1 INTRODUCTION

1.1 Background and Purpose of Report

Klip Gat Solar Energy Facility (Pty) Ltd. proposes to establish a commercial photovoltaic (PV) solar energy facility as well as associated infrastructure on a site approximately 20km northwest of Noupoort in the Northern Cape Province.

This Visual Impact Assessment (VIA) is undertaken as part of the Environmental Impact Assessment (EIA) process being facilitated by Savannah Environmental (Pty) Ltd. in terms of the National Environmental Management Act 107 of 1998 (NEMA). As such, the purpose of this report is to assess the proposed activity for the site(s) in terms of the *Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process* and the *NEMA EIA Regulations of 2010*.

1.2 Components of the Report

The aspects addressed in this report are as follows:

a) Description of the methodology adopted in preparing the report.
b) Description of the receiving environment.
c) Description of the view catchment area, view corridors, viewpoints and receptors.
d) Identification and evaluation of potential visual impacts associated with the proposed activity and the alternatives identified, by using the established criteria, including potential lighting impacts at night.
e) Identification in terms of best practical environmental option in terms of visual impact.
f) Addressing of additional issues such as:
    - Impact on skyline.
    - Negative visual impact.
    - Impact on aesthetic quality and character of place.
g) Assumptions made and uncertainties or gaps in knowledge.
h) Recommendations in respect of mitigation measures that should be considered by the applicant and competent authority.

1.3 Study Methodology

As stated previously, this VIA was undertaken in accordance with the *Guideline for Involving Visual and Aesthetic Specialists in EIA Processes*, as issued by the Western Cape Government's Department of Environmental Affairs and Development Planning during 2005.

The VIA was undertaken in distinct steps, each of which informed the subsequent steps. The figure below summarises the methodology adopted for undertaking the assessment.

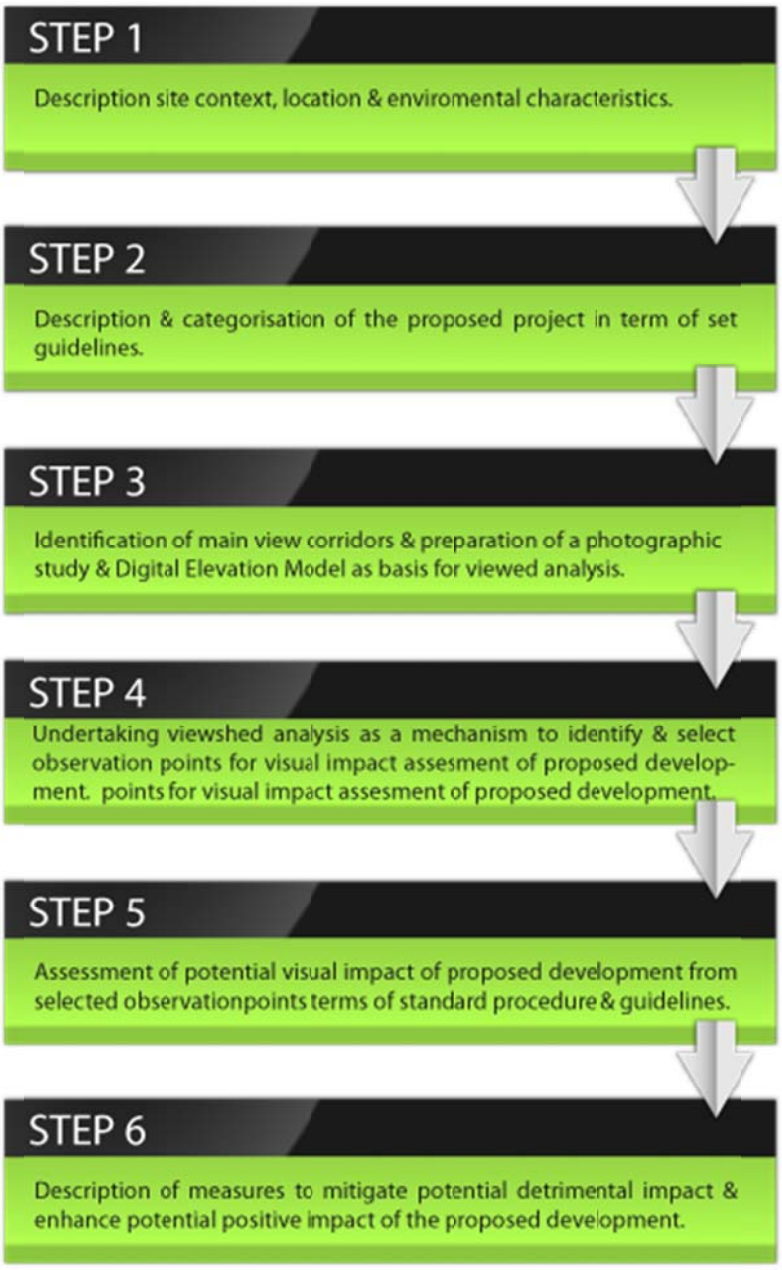

Figure 1: Methodology adopted for the VIA.

1.4 Supplementary Documentation

This report is to be read together with Annexure 2 (Selected observation point viewsheds and assessments), which provides an identification of selected observation points and visual assessment of the proposed activity from each of these points.

1.5 Gaps in Knowledge, Assumptions and Limitations

This assessment was undertaken during the planning stage of the project and is based on the information provided by Savannah Environmental (Pty) Ltd. on 17 July 2012, for the mentioned project.

No details with regard to the physical appearance of the structures have been provided. The description of the photovoltaic plant is based on a generic classification of photovoltaic structures and ancillary infrastructure.

2 SITE DESCRIPTION

2.1 Locality

The project site is located in the Emthanjeni Local Municipality (NC073) in the Northern Cape Province. The subject property is some 20km northwest of the town of Noupoort. As illustrated by the figure below, the subject property is not located near any transportation routes. The major transportation routes in the area are the N1, N9 and N10. All of these roads are situated between 17km and 20km from the project site. The R389 runs between Hanover in the east and Noupoort in the west. This road is some 8km to the south of the project site. In addition, a railway line crosses some 2.5km northeast of the project site en route to De Aar.

