RENOSTERBERG WIND ENERGY CORPORATION
INDUSTRIAL DEVELOPMENT CORPORATION

Proposed Construction of a Solar Photovoltaic (PV) Power Plant and a Wind Farm near De Aar, Northern Cape Province of South Africa

Visual Impact Assessment Report – Scoping Phase

Issue Date: 09 October 2012
Revision No.: 1.1
Project No.: 11482

Date:	09 October 2012
Document Title:	Proposed Construction of a Solar Photovoltaic (PV) Power Plant and a Wind Farm near De Aar, Northern Cape Province of South Africa – Visual Impact Assessment Report – Scoping Phase
Author:	Andrea Gibb Mina Lovisa
Revision Number:	1.1
Checked by:	
Approved:	
Signature:	
For:	SiVEST Environmental Division

Contents Page

List of Figures

RENOSTERBERG WIND ENERGY CORPORATION / INDUSTRIAL DEVELOPMENT CORPORATION

PROPOSED CONSTRUCTION OF A SOLAR PHOTOVOLTAIC (PV) POWER PLANT AND A WIND FARM NEAR DE AAR, NORTHERN CAPE PROVINCE OF SOUTH AFRICA

VISUAL IMPACT ASSESSMENT REPORT – SCOPING PHASE

1 INTRODUCTION

SiVEST has been appointed by Renosterberg Wind Energy Corporation (RWEC) in partnership with the Industrial Development Corporation (IDC) to undertake an EIA study for the proposed construction of a wind farm and Solar Photovoltaic (PV) Plant near De Aar in the Northern Cape Province. As part of the EIA studies being conducted for the proposed development, the need to undertake a visual impact assessment study has been identified. Accordingly a desktop scoping-level visual impact assessment study has been conducted to identify key visual issues relating to the development of a wind and solar energy facility within this context and determine the potential extent of visual impact. This is done by characterising the visual environment of the area and identifying areas of potential visual sensitivity that may be subject to visual impacts.

1.1 Assessment Methodology

This scoping level visual impact assessment (VIA) has been undertaken at a desktop-level. In the first stage of the study the visual environment of the study area was characterised based on a number of factors such as land use, topography and vegetation cover, to provide an assessment of the area's visual character, and the potential of the area to absorb the visual impacts. Digital information from spatial databases such as ENPAT and SANBI were sourced to provide information on land use and vegetation cover in the study area.

The potential visual issues associated with the proposed wind farm and PV plant was determined based on the characterisation of the visual environment and visual absorption capacity. Receptor locations and routes that are potentially sensitive to the visual intrusion of the proposed wind and solar energy facility were also identified, in order to ascertain if a more focussed assessment needs to be undertaken in the next phase of the EIA.

1.2 Assumptions and Limitations

For the purpose of this visual assessment, the study area is assumed to encompass a zone of 10km from the proposed application site – i.e. 10km from the boundary of application site. This area was assigned, as distance is a critical factor when assessing visual impacts. While the impact of the solar field is likely to be insignificant beyond a distance of 5km, the wind turbines are very large structures by their nature and could impact on receptors located within 10km from the wind farm.

Several grid connection options are also proposed, which fall outside the assigned study area for this visual assessment. As such, the visual impact of the proposed power line alternatives will be investigated in more detail during the EIA-phase visual assessment, once the grid connection options have been finalised. The potential visual impact of this associated infrastructure is provided in section 4.3 Associated Infrastructure.

A detailed stakeholder consultation process was not followed as part of this visual study, however any feedback regarding the visual environment, received from the public participation process, will be incorporated into further drafts of this report.

No viewsheds were generated during this visual study. A viewshed analysis should be undertaken during the EIA phase visual assessment to determine the geographical area from where the development would generally be visible, once the layout has been finalised.

No ground-truthing was undertaken for this study. As such, the visual sensitivity of each receptor location was not investigation and this will need to be further explored in the next phase of the study. The night-time environment in the study area was also not characterised and will need to be assessed in the next phase of this study.

This scoping phase visual assessment focused on the proposed application site. The layout of the PV facility and wind farm within the application site was not taken into account as it is subject to change.

It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact would be experienced.

2 FACTORS INFLUENCING VISUAL IMPACT

2.1.1 Subjective experience of the viewer

The perception of the viewer/receptor toward an impact is highly subjective and involves 'value judgements' on behalf of the receptor. This is important, as certain receptors may not consider the development of a wind farm or PV plant to be a negative visual impact.

