proposed Plant and ancillary infrastructure on tourist routes and tourist potential within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Improbable **(2)**	N/a
Significance	Low **(22)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated during operational phase?	No	No
Mitigation: Decommissioning: o removal of the STPP and ancillary infrastructure after 20 to 30 years; o ripping and rehabilitation of decommissioned infrastructure, roads and servitude.		
Cumulative impacts: The construction of the STPP and associated infrastructure will increase the cumulative visual impact of electricity related infrastructure within the region. This is relevant in light of a number of PV and CSP facilities approved within the region, as well as the existing power line infrastructure already present in the area, albeit limited in extent and scale.		
Residual impacts: None. The visual impact will be removed after decommissioning.		

5.9 The potential to mitigate visual impacts

- The primary visual impact of STPP and ancillary infrastructure, including the power line, is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

  Mitigation is limited to the decommissioning stage - structures, infrastructure, roads and servitudes not required for the post-decommissioning use of the site should be removed and rehabilitated.

- Mitigation of lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for the Plant and the ancillary infrastructure will go far to contain rather than spread the light. Additional 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.

- Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:
  - Reduce the construction period through careful planning and productive implementation of resources.
  - Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.
  - 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 managed and removed regularly.
  - Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
  - Reduce and control construction dust through the use of approved dust suppression techniques.
  - 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 and servitudes to acceptable visual standards.

- Secondary impacts anticipated as a result of the proposed facility (i.e. visual character, sense of place and tourism potential) are not possible to mitigate.

The possible mitigation of visual impacts as listed above should be implemented and maintained on an ongoing basis.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 The STPP

The construction and operation of the Ilanga Solar Thermal Power Plant and ancillary infrastructure will have a visual impact on the natural scenic resources and rural character of the study area, and particularly within 4km of the proposed facility.

The author is, however, of the opinion that the facility has an advantage over other more conventional power generating plants (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

The facility further has a generally unfamiliar novel and futuristic design that invokes a curiosity factor not generally present with other conventional power generating plants. The advantage being that the facility can become an attraction or a landmark within the region, that people would actually want to come and see. As it is impossible to hide the facility, the only option would be to promote it.

Notwithstanding, the positive aspect should not distract from the fact that the facility would be visible to (a limited number of) sensitive visual receptors that should ideally not be exposed to the type or scale of structures under consideration.

In this respect, the landscape character, sense of place and tourism value of the region is of relevance. This includes not only the N10 and N14 tourist access routes, but also the tourism potential of the region, despite the fact that tourism in the area has not been optimised.

There are not many options as to the mitigation of the visual impact of the facility. The following is, however, recommended:

- A lighting engineer should be consulted to assist in the planning and placement of light fixtures for the STPP and the ancillary infrastructure in order to reduce visual impacts associated with glare and light trespass.
- All activities associated with the construction phase, albeit temporary, should be managed to reduce / minimise visual impact during the phase.
- All construction areas, specifically trenches, road servitudes and disturbed vegetation should be appropriately rehabilitated after construction. This rehabilitation must also be monitored and maintained during operation.

Should the proposed development proceed, then the possible mitigation of visual impacts as listed above should be implemented and maintained on an ongoing basis.

6.2 The No-Project Alternative

Should the proposed Ilanga Solar Thermal Power Plan as proposed not go ahead, then the anticipated visual impacts as described above would not occur.

These impacts, regardless of their low significance, are all negative in nature. No positive visual impacts are anticipated as a result of the proposed facility. This does not mean, however, that the absence of the proposed facility would result in

a positive visual impact. Rather, the No-Project alternative would result in the absence of visual impact. The anticipated visual impact would be nil.

7. IMPACT STATEMENT

In light of the results and findings of the Visual Impact Assessment undertaken for the Ilanga Solar Thermal Power Plant and ancillary infrastructure, it is acknowledged that the rural, natural, and relatively unspoiled views surrounding the site will be transformed for the entire operational lifespan of the facility.

Due to the nature of the topography, however, significant areas will not be visually exposed, and due to settlement patterns, very few visual receptors will be impacted upon.