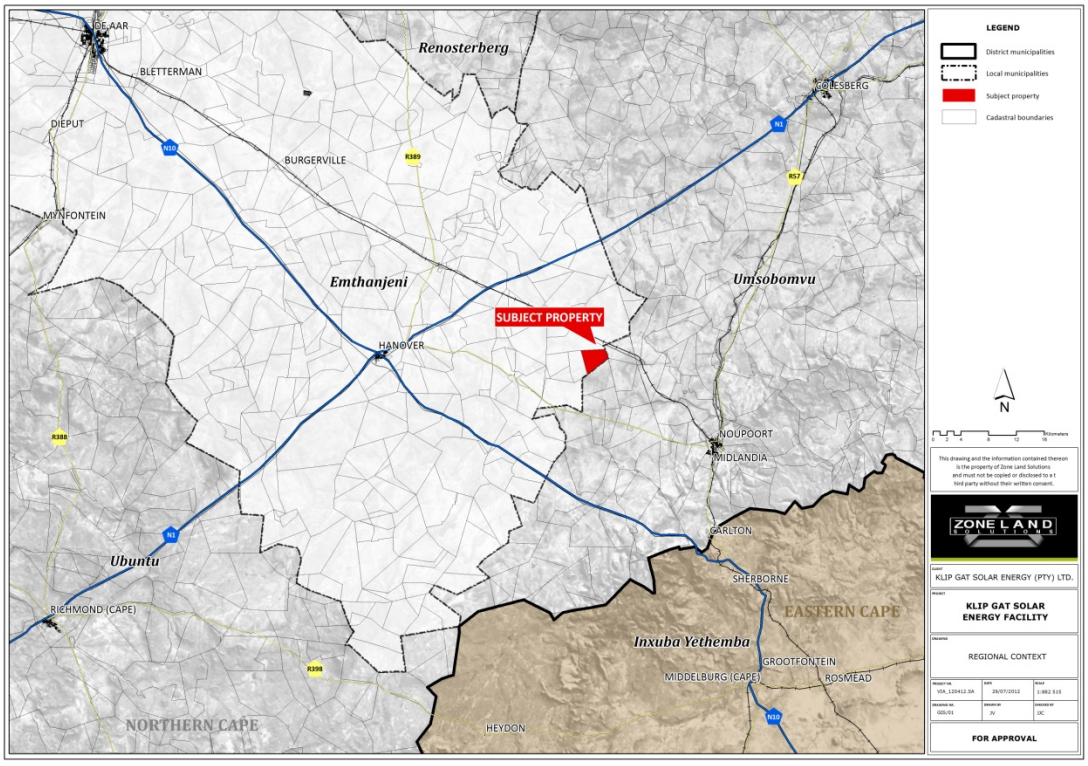

Figure 2: Regional context of the subject property.

2.1.1 Intrinsic Values of the Karoo

It is a common principle of planning that each place has a specific intrinsic, instrumental and systemic value and that such values need to be carefully considered when contemplating the current and future use of any particular place.

Broadly spoken, two different philosophical perspectives are possible when considering the value of any place or object, namely **what is it good for?** And **what is its own good?** The first question relates to its instrumental value, while the second deals with intrinsic value. Instrumental value use something as a '*means to an end'* while intrinsic value refers to being '*worthwhile in itself'* (Rolston, 1994).

Systemic value relates to the fact that '*things do not have their separate natures merely in, and for themselves, but they face outward and co-fit into broader natures. Value seeps out into the system and the individual lose its status as sole locus of value'* (Rolston, 1994:174). Systemic value refers to the relations that things have with other things, and to the role they play in larger wholes.

The value system of the Karoo, and specifically the Noupoort region, was determined in the various collaborative, participative processes undertaken during the drafting of forward planning documentation, policy and guidelines. As such, the intrinsic value of the Karoo is found in the agrarian landscape with strong linkages to the rural, natural landscape.

It is also recognised that tourism is becoming an increasingly important industry in the area. The Emthanjeni Local Municipality Tourism Strategy (Creative Harvest, 2010) states that the municipality has immense untapped tourism potential. The strategy categorises the tourism industry into four sub-categories, with leisure tourism being the strongest sub-sector. Accordingly much effort and energy should be concentrated to developing Emthanjeni as a leisure tourist destination. *This will include the reconstruction of its cultural and natural heritage in collaboration with stakeholders including the farming community; SMME'S in tourism e.g. tour guides, crafters, cultural groups* (Creative Harvest, 2010).

2.2 Project Site Description

As illustrated by the figure below, the project site consists of a single site/phase to be established on Portion 2 (Waltvlakte) of the Farm Klipgat No. 80. This property is some 850ha in extent, while approximately 315ha has been made available for the establishment of the proposed activity.

The provisional location of the project phase is indicated by the figure below.

Figure 3: Extent of subject property and improvements.

An electrical power line servitude of 31.0m (Linde/Carolus 1 132 kV line) in total crosses the subject property in a southeast-northwest direction. The electricity generated on site will be evacuated into the electrical grid at a new substation to be established underneath this line.

2.2.1 Landscape Character

The landscape character of the region typifies a Karoo landscape of great open plains surrounded by mountain chains. Open karoo shrubland characterise the project site. No large trees or bushes are present on site. The most prominent topographical feature in the region is the Schuilhoek Mountain(1625m) to the north. Commercial livestock (sheep and goat) farming is the main form of farming in the region and the mainstay of the economy.

The upper Karoo in the vicinity of Noupoort experience severe climatic conditions with rainfall being as low as 261mm per year with most rain occurring during autumn. The average midday temperatures range from approximately 13.6°C in June to 29.2°C in January. The region is the coldest during July when the mercury drops to 0.2°C on average during the night.

The project site has a generally flat terrain, which gently slopes downwards in a northern direction. This visual aspect presents excellent exposure from a solar energy generation point of view.

The height variations of the project site vary between 1417m and 1397m above mean sea level over a distance of approximately 2.5km.

The area is dominated by Eastern Upper Karoo (NKu 4) vegetation type. According to Mucina and Rutherford (2006), Eastern Upper Karoo forms part of the Nama-Karoo Biome which is found between Carnarvon and Loxton in the west, De Aar, Petrusville and Venterstad in the north, Burgerdorp, Hofmeyer and Cradock in the east and the Great Escarpment and the Sneeuberge-Coetzeeberge mountain chain in the south. The vegetation type occurs between 1000m and 1700m above mean sea level.

Eastern Upper Karoo occurs on flat and gently-sloping plains (interspersed with hills and rocky areas). The vegetation type is dominated by dwarf microphyllous shrubs with 'white' grasses of the genera *Aristida* and *Eragrostis*. Important taxa in this group include *Lycium cinereum* (d), *L horridum*, *Eriocephalus ericoides subsp. Ericoides* (d), etc. Overgrazed and trampled low-lying areas with heavy clayey soils are prone to *Acacia karroo* encroachment.

Eastern Upper Karoo has the largest mapped area of all vegetation types in South Africa. The vegetation type is classified as least threatened with a protection target of 21%.Eastern Upper Karoo is conserved in *inter alia* the Mountain Zebra and Karoo Nationalo Parks as well as in Oviston, Commando Drift, Rolfontein and Gariep Dam Nature Reserves.

3 PROJECT DESCRIPTION AND INSTALLATIONS

The proposed solar power plant will make use of PV solar panels and associated infrastructure with a total generation capacity of approximately 75MW. This facility is to be developed in a single phase. The project will be known as the Klip Gat Solar Energy Facility.