A study of perceived visual impacts of wind farms in rural areas in the USA demonstrated this phenomenon; arguing that visual perceptions are based upon judgements of symbolic and rational aspects of the wind farms (e.g. its size, colour, shape, etc.). The assessment concluded that people evaluate visual impacts based upon a combination of their perceptions of the abstract sculptural nature of turbines, their perceived intrusiveness in a specific context and, finally, the degree to which turbines symbolised 'higher' concepts. These could be both positive and negative, such as the degree to which turbines are associated with wider environmental concerns such as climate change (Thayer and Hansen, 1988, as referenced in Devine-Wright,2005). Some views have expressed the graceful nature of wind farms or the beauty associated with the turbines (Devine-Wright, 2005).

If a development is associated with employment creation, social upliftment and the general growth and progression of an area, it may not be associated with any negative visual impacts and could even have positive connotations. It should be noted that the proposed renewable energy facility may be considered to be an environmentally sustainable option of generating electricity, and this may positively alter the viewer's perceived experience of the visual impact, as the facility may be viewed as a symbol of progress toward a 'greener' future.

2.1.2 Visual environment

Wind and solar developments are likely to be perceived as visually intrusive in areas that have a natural scenic quality and where tourism activities based upon the enjoyment of, or exposure to, the scenic or aesthetic character of the area are practiced. Residents and visitors to these areas may regard the wind turbines and solar panels to be unwelcome intrusions, which degrades the natural character and scenic beauty of the area, and which would potentially even compromise the practising of tourism activities in the area. Wind turbines and solar panels are not features of the natural environment, but are rather a representation of human (anthropogenic) alteration. Thus when placed in a largely natural landscape, they could be perceived to be highly incongruous in this context.

The presence / existence of other anthropogenic objects associated with the built environment may not only obstruct views but also influence the perception of whether a development is a visual impact. In industrial areas where structures, buildings and other infrastructure exist, the visual environment could be considered to be 'degraded' and thus the introduction of a wind farm and PV plant into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible. In this case value may not be placed in the aesthetic quality of the landscape, and the renewable energy facility may not necessarily be considered to be visually intrusive.

Much literature has explored public perceptions of wind farms and objection to them. In parts of the world where wind farms have been developed, they have been subject to opposition based around concerns about the transformation of natural landscapes into 'landscapes of power' (Warren, *et al,* 2005). This relates to the alteration of the visual character of an area.

Internationally, wind farms are often perceived to be a source of visual impact if they affect or change the visual quality of a landscape, particularly in a natural or rural landscape within which the turbines would be considered to be highly incongruous. In the British Isles much of the opposition to wind farms has centred upon this factor. Landscape-based impacts of the wind farms have been exacerbated by the proposed development of wind farms in exposed upland areas which are valued for their scenic qualities and which are often ecologically sensitive (Warren, *et al,* 2005).

2.1.3 Type of visual receptor

Visual impacts can be experienced by different types of receptors, such as people driving along roads, or people living / working in the area in which the wind turbines or PV panels would be visible. The receptor type in turn affects the nature of the typical 'view' of a potential source of visual impact, with views being permanent in the case of a residence or other place of human habitation, or transient in the case of vehicles moving along a road. The nature of the view experienced affects the intensity of the visual impact experienced.

It is important to note that visual impacts are only experienced when there are receptors present to experience this impact; thus in a context where there are no human receptors or viewers present there are not likely to be any visual impacts experienced.

2.1.4 Viewing distance

Viewing distance is a critical factor in the experiencing of visual impacts, as beyond a certain distance, even large developments such as a wind farm or PV plant tend to be much less visible, and difficult to differentiate from the surrounding landscape. The visibility of an object is likely to decrease exponentially as one moves away from the source of impact, with the impact at 1000m being a quarter of the impact at 500m away (Figure 1).