The following is a summary of those visual impact expected to remain, assuming mitigation as recommended is exercised:

- The visual impact of the STPP on users of national and secondary roads and on residents of settlements and homesteads within the region is expected to be of **low** significance.
- In terms of ancillary infrastructure located within the STPP footprint, the anticipated visual impact will be of **low** significance.
- The potential visual impact of the power lines (located beyond the STPP footprint) is likely, however, to be of **moderate** significance.
- Visual impacts related to lighting are expected to be of **low** significance.
- Similarly, the anticipated visual impact of construction will be of **low** significance.
- In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place as well as on tourist routes and tourism potential will be of **low** significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) are not considered fatal from a visual perspective, considering the relatively contained area of potential visual exposure and the low occurrence of visual receptors.

Furthermore, it is the opinion of the author that the anticipated visual impact is not likely to detract from the regional tourism appeal, numbers of tourists travelling along the N10 and N14 or the tourism potential of the area. These receptors will be exposed to the proposed facility for a very short period of their journey.

It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures (chapter 6) and management actions (chapter 8).

8. MANAGEMENT PLAN

The management plan tables aim to summarise the key findings of the visual impact report and to suggest possible management actions in order to mitigate the potential visual impacts.

Table 9: Management plan – Planning

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the Ilanga Solar Thermal Power Plant.

Project Component/s	STPP and ancillary infrastructure (i.e. access road, water extraction point, pump set, sand filter, still basin, coffer dam, water supply pipeline, water storage reservoirs, power lines internal access roads; storerooms, waste storage facilities etc)		
Potential Impact	Primary visual impact of the core facility, powerline, and night lighting.		
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site as well as within the region.		
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.		
Mitigation: Action/Control		**Responsibility**	**Timeframe**
Consult a lighting engineer in the planning and placement of light fixtures for the Plant and the ancillary infrastructure.		Project proponent, or design consultant	Planning.
Performance Indicator	Lighting impact is minimal and no complaints received from settlements or homesteads.		
Monitoring	Not applicable.		

Table 10: Management plan – Construction

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the Ilanga Solar Thermal Power Plant.

Project Component/s	Construction site and construction accommodation.
Potential Impact	Visual impact of general construction activities and construction accommodation, and the potential scarring of the landscape due to vegetation clearing.
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 construction accommodation and intact vegetation cover outside of immediate works areas.

Mitigation: Action/Control	**Responsibility**	**Timeframe**
Reduce the construction period through careful planning and productive implementation of resources.	Project proponent, or design consultant	Construction
Plan the placement of lay-down areas and temporary construction accommodation in order to minimise vegetation clearing.	Project proponent, or design consultant	Construction
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent, or design consultant	Construction
Ensure that rubble, litter, and disused construction materials are managed and removed regularly.	Project proponent, or design consultant	Construction
Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way	Project proponent, or design consultant	Construction
Reduce and control construction dust using approved dust suppression techniques.	Project proponent, or design consultant	Construction
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent, or design consultant	Construction
Rehabilitate all disturbed areas, construction areas, roads, and servitudes to acceptable visual standards.	Project proponent, or design consultant	Construction

Performance Indicator	Vegetation cover on and near the site is intact with no evidence of degradation or erosion.
Monitoring	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas post construction.

Table 11: Management plan – Operation

OBJECTIVE: The mitigation and possible negation of the potential visual impacts associated with the operation of the Ilanga Solar Thermal Power Plant.		
Project Component/s	The entire facility	
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 in an aesthetically pleasing way.	Project proponent, or design consultant	Operation.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent, or design consultant	Operation.
Performance Indicator	Well maintained and neat facility with intact vegetation on and near the facility.	
Monitoring	Monitoring of rehabilitated areas.	

Table 12: Management plan – Decommissioning

OBJECTIVE: The mitigation and possible negation of the potential visual impacts associated with the decommissioning of the Ilanga Solar Thermal Power Plant.		
Project component/s	The Ilanga Solar Thermal Power Plant.	
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	Infrastructure required for post decommissioning use of the site and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	Responsibility	Timeframe
Remove structures and infrastructure not required for the post-decommissioning use of the site.	Project proponent, or design consultant	Operation.
Rip and rehabilitate decommissioned infrastructure, roads, and servitudes not required for the post-decommissioning use of the site.	Project proponent, or design consultant	Operation.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent, or design consultant	Operation.
Performance Indicator	Site with intact vegetation on and near the facility.	
Monitoring	Monitoring of rehabilitated areas.	

9. REFERENCES/DATA SOURCES

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