The overall aim of the design and layout of the facilities is to maximise electricity production through exposure to the solar radiation, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. The use of solar energy for power generation can be described as a non-consumptive use of natural resources which emits zero greenhouse gas emissions.

3.1 Project Components

The proposed Klip Gat Solar Energy Facility would typically comprise of the following infrastructure:

- An array of photovoltaic panels with an installed capacity of up to 75MW;
- A new on-site electricity substation to evacuate the power from the facility into the Eskom grid;
- Inverter/transformer enclosures;
- Grid connection and 132kV overhead power lines;
- A mounting structure to be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the project components, to be lain underground where practical;
- Internal access roads and fencing; and
- A workshop area for maintenance and storage and offices.

3.2 Renewable Energy Technology Proposed

Various renewable energy technologies are available for electricity generation. Renewable energy technologies offer an alternative to fossil fuels, thereby reducing the amount of CO2 emissions into the atmosphere.

3.2.1 Photovoltaic Technology

Solar energy facilities, such as those using PV panels use the energy of the sun to generate electricity through a process known as Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity.

Photovoltaic systems use solar panels to convert sunlight into electricity. The system is made up of one or more solar panels, usually a controller or power converter, and the interconnections and mounting for the other components.

Individual ground-mounted PV panels (also referred to as free-field or stand-alone arrays) will be connected into a 'string' of panels of up to (an assumed) 4 in height. The 'string' will be attached to a steel support structure set at an angle so to receive the maximum amount of solar radiation. The angle of the panel is dependent on the latitude of the proposed facility and the angles may be adjusted to optimise for summer or winter solar radiation characteristics.

Figure 4: Illustration of typical photovoltaic panels (Source: Savannah Environmental [Pty] Ltd.).

Photovoltaic cells typically consist of a thin film technology or polycrystalline silicone cell which acts as a semiconductor used to produce the photovoltaic effect. Individual PV cells are linked and placed behind a protective glass sheet to form a photovoltaic panel.

The photovoltaic effect produces electricity in direct current. Therefore an inverter must be used to change it to alternating current.

The PV panels are designed to operate continuously for more than 20 years, unattended and with low maintenance.

3.3 Potential 'triggers' or Key Issues

A 'trigger' is a characteristic of either the receiving environment or the proposed project which indicates that visibility and aesthetics are likely to be key issues and may require further specialist involvement (DEA&DP, 2005).

The 'triggers', as it relates to the proposed project refer to the following:

Table 1: Potential triggers.

KEY ISSUE	FOCAL POINTS	DESCRIPTION
a) Nature of the receiving environment:	*Areas with intact or outstanding rural or townscape qualities.*	The project site presents a typical Karoo landscape. It is not identified as an area of outstanding rural quality. Nonetheless, the proposed activity will be measured in terms of this landscape.

	Areas lying outside a defined urban edge line.	The proposed activity is situated outside the demarcated urban edge of the nearest town and will be assessed accordingly.
b) Nature of the project:	*A change in land use from the prevailing use.*	The prevailing use will change on approximately 150ha. Should the proposed mitigation measures be implemented, the prevailing use could be retained to a degree.
	A significant change to the fabric and character to the area.	The proposed activity will form an integral part of the future landscape character. The extent and significance of a possible visual impact is to be determined through this VIA.

3.4 Development Category

Based upon the 'triggers' and key issues and the environmental context summarised above, the proposed activity is categorised as a **Category 4 Development**.

This categorisation is based upon the *Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes*, which lists the following categories of development:

Box 3: KEY TO CATEGORIES OF DEVELOPMENT

Category 1 Development: e.g. nature reserves, nature-related recreation, camping, picnicking, trails and minimal visitor facilities.

Category 2 Development: e.g. low-key recreation/resort/residential type development, small-scale agriculture/nurseries/narrow roads and small-scale infrastructure.

Category 3 Development: e.g. low density residential/resort type development, golf or polo estates, low to medium-scale infrastructure.

Category 4 Development: e.g. medium density residential development, sport facilities, small-scale commercial faculties/office parks, one-stop petrol stations, light industry, medium-scale infrastructure.

Category 5 Development: e.g. high density township/residential development, retail and office complexes, industrial facilities, refineries, treatment plants, power stations, wind energy farms, power lines, freeways, toll roads, large-scale infrastructure generally. Large-scale development of agriculture land and commercial tree plantations. Quarrying and mining activities with related processing plants.

Based upon the above categorization and the assessment criteria provided in the *Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes* it is expected that the visual impact of the proposed activity would be classified as **'moderate'** (refer to the table below).

The objectives of the VIA described in this report is to:

a) determine whether such broad impact categorisation is appropriate and if not, to determine an appropriate category of impact;

b) formulate and implement measures or interventions that would mitigate any detrimental impacts to the extent that the activity will be acceptable.

Table 2: Categorization of expected visual impact (DEA&DP, 2005).

Type of environment	Type of development				
	Category 1	Category 2	Category 3	Category 4	Category 5
Protected/wild areas of international or regional significance	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected	Very high visual impact expected
Areas or routes of high scenic, cultural, historical significance	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected	Very high visual impact expected
Areas or routes of medium scenic, cultural or historical significance	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	High visual impact expected
Areas or routes of low scenic, cultural or historical significance/disturbed	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	**Moderate visual impact expected**	High visual impact expected
Disturbed or degraded sites / run-down urban areas / wasteland	Little or no visual impact expected. Possible benefits	Little or no visual impact expected. Possible benefits	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected

4 VIEWSHED ANALYSIS

4.1 Dominant View Corridors

As a first step of this VIA, a survey was undertaken to determine the existence of significant view corridors associated with the project site. A view corridor is defined as *'a*

linear geographic area, usually along movement routes, that is visible to users of the route' (DEA&DP, 2005). Accordingly, four dominant *view corridors* were identified in the region, namely:

a) **N1-** The main movement corridor between Cape Town and Johannesburg.
b) **N9-** The main movement corridor that run across the spine of the country from Port Elizabeth to Upington, via Cradock, Middelburg, Hanover, De Aar and Groblershoop.
c) **N10-** A main movement route between Colesberg in the Northern Cape and Graaff-Reinett in the Eastern Cape.
d) **R389-** A secondary road linking the N9 in the east with the N1 in the west.

All of the above national routes are located between 17km and 20km from the project site. In turn, the R389 is some 7km south of the project site. All of these roads are therefore located in the *Background* of the project site (refer to Chapter 5.1) and should not be regarded as dominant view corridors of relevance to the proposed activity.

The only relevant view corridor is that of a minor farm road, which runs parallel to the De Aar – Noupoort railway line, north of the project site.