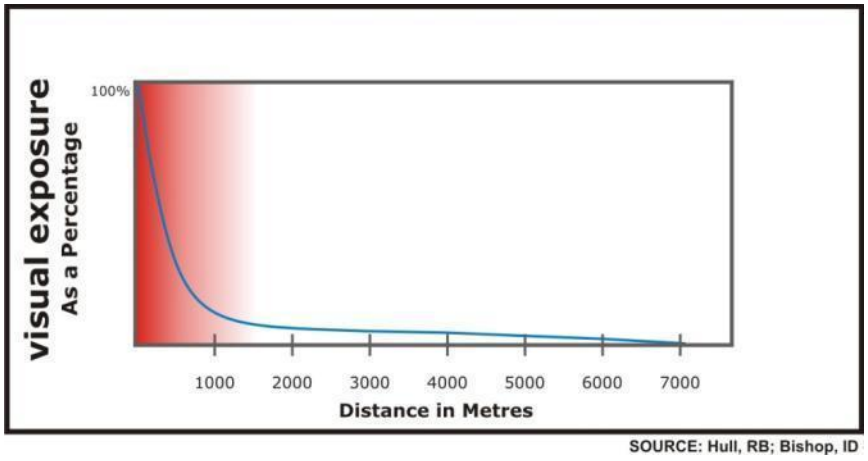


Figure 1: Diagram illustrating diminishing visual exposure over distance

Interestingly, literature does not reveal a direct correlation between those receptors located closest to existing turbines, and the level of objection to the wind farm, even though one may

expect those most visually exposed to harbour the most negative perceptions towards it. However, some case studies contradict this (Devine-Wright, 2005).

3 VISUAL CHARACTER AND SENSITIVITY OF THE STUDY AREA

The physical and land use related characteristics are outlined below as they are important factors contributing to the visibility of a development and visual character of the study area. Defining the visual character is an important part of assessing visual impacts as it establishes the visual baseline or existing visual environment in which the development would be constructed. The visual impact of a development is measured according to this visual baseline by establishing the degree to which the development would contrast or conform with the visual character of the surrounding area.

The visual character also needs to be defined in order to establish the visual absorption capacity (VAC) of an area, or ability of an area / landscape to absorb development without noticeable intrusion or change to the visual character. The inherent sensitivity of the area to visual impacts or visual sensitivity is thereafter determined, based on various factors which include; the pristine character of the visual landscape, cultural or open space value of the environment and presence of visual receptors.

3.1 Physical and Land Use Characteristics

3.1.1 Topography

The prevailing topography within the application site displays an extreme variation in form. The northern parts of the site is characterised by relatively flat to gently undulating terrain, typical of much of the Karoo, that slopes down gradually in a northerly direction. In contrast, the southern part of the site covers a large portion of the Renosterberg Mountain Range, which are characterised by very steep slopes that rise up and form a relatively extensive level plateau (Figure 2 and Figure 3).

Figure 2: Google Earth aerial view of the application site showing the high-lying plateaus in the southern part of the site.