4.2 Relevant Topographic and Physical Characteristics

A further key aspect affecting the potential visual impact of any proposed activity is the topography of the project site and the surrounding environment and the existence of prominent biophysical features from where the project site is visible. The topography and the major ridgelines of the area were subsequently determined and mapped by using a *Digital Elevation Model*[1].

As illustrated by the DEM on the following page, the project site is located at a mean elevation of approximately 1407m above sea level on a slight downward northerly slope. The DEM shows that there are very few prominent topographical manifestations in close proximity to the project site from which the proposed activity is particularly visually exposed. The nearest prominent hill or mountain is that of Schuilhoekberg at some 1625m, situated some 7km north of the project site.

Furthermore, as stated previously, the project site is located below any ridgeline. The proposed activity will therefore not impact on the skyline.

[1] A Digital Elevation Model (DEM) is a geographic information system-based outcome generated from contours for a specific area. In this instance, 20m contour intervals for reference sheet nos. 3024dc, 3024dd, 3124ba and 3124bb were used to calculate the DEM for the region.

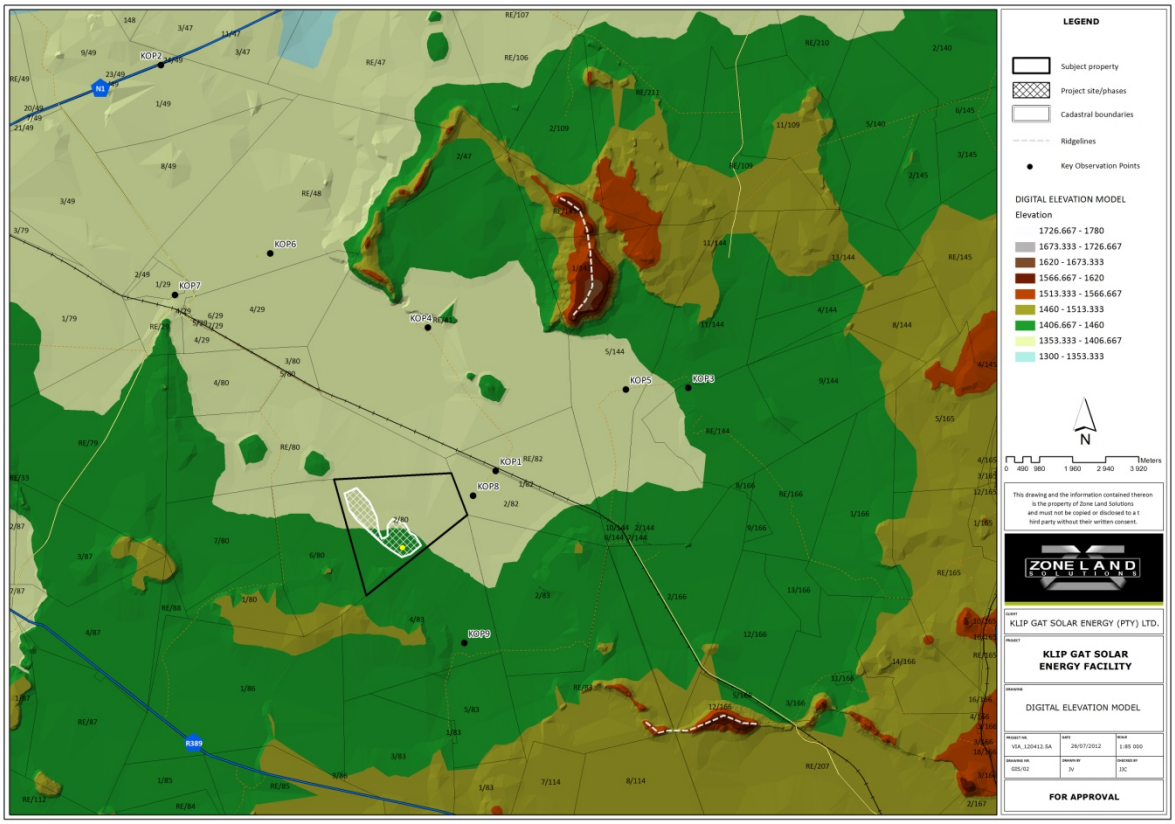

Figure 5: Digital Elevation Model illustrating major ridgelines and dominant view corridors in the sub-region.

4.3 Photographic Study as Supplementary Component

In order to quantify and assess the visibility and potential impact of the proposed activity and to provide a basis for selecting appropriate observation points outside of the project site, a photographic study and analysis was undertaken in the vicinity of the project site. The analysis and ground-truthing identified several observation points with similar characteristics and assessments outcomes. A selection of Key Observation Points is therefore included under Annexure 2. The figure below illustrates the nature of the landscape in the vicinity of the project site.

Figure 6: Panoramic north-easterly view taken from the centre of the project site.

5 DIGITAL VIEWSHED ANALYSIS

The photographic study summarised above was supplemented with a digital viewshed analysis based upon the Digital Elevation Model (refer to Figure 5). As stated previously, the purpose of these two steps was to provide a basis for the identification and selection of appropriate observation points outside the project site for the VIA.

The viewshed[2] analysis was undertaken in accordance with the *Guideline Document for involving Visual Specialists in EIA Processes*. Geographic Information Systems (GIS) technology was used to analyse and map information in order to understand the relationships that exist between the observer and the observed view. Key aspects of the viewshed are as follows:

- It is based on a *single viewpoint* from the highest point of the project site.
- It is calculated at an assumed 4mabove the natural ground level to reflect the highest point of the PV panels.
- It represents a '*broad-brush' designation*, which implies that the zone of visual influence may include portions that are located in a view of shadow and it is therefore not visible from the project site and *vice versa*. This may be as a result of landscape features such as vegetation, buildings and infrastructure not taken into consideration by the DEM.
- The viewshed generated from each of the selected observation points referred to in Annexure 2 is calculated at 1.7m above the natural ground level to reflect the average height of person either walking or sitting in a vehicle.

As illustrated by the generated viewsheds (refer to Figure 7 below), the *zone of visual influence*[3]is primarily located in a northern direction. The *zone of visual influence* extends in a north-western direction up to 15km and in a north-eastern direction up to 20km from the project site. The *zone of visual influence* is closely associated with the most prominent topographical features to the north.

The GIS-generated viewshed illustrates a theoretical *zone of visual influence*. This does not mean that the proposed activity would be visible from all observation points in this area. The purpose of the assessment included as Annexure 2 is to ground truth the GIS-generated viewshed and expected visual impact.

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[2] A viewshed is defined as *'the outer boundary defining a view catchment area, usually along crests and ridgelines. Similar to a watershed'*. A Viewshed Analysis is therefore the study into the extent to which a defined area is visible to its surroundings.

[3] Zone of visual influence is defined as *'An area subject to the direct visual influence of a particular project'*.