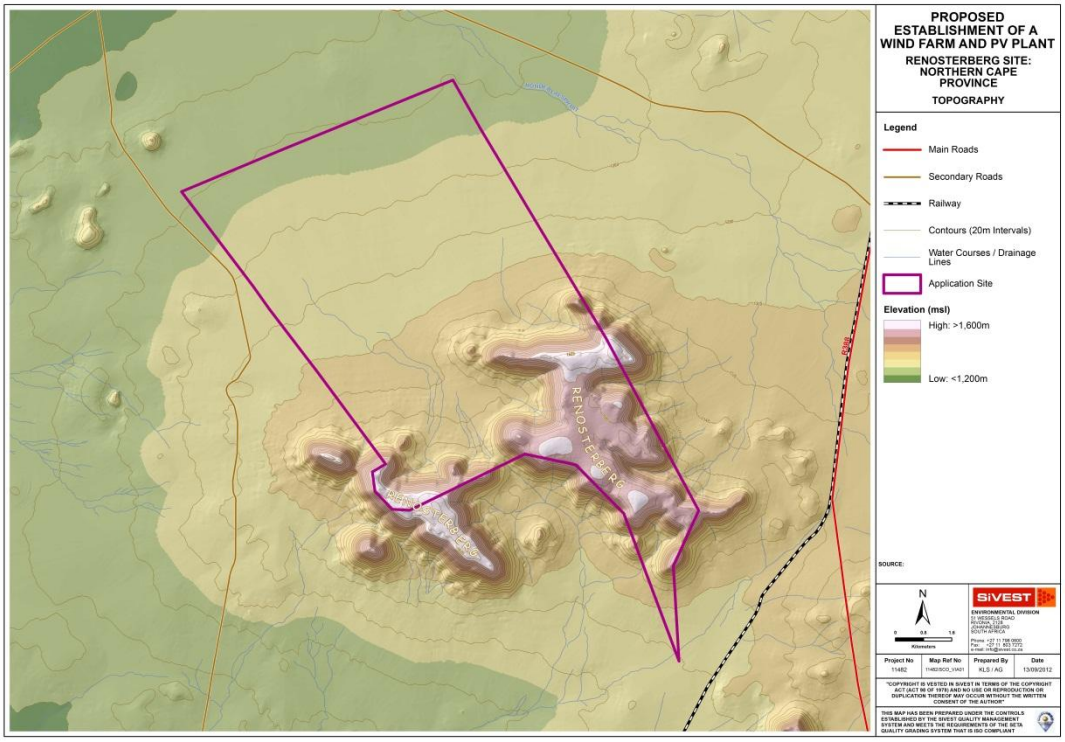


Figure 3: Topography within the application site

Visual Implications

The mixed nature of the terrain across the study area has differing visual implications. The mountainous terrain would constrain the viewshed and limit views of certain parts of the proposed site from farmsteads located to the south and east as well as from the R48 and

R388. Conversely, if the development is positioned on the high-lying plateau the structures would be highly visible from the surrounding area in all directions. Bearing in mind the fact that wind turbines are very large structures, the visual impact would be exacerbated, if the wind farm were to be located on these high lying areas.

3.1.2 Land cover

The site falls partly within the Grassland biome and partly within the Nama-Karoo biome. As such, it is characterised by shrubs of various sizes, intermixed with grasses, succulents, geophytes and annual forbs. The dominant vegetation unit in the southern part of the site is the Northern Upper Karoo which is a typical Karoo shrubland, dominated by shrubs and grasses. The Renosterberg Mountain Range in the southern part of the site forms part of the Beseemkaree Koppies Shrubland. In these high lying areas, a two layered shrubland characterised by a lower layer of small-leaved dwarf shrubs and an upper layer of taller shrubs and trees is prevalent (Figure 4) (Mucina and Rutherford, 2006).

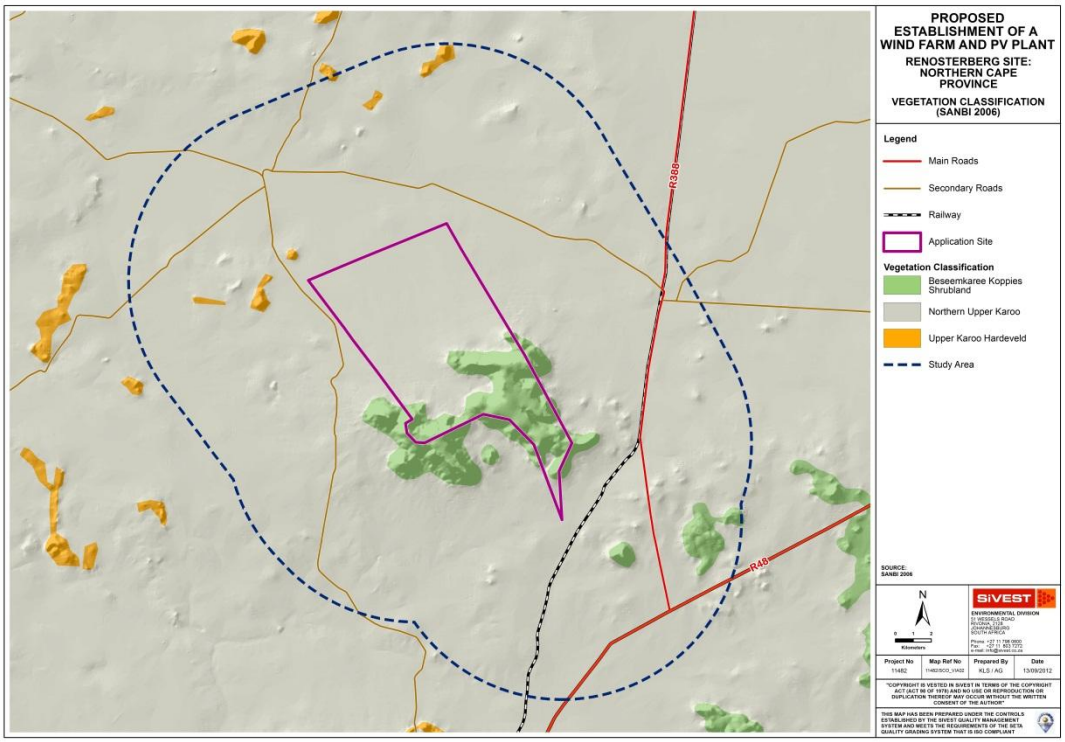


Figure 4: Map showing the vegetation within the study area

The closest built up area is the town of De Aar which is located approximately 20km from the proposed site. Although a site visit was not been undertaken, it is expected that the built form in the study area would be limited to isolated farmsteads, gravel access roads, ancillary farm buildings and other structures associated with a typical pastoral environment. There are no built-up areas in within a 10km radius of the proposed site.

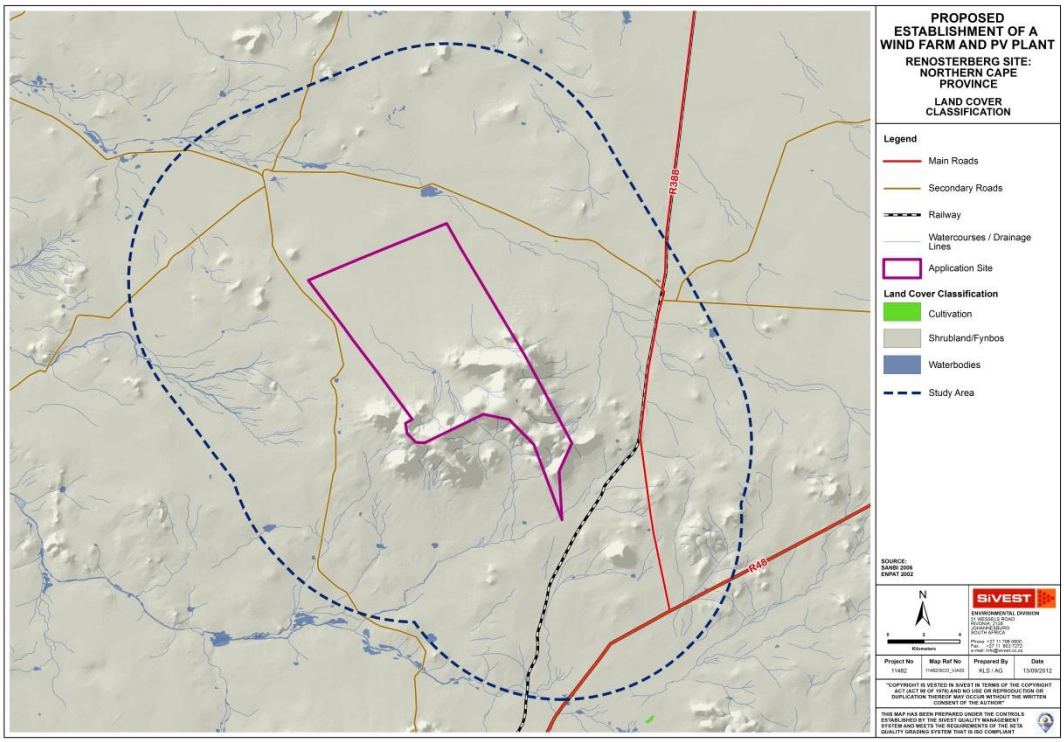


Figure 5: Map showing the land use within the study area

The degree of transformation as well as the on-site infrastructure present on the site will be ground truthed during the next phase of this study.

Visual Implications:

The relatively short vegetation cover in the northern part of the site will provide limited visual screening. In contrast, although more dense wooded vegetation is present on the Renosterberg Mountain Range in the southern part of the site, this vegetation type is only likely to offer partial visual screening, as the development is of such a height that it would rise above this shrub layer. The land use in the surrounding environment is typical of a rural / pastoral landscape with limited anthropogenic features present, which will influence the visual character of the area, as described below.

3.2 Visual Character

The above physical and land use-related characteristics of the study area contribute to its visual character. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation. Varying degrees of human transformation would produce different visual characteristics, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of unique natural features or built infrastructure, such as buildings, roads and power lines.

Built infrastructure within the proposed study area is limited to the R48 and R388 access routes, a railway line, a network of gravel access roads, several farm boundary fences, distribution power lines and a few farm buildings. Despite these localised anthropogenic features the study area is considered to have a rural or pastoral visual character, as uninhabited Karoo vegetation still prevails, thus retaining the natural appearance of the landscape. This is important in the context of potential visual impacts associated with the proposed development as introducing a wind and solar energy facility would be considered a degrading factor that does not conform to the typical character of the area.