5.1 Key Aspects of the Viewshed

The distance between the observer and the observed activity is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an activity diminishing as the distance between the viewer and the activity increases. Viewsheds are categorised into three broad categories of significance, namely:

a) Foreground: The foreground is defined as the area within 1km from the observer within which details such as colour, texture, styles, forms and structure can be recognised. Objects in this zone are highly visible unless obscured by other landscape features, existing structures or vegetation.

b) Middle ground: The middle ground is the area between 1km and 3km from the observer where the type of detail which is clearly visible in the foreground becomes indistinguishable. Objects in the middle ground can be classified as visible to moderately visible, unless obscured by other elements within the landscape.

c) Background: the background stretches from approximately 3km onwards. Background views are only distinguishable by colour and lines, while structures, textures, styles and forms are often not visible (SRK Consulting, 2007).

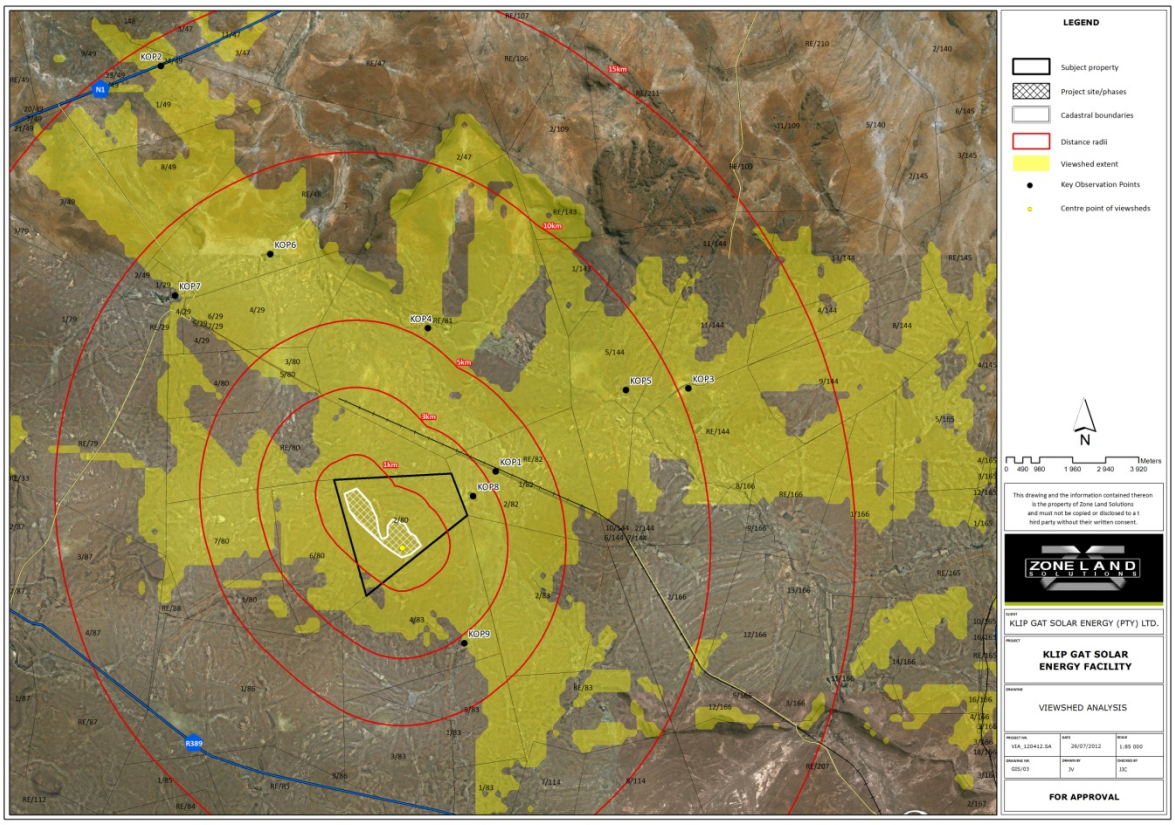

Figure 7: Viewshed generated from the project site.

The distance radii indicating the various viewing distances from the combined phases are illustrated by Figure 7. Also illustrated by the figure are the view corridors of the N1 and R389. As described above, these corridors are all situated in the background to the project site and should therefore not be affected by the proposed activity.

6 VISUAL IMPACT ASSESSMENT

6.1 Selection of Observation Points

A total of 10 Key Observation Points (KOPs) were provisionally identified and selected within the defined viewshed for the visual assessment in accordance with the selection criteria stipulated in the Visual Guidelines. These KOPs correspond with movement routes and the major farmsteads in the region. As a result of the similarity in the assessment results of the KOPs, the description and assessment of only a selected few KOPs are included in Annexure 2.

KOPs selected for the assessment are generally located at the intersection between the zone of visual influence and the defined view corridors (refer to Sections 4.1 and 5 above). The view corridors are those areas that are accessible to the general observer.

6.2 Assessment Process

The identified *observation points* were categorised and assessed as summarised in the table below.

Table 3: VIA methodology and process.

KEY	DESCRIPTION
NUMBER	Each observation point was allocated a reference number.
CO-ORDINATES	The co-ordinates of each of the observation points are provided.
ALTITUDE	The altitude of the observation point was provided in meters above sea level.
DESCRIPTION	A brief description where the observation point is located is provided.
TYPE	Each observation point is categorised according to its location and significance rating. These criteria include the following: • Tourist-related corridors, including linear geographical areas visible to users of a route or vantage points. • Residential areas (including farmsteads).
PHOTOGRAPH	A photograph was taken from each observation point in the direction of the project site to verify the digitally-generated viewshed.

PROPERTY LOCATION	The location of the property was described a *foreground*, *middle ground* or *background*.
PROXIMITY	The distance between the observation point and the project site was provided in kilometres.
VISUAL SENSITIVITY OF RECEPTORS	The visual impact considered acceptable is dependent on the type of receptors. A *high* (i.e. residential areas, nature reserves and scenic routes or trails), *moderate* (e.g. sporting or recreational areas, or places or work), or *low* sensitivity (e.g. industrial, mining or degraded areas) was awarded to each observation point.
VISUAL EXPOSURE	Exposure or visual impact tends to diminish exponentially with distance. A *high* (dominant or clearly visible), *moderate* (recognisable to the viewer) or *low* exposure (not particularly visible to the viewer) rating was allocated to each observation point.
VISUAL ABSORPTION CAPACITY (VAC)	The potential of the landscape to conceal the proposed activity was assessed. A rating of *high* (effective screening by topography and vegetation), *moderate* (partial screening) and *low* (little screening) was allocated to each observation point.
VISUAL INTRUSION	The potential of the activity to fit into the surrounding environment was determined. The visual intrusion relates to the context of the proposed activity while maintaining the integrity of the landscape. A rating of *high* (noticeable change), *moderate* (partially fits into the surroundings) or *low* (blends in well with the surroundings) was allocated.
DURATION	With regard to roads, the distance (in kilometres) and duration (in seconds) for which the property will be visible to the road user, were calculated for each observation point.