The scenic quality of the landscape is also an important factor that contributes to the visual character or inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in form. As such, the Renosterberg Mountain Range in the southern part of the application site is an important topographical feature that creates a focal point within the relatively uniform nature of the surrounding flat terrain (Figure 6). The mountain range not only increases the visual appeal and visual interest in the surrounding area, but may also be valued for its ability to provide mental well-being to surrounding residents.

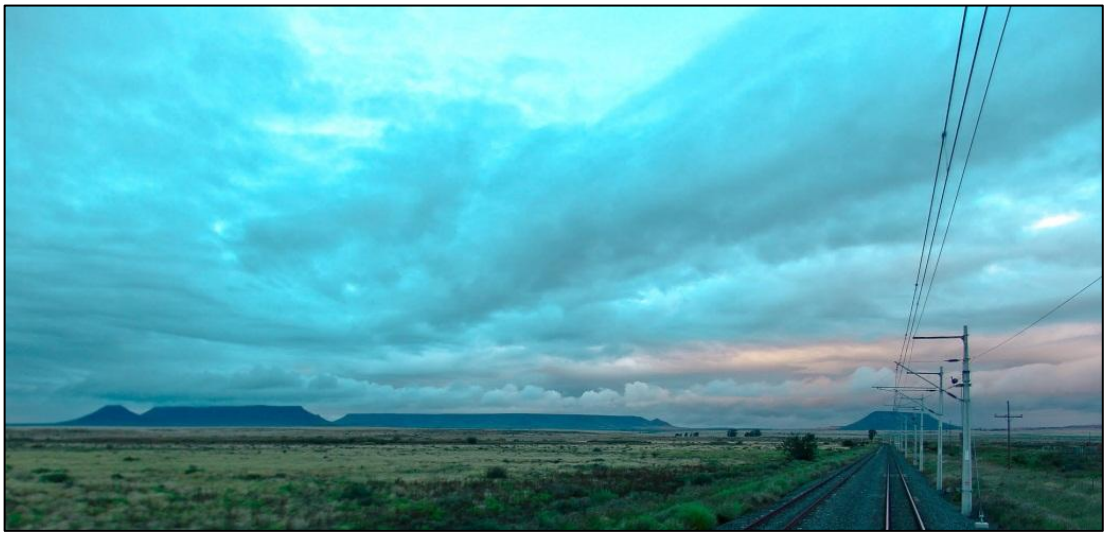


Figure 6: View of the Renosterberg Mountain Range (Phil R Hamar)

Overall, the study area has a natural scenic visual character, typical of a pastoral environment. The Renosterberg Mountain Range further contributes to the natural scenic character and unique visual appeal.

3.3 Cultural, Historical and Open Space Value

Cultural landscapes are becoming increasingly important concepts in terms of the preservation and management of rural and urban settings across the world. The concept of 'cultural landscape' is a way of looking at a place that focuses on the relationship between human activity and the biophysical environment (Breedlove, 2002). The cultural landscape concept is relatively new in the heritage conservation movement across the world. In 1992 the World Heritage Committee adopted the following definition for cultural landscapes:

Cultural landscapes represent the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal.

According to the Committee's Operational Guidelines Cultural Landscapes can fall into three categories

i) "a landscape designed and created intentionally by man";
ii) an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
iii) an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The greater area surrounding the proposed development site can be considered to be typical of a Karoo or "platteland" landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible on route between the major inland centres and the Cape coast, or between the Cape and Namibia. However, in the last couple of decades this has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this little visited, but large part of South Africa. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008).

The exposure of the Karoo in the national press during 2011, as part of the debate around the potential for fracking (hydraulic fracturing) mining activities, has brought the natural resources, land use and lifestyle of the Karoo into sharp focus. Many potential objectors stress the need to preserve the environment of the Karoo, as well as preserve the 'Karoo Way of Life', i.e. the stock farming practices which are highly dependent on the use of abstracted ground water (e.g. refer to the Treasure Karoo Action Group website http://treasurethekaroo.co.za/).

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important 'cultural landscape' that is part of the cultural matrix of the South African environment. The Karoo farmstead is an important representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns, such as De Aar, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, "continuing" landscape.

The study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the proposed development of a wind farm and PV plant as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area.

3.4 Visual Sensitivity of the Area

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards a new development. A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal. The visual sensitivity of an area is broken up into a number of categories, as described below:

i) **High** - The introduction of a new development would be likely to be perceived negatively by receptors in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptors

ii) **Moderate** - Presence of receptors, but due to the nature of the existing visual character of the area and likely value judgements of receptors, there would be limited negative perception towards the new development as a source of visual impact.

iii) **Low** - The introduction of a new development would not be perceived as negative and there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 1: Environmental factors and ratings used to define visual sensitivity of the study area

FACTORS	RATING									
	1	2	3	4	5	6	7	8	9	10
Pristine / natural character of the environment										
Presence of sensitive visual receptors										

Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										
International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
Scenic quality under threat / at risk of change*										

*Any rating above '5' will trigger the need to undertake an assessment of cumulative visual impacts.

Low						**Moderate**								**High**
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a moderate visual sensitivity. This is mainly owing to the scenic quality of the area resulting from the natural mountainous terrain in combination with the relatively uninhabited nature of the area. Although the area is regarded to be scenic, there are very few visual receptors present and most of these receptors are involved in farming practices and therefore do not rely on the scenic quality of the area to produce revenue.

4 VISUAL IMPACTS ASSOCIATED WITH THE DEVELOPMENT

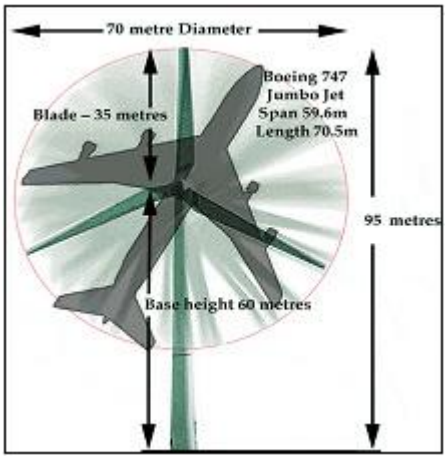
In this section, the typical visual issues / impacts related to the establishment of a wind farm and PV plant are discussed. It is important to note that, no wind farms or PV plants have been developed in South Africa, although within a few years wind and solar facilities approved recently in the late part of 2011 should be constructed in this country. The development and associated environmental assessment of wind farms in South Africa is relatively new, and thus it is valuable to draw on international experience. This section of the report therefore draws on international literature and web material (of which there is significant material available) to describe the generic impacts associated with wind farms and PV plants.

4.1 Wind Farm

At this stage it is anticipated that the proposed project will consist of 83-138 wind turbines which would cover an area of approximately 2.6ha to 4.5ha. The size of the wind turbines will have a hub height of 80 to 125m (approximate in height to a building of 25 to 40 storeys) and

a rotor diameter of 80 to 112m. The height of the turbines and the fact that a wind farm consists of a series of turbines spaced apart in groups around the site would result in it being typically visible for a large radius.

Internationally, studies have demonstrated that there is a direct correlation between the number of turbines and the degree of objection to a wind farm, with potential opposition to a wind farm being lower when fewer turbines are proposed (Devine-Wright, 2005). Certain objectors to wind farms also mention the “sky space” occupied by the rotors of a turbine. As well as height, "sky space" is an important issue. “Sky space” refers to the area in which the rotors would rotate. The diagram below indicates that the “sky space” occupied by rotors would be similar to that occupied by a jumbo jet (http://www.stopbickertonwindturbines.co.uk/ - page on visual impact).



The visual prominence of the facility would be exacerbated within natural settings, in areas of flat terrain or if located on a ridge top. Even dense stands of wooded vegetation is likely to only offer partial visual screening, as the wind turbines are of such a height that they will rise above even mature large trees.

4.1.1 Shadow flicker

Shadow flicker is an effect which is caused when shadows repeatedly pass over the same point. It can be caused by wind turbines when the sun passes behind the hub of a wind turbine and casts a shadow that continually passes over the same point as the blade of the wind turbine rotates (http://www.ecotricity.co.uk).

The effect of shadow flicker is only likely to be experienced by people situated directly within the shadow cast by the blade of the wind turbine. As such, shadow flicker is only expected to have an impact on and cause health risks to people residing within houses that are located at a specific orientation and within close proximity to a wind turbine (less than 500m), particularly in areas where there is little screening present. Shadow flicker may also be experienced by and impact on motorist if a wind turbine is located in close proximity to an existing road. The impact of shadow flicker can be effectively mitigated by choosing the correct site and layout

for the wind turbines, taking the orientation of the turbines relative to the nearby houses and the latitude of the site into consideration. Tall structures and trees will also obstruct shadows and prevent the effect of shadow flicker from impacting on surrounding residents (http://www.ecotricity.co.uk).