6.3 Summary of Assessment

Based on the viewshed analysis and the preceding sections, the envisaged visual impact of the proposed activity was assessed in accordance with the criteria for visual impact assessments (DEA&DP, 2005). The findings of the assessment from selected observation points are included under Annexure 2.

6.3.1 Assessment Criteria

It is stated in the DEA&DP's Visual Guidelines that to aid decision-making, the assessment and reporting of possible impacts requires consistency in the interpretation of impact assessment criteria. The criteria that specifically relate to VIAs were therefore described in Table 3 and Annexure 2.

The potential visual impact of the proposed activity was assessed against these criteria, with reference to the summary of criteria in Box 12 of the Visual Guidelines. Table 4 provides a description of the summary criteria used to determine the impact significance.

Table 4: Summary of criteria used to assess the potential impacts of the proposed activity.

CRITERIA	DESCRIPTION
NATURE OF THE IMPACT	The nature of the impact refers to the visual effect the proposed activity would have on the receiving environment. The nature of the development proposals are described in the preceding sections.
EXTENT	This category deals with the spatial or geographic area of influence and refers to the following levels: • *Site-related* (extending only as far as the activity), • *Local* (limited to the immediate surroundings), • *Regional* (affecting a larger metropolitan or regional area), • *National* (affecting large parts of the country), • *International* (affecting areas across international boundaries). A value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high).
DURATION	Duration refers to the expected life-span of the visual impact. A rating of short term (during the construction phase) (assigned score of 1 or 2), *medium term* (duration for screening vegetation to mature) (assigned score of 3), *long term* (the lifespan of the project) (assigned score of 4), or *permanent* (where time will not mitigate the visual impact) (assigned score of 5) were applied.
MAGNITUDE	Magnitude refers to the magnitude of the impact on views, scenic or cultural resources. The following ratings were allocated to determine the intensity of the impact: • *No effect* (assigned score of 0), • *Low* (visual and scenic resources not affected) (score of 2), • *Minor* (will not result in impact on processes) (score of 4), • *Medium* (affected to a limited scale) (assigned score of 6), • *High* (scenic and cultural resources are significantly affected) (assigned score of 8), • *Very high* (result in complete destruction of patterns) (score of 10).
PROBABILITY	This category refers to the degree of possibility of the visual impact occurring. A rating of *very improbable* (probably will not happen) (assigned score of 1), *improbable* (very low possibility of the impact occurring) (assigned score of 2), *probable* (distinct possibility that the impact will occur) (assigned score of 3), *highly probable* (most likely) (assigned score of 4), or *definite* (impact will occur regardless of any preventative measures) (assigned score of 5) were applied.

STATUS	Status will be described as positive, *negative* or *neutral*.
REVERSIBILITY	Degree to which the activity can be reversed. The following rating were allocated: • Reversible (assigned score of 1), • Recoverable (assigned score of 3), or • Irreversible (assigned score of 5).
SIGNIFICANCE	The significance is calculated by combining the criteria in the following formula: S = (E+D+M)P S = Significance E = Extent D = Duration M = Magnitude P = Probability The significance ratings for each potential impact are as follows: • *Low* (where it will not have an influence on the decision) (<30 points), • *Medium* (where it should have an influence on the decision unless it is mitigated) (30-60 points), or • *High* (where it would influence the decision regardless of any possible mitigation) (>60 points).

6.4 Assessment of Impacts

6.4.1 Assessment of Impact on Sensitive Receptors in Background

All but one of the identified receptors is located in the *background*. In addition, no receptors are located in the *foreground* to the project site. The sensitive receptors in the *background* of the generated viewshed represent mostly private farmsteads and limited users of the farm access road, some 2.5km north of the project site.

The proposed activity will represent a change in land use and land form to what is currently the status quo. The introduction of foreign structures and forms in the agrarian landscape might have a limited impact on these sensitive receptors as described in the table below.

Table 5: Impact table summarising the significance of visual impact on sensitive receptors in the *background*.

NATURE:	Potential visual impact on the sensitive receptors in the background.	
	Without Mitigation Score	**With Mitigation Score**
EXTENT	Local **(2)**	Site-related **(1)**
DURATION	Long term **(4)**	Long term **(4)**
MAGNITUDE	Minor **(4)**	Low **(2)**
PROBABILITY	Probable **(3)**	Improbable **(2)**
SIGNIFICANCE	Medium **(30)**	Low **(14)**
STATUS	Neutral	Neutral
REVERSIBILITY	Recoverable **(3)**	Recoverable **(3)**
IRRIPLACEABLE LOSS OF RESOURCE?	No	No
CAN IMPACTS BE MITIGATED?	Yes	
MITIGATION:	• Keep disturbed areas to a minimum. • No clearing of land to take place outside the demarcated footprint. • Institute a rigorous planting regime along the northern boundary of the project site. Only indigenous plant species to be introduced and planted in an organic manner and location that would not cast shadows on the PV 'strings'. Tall shrubs such as *Lyciumcinereum (d), L. horridum, L. oxycarpum* are proposed. • Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits. • Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.	
CUMULATIVE IMPACTS:	Apart from the two linear infrastructure lines (railway and electrical transmission), very little infrastructural improvements exist in the area. Therefore, the cumulative impact of the proposed activity will be negligible.	
RESIDUAL IMPACTS:	The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.	

6.4.2 Assessment of Impact on Sense of Place

Sense of place and intrinsic values are closely related to one another. 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 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 (MetroGIS, 2012).

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 (MetroGIS, 2012).

The sense of place of Noupoort is very much one of an agrarian landscape, dotted by agricultural farmsteads set against a backdrop of mountains and hills.

Table 6: Impact table summarising the significance of visual impact on the sense of place.

NATURE:	Potential visual impact on the intrinsic value and sense of place of the Noupoort region.		
	Without Mitigation Score	**With Mitigation**	**Score**
EXTENT	Local **(2)**	Local **(2)**	
DURATION	Long term **(4)**	Long term **(4)**	
MAGNITUDE	Medium **(6)**	Medium **(6)**	
PROBABILITY	Probable **(3)**	Probable **(3)**	
SIGNIFICANCE	Medium **(36)**	Medium **(36)**	
STATUS	Negative	Negative	
REVERSIBILITY	Recoverable **(3)**	Recoverable **(3)**	
IRRIPLACEABLE LOSS OF RESOURCE?	No	No	
CAN IMPACTS BE MITIGATED?	Yes		
MITIGATION:	• Keep disturbed areas to a minimum. • No clearing of land to take place outside the demarcated footprint. • Institute a rigorous planting regime along the northern boundary of the project site. Only indigenous plant species to be introduced and planted in an organic manner and location that would not cast shadows on the PV 'strings'. Tall shrubs such as *Lycium cinereum (d), L. horridum, L. oxycarpum* are proposed. • Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical regionalism, namely sense of place, sense of history, sense of nature, sense of craft and sense of limits. • Utilise existing roads and tracks to the extent possible. Where new roads are required, they should be two-track gravel roads, maintained to prevent dust plumes and erosion.		
CUMULATIVE IMPACTS:	Apart from the two linear infrastructure lines (railway and electrical transmission), very little infrastructural improvements exist in the		

	area. Therefore, the cumulative impact of the proposed activity will be negligible.
RESIDUAL IMPACTS:	The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

6.4.3 Assessment of Impact of Lighting

The project site has a very low illumination factor. The occurrence of light sources in the vicinity of the project site is strictly confined to individual farmsteads. A slight sky glow[4] effect is associated with the town of Noupoort, but due to its distance from the project site, it is not visible from the site.

The proposed PV 'string' will not include lights of any kind, however, the associated ancillary buildings and infrastructure may include some degree of lighting.

It is not expected that the proposed activity will contribute to the effects of sky glow or artificial lighting of the area. In order to ensure this, the proposed mitigation measures will have to be complied with.

Table 7: Impact table summarising the significance of visual impact of lighting.

NATURE:	Potential visual impact of artificial lighting as a result of the activity.	
	Without Mitigation Score	**With Mitigation Score**
EXTENT	Local**(2)**	Site-related**(1)**
DURATION	Long term**(4)**	Long term**(4)**
MAGNITUDE	Minor**(4)**	Low**(2)**
PROBABILITY	Probable**(3)**	Probable**(3)**
SIGNIFICANCE	Medium**(30)**	Low**(21)**
STATUS	Negative	Negative
REVERSIBILITY	Recoverable**(3)**	Recoverable**(3)**
IRRIPLACEABLE LOSS OF RESOURCE?	No	No
CAN IMPACTS BE MITIGATED?	Yes	
MITIGATION:	• Outdoor lighting must be strictly controlled so as to prevent light pollution. • All lighting must be installed at downward angles. • Sources of light must as far as possible be shielded by physical barriers. • Consider the application of motion detectors to allow the	

[4]Sky glow refers to the illumination of the night sky or parts thereof. The most common cause of sky glow is artificial light that emits light pollution, which accumulates into a fast glow that can be seen from miles away.

	application of lighting only where and when it is required. • Only minimum wattage light fixtures must be used.
CUMULATIVE IMPACTS:	As mentioned above, the area within which the proposed activity is to be undertaken is relatively low lit. The occurrence of ancillary structures of the PV Plant will contribute to the cumulative lighting effect of the area but it is expected to be negligible in a local context.
RESIDUAL IMPACTS:	The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

6.4.4 Assessment of Impact of Reflection of PV Panels

Photovoltaic solar panels are designed to absorb sunlight in order to convert it into electricity. The more sunlight that is absorbed, the more energy can be produced.

The polycrystalline silicone cell absorbs two-thirds of the sunlight reaching the panel's surface. This effectively means that only one-third of the sunlight reaching the surface of a solar panel has a chance to be reflected.

In addition, the PV panels have a reflectivity of around 30%, while surface materials such as dry sand has a reflectivity of around 45% and grass-type vegetation at 25%. Moreover, PV panels are installed at a fixed angle of around 30°. The solar panels will therefore not noticeably alter the site's current amount of reflected, indirect sunlight.

Table 8: Impact table summarising the significance of visual impact of reflection of the PV panels.

NATURE:	Potential visual impact of reflection of the PV Panels on the sensitive receptors.		
	Without Mitigation Score	**With Mitigation**	**Score**
EXTENT	Local**(2)**	Local	**(2)**
DURATION	Long term**(4)**	Long term**(4)**	
MAGNITUDE	Low**(2)**	Low**(2)**	
PROBABILITY	Improbable**(2)**	Improbable**(2)**	
SIGNIFICANCE	Low**(16)**	Low**(16)**	
STATUS	Neutral	Neutral	
REVERSIBILITY	Recoverable**(3)**	Recoverable**(3)**	
IRRIPLACEABLE LOSS OF RESOURCE?	No	No	
CAN IMPACTS BE MITIGATED?	Yes		
MITIGATION:	• Consider installing anti-reflective coating or glass to reduce the sunlight that is reflected and increase the amount of sunlight that is absorbed. • Install all electrical cables underground en-route to the substation.		

	• Strictly orientate PV panels in a northerly direction to prevent possible reflection on sensitive receptors northeast of the project site.
CUMULATIVE IMPACTS:	The introduction of the PV plant, coupled with the transmission lines and proposed substation will contribute to an increased cumulative visual impact and possible overall increased reflection in the area.
RESIDUAL IMPACTS:	The proposed infrastructure is of such a nature that the status quo could be regained after decommissioning of the plant. Providing that the site is rehabilitated to its current state, the visual impact will also be removed.

6.4.5 Assessment of Impact of Desertification of the Landscape

The dangers of desertification are well documented. The lack of continued plant growth, coupled with the periodic flash floods and severe thunderstorms, the Karoo is so well known for, could have dire consequences for any development.

Great concern therefore needs to be taken in the construction and operation of the plant to prevent desertification, erosion and scouring of the landscape.

Table 9: Impact table summarising the significance of visual impact of desertification of the landscape.

NATURE:	Potential visual impact of desertification of the landscape.		
	Without Mitigation Score	**With Mitigation**	**Score**
EXTENT	Site related **(1)**	Site related	**(1)**
DURATION	Permanent**(5)**	Long term**(4)**	
MAGNITUDE	High**(8)**	Low**(2)**	
PROBABILITY	Highly probable**(4)**	Probable**(3)**	
SIGNIFICANCE	Medium**(56)**	Low**(21)**	
STATUS	Negative	Negative	
REVERSIBILITY	Recoverable**(3)**	Recoverable**(3)**	
IRRIPLACEABLE LOSS OF RESOURCE?	No	No	
CAN IMPACTS BE MITIGATED?	Yes		
MITIGATION:	• Keep disturbed areas to a minimum. • No clearing of land to take place outside the demarcated footprint. • Institute a rigorous planting regime once construction has ceased. • Reintroduce suitable grass and shrub species beneath the PV 'strings' to stabilise and cover soils. • Create stormwater channels alongside access roads and divert stormwater in the natural veld at regular intervals along the road. • Consider installing rainwater tanks to save all water from building roofs.		

	• Install spreaders at the bottom of all downpipes/outlets to prevent scouring of the land. • All contractors to adhere to the Environmental Specifications report.
CUMULATIVE IMPACTS:	The construction of the proposed plant will increase the cumulative visual impact of erosion in the area. The proposed cumulative impact is considered to be negligible in a regional context.
RESIDUAL IMPACTS:	Should the proposed mitigation measures be introduced, it is possible that the sourcing of the landscape could be prevented. Failing to implement these measures, the impact will remain.

7 POLICY CONTEXT

The development of sustainable energy sources holds huge benefits for the country as a whole, and would have significant multipliers in the local economy. Not only do renewable energy projects contribute to clean development mechanism, but it would also establish an empowering environment in the region within which the facility is established. Sustainable energy projects should therefore be undertaken to provide the necessary infrastructure and associated amenities to accommodate the industry in an efficient manner and which does not negatively impact on the comparative economic advantages of a region.

Several policy documents have been drafted which promote the expansion of the green economy and especially environmentally friendly practice with regard to electricity generation in the country. Of particular reference to the Klip Gat Solar Energy Facility is the recent Northern Cape Provincial Spatial Development Framework (NCPSDF), which also deals with these issues.

The NCPSDF, under Chapter C7.3 provides policy with regard to regulating the development of industrial areas. As such, the document states that *renewable energy sources are to comprise 25% of the province's energy generation capacity by 2020*. Several other references to renewable energy sources are found throughout the document. Some of these are found in Chapters B14.4, C8.2.3, C8.3.3, etc.

Of particular important, however, to any potential developer of a renewable energy facility is Policy No. C9.1.2 (d), which states; *Where tracts of agricultural land are to be used for non-agricultural uses such as mining, construction of renewable energy installations, the SKA activities, etc., such activities must create sustainable multipliers in the local economy and synergies that would unlock meaningful benefit through implementation programmes (refer to Toolkit D10 [The Sustainable Development Initiative Approach]).*

8 IMPACT STATEMENT

The on-site verification from the selected Key Observation Points and the viewsheds generated from the latter points indicated that the project site is indistinguishable from most observation points. This is perhaps with the exception of the observation points from the farmstead adjacent to the project site.

To this end, the results of the viewshed analysis from defined Key Observation Points, together with a photograph indicating the actual view has been included under Annexure 2. The assessment findings of the KOPs were categorised as follows:

8.1 Impact on the Background

Due to its remoteness and separation from most sensitive receptors, all but one of the receptors is located in the background of the project. All of the potential impacts therefore relate to the *middle*- and *background* zone of visual influence. The visual analysis and assessment from all of these observation points found that the proposed activity are unrecognisable from the relevant Observation Points. The summarised assessment of the KOPs is as follows:

a)	**Visibility:**	Medium to low
b)	**Visual exposure:**	Medium to Low
c)	**Visual absorption capacity:**	High
d)	**Visual sensitivity of receptors:**	Medium
e)	**Visual intrusion:**	Low
f)	**Significance of impact:**	Low

The results of the Visual Impact Assessment for the proposed Klip Gat Solar Energy Facility therefore found that the proposed activity will have a **low** impact from KOPs identified in the *background* (>3km).

8.2 Recommendations

Based on the above and the documentation attached under Annexure 2, it is herewith recommended that the proposed activity be approved subject to the mitigation measures described in section 6.4 above and the Environmental Management Programme described in section 9 below.

It is furthermore recommended that the proposed project do not sterilize the entire landholding upon which it is to be developed. Once the exact position of the activity has been determined, consideration should be given to erect PV 'strings' in such a manner so that sheep can roam underneath the panels. Alternatively, the project site should be demarcated and the existing extensive agricultural practices be allowed to continue unabated.

9 ENVIRONMENTAL MANAGEMENT PROGRAMME

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 10: Environmental Management Programme – Construction Phase

OBJECTIVE: Mitigate the possible visual impact associated with the construction phase.		
Project component/s	Construction site	
Potential Impact	Visual impact of general construction activities and associated impacts.	
Activity/risk source	Potential impact on sensitive receptors within the *background*.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and general acceptance and compliance with Environmental Specifications.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
An Environmental Control Officer (ECO) must be appointed to oversee the construction process and ensure compliance with conditions of approval.	Klip Gat Solar Energy (Pty) Ltd.	Pre-construction
Contractor to sign and undertake to comply with Environmental Specifications.	Contractor	Pre-construction
Demarcate sensitive areas and no-go areas with danger tape to prevent disturbance during construction.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Pre-construction
Design buildings to reflect the local architecture and sense of place of the Karoo.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Pre-construction
Keep disturbed areas to a minimum.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Throughout construction
Identify suitable areas within the construction site for fuel storage, temporary workshops, eating areas, ablution facilities and washing areas.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Throughout construction
Institute a solid waste management programme to minimise waste generated on the construction site, and recycle where possible.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Throughout construction
Reduce and control dust through the use of approved dust suspension techniques as and when required.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Throughout construction
Construction to occur only during daytime. Should the ECO authorize night work, low flux and frequency lighting shall be used.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Throughout construction
Consider raising the PV platforms so that sheep can roam underneath the PV 'string'.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Construction
Rehabilitate all disturbed areas in accordance with the development plan.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Construction

Institute a rigorous planting regime in collaboration with the appointed botanical specialist.	Klip Gat Solar Energy (Pty) Ltd./ contractor	Construction
Performance Indicator	Construction site is confined to the demarcated areas identified on a Development Plan. No transgression of the Environmental Specifications visible and natural processes occurring freely outside boundaries of the construction site.	
Monitoring	Monitoring to be undertaken by an appointed Environmental Control Officer who will enforce compliance with the Environmental Specifications.	

Table 11: Environmental Management Programme – Operational Phase

OBJECTIVE: Mitigate the possible visual impact associated with the operational phase.		
Project component/s	Photovoltaic 'string' of panels including ancillary infrastructure such as the substation, security building, maintenance workshop, offices and toilets.	
Potential Impact	Potential visual intrusion in the area and damage to the natural environment.	
Activity/risk source	Potential impact on sensitive receptors within the *background*.	
Mitigation: Target/Objective	A facility that fits in with the landscape, that is well maintained and managed.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole (i.e. the PV panels, buildings and associated infrastructure, roads and natural environment).	Klip Gat Solar Energy (Pty) Ltd./ operator	Throughout operational phase
Monitor land surface below PV 'strings' to prevent loss of vegetation and first signs of desertification.	Klip Gat Solar Energy (Pty) Ltd./ operator	Throughout operational phase
Maintain access roads to prevent scouring and erosion, especially after rains.	Klip Gat Solar Energy (Pty) Ltd./ operator	Throughout operational phase
Performance Indicator	Well maintained facility that has a small footprint on the environment. Natural processes continuing to occur unhindered. All actions to be measured against the Operational Phase Environmental Management Plan.	
Monitoring	ECO to undertake monitoring functions for a year after construction has been completed to ensure compliance with mitigation measures. Management thereafter to be undertaken by operator.	

10 REFERENCES

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