4.1.2 Motion-based visual intrusion

An important component of the visual impact associated with wind turbines is the *movement* of the rotors. Labelled as motion-based visual intrusion, this refers to the inclination of the viewer to focus on discordant, moving features when scanning the landscape. Evidence from surveys of public attitudes towards wind farms suggest that the viewing moving blades are not necessarily perceived negatively (Bishop and Miller, 2006). The authors of the study suggest two possible reasons for this; firstly when the turbines are moving they are seen as being 'at work', doing good and producing energy. Conversely, when they are stationary they are regarded as a visual intrusion that has no evident purpose. More interestingly, the second theory that explains this perception is related to the intrinsic value of wind in a certain areas and how turbines may be an expression or extension of an otherwise 'invisible' presence.

Famous winds across the world include the Mistral of the Camargue in France, the Föhn in the Alps, or the Bise in the Lavaux region of Switzerland. The wind, in these cases, is an intrinsic component of the landscape, being expressed in the shape of trees or drifts of sands, but being otherwise invisible. The authors of the study argue that wind turbines in these environments give expression, when moving, to this quintessential landscape element. In a South African context, this phenomenon may well come to be experienced if wind farms are developed in areas where typical winds, like berg winds, or the south-easter in the Cape are an intrinsic part of the environment. In this way, it may even be possible that wind farms will, through time form part of the cultural landscape of an area, and become a representation of the opportunities presented by the natural environment

4.2 PV Plant

The solar power component of the proposed energy generation facility will occupy an area of approximately 250 hectares and will consist of photovoltaic (PV) panels grouped together to form a 'solar field'. Each PV panel is a large structure, being between 5m and 10m in height (equivalent in height to a building of 1 to 3 storeys). The height of these objects will make them visible, especially in the context of a flat landscape. More importantly, the concentration of these panels will make them highly visible, which will depend on the number of panels in each solar field, known as its spatial extent or footprint. Solar fields with a large spatial extent will become an important focal point in a landscape, especially if the landscape has a natural character. As most solar power plants tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural. In this natural setting, the solar field would visually contrast with the surrounding landform and may alter the visual environment, especially if the pre-development visual context is particularly scenic.

In order to establish a PV plant, taller vegetation such as trees and shrubs would need to be cleared. This practice of clearing vegetation will intensify the visual prominence of the solar energy facility, particularly in natural locations where woody vegetation still exists, but to a lesser degree if the proposed facility is located on land that has already been cleared or where the natural vegetation cover is short.

4.3 Associated Infrastructure

The infrastructure associated with the proposed wind and solar energy facility will include the following:

- A substation and associated transformers to supply electricity the Eskom grid;
- Overhead power lines to connect the substation to the Eskom grid;
- Buried (where possible) cabling to connect the wind turbines and PV panels to each other;
- Gravel access roads;
- A central inverter station to house the DC to AC inverters associated with the PV plant;
- Single storey administration buildings;
- Temporary lay down areas required during construction.

The new substation (approximately 90m x 120m) and overhead power lines by their nature are large objects and will typically be visible for great distances. Power lines consist of a series of tall towers thus making them highly visible. Like wind turbines and solar panels, power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic objects associated with the built environment, especially other power lines or substations, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

Other associated infrastructure may also be associated with visual impacts. The turbines are inter-connected with a series of cables, which are likely to be buried, but which also may take the form of above-ground power lines. These cables may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially those areas that are located on the low ridges and associated sloping ground. A trench dug for the cable (both during construction and post-construction once the trench has become back-filled) may become prominent if it creates a linear feature that contrasts with the surrounding vegetation, which typically is low shrubs and small trees on the ridges.

A similar principle exists with respect to any access roads constructed in these parts of the site. Roads are likely to be wider than cable trenches and thus could be even more greatly

visible than the cable servitude. Cutting a 'terrace' into a steep side slope would increase the visibility and contrast the road against the surrounding vegetation.

Lastly, buildings placed in prominent positions such as on ridge tops may also break the natural skyline, drawing the attention of the viewer.

The visual impact of the other associated infrastructure is generally not regarded to be a significant factor when compared to the visual impact associated with wind turbines and solar panels. They would however, magnify the visual prominence of the development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

5 PRESENCE OF POTENTIAL SENSITIVE RECEPTORS

For the purposes of this report, a sensitive receptor is defined as a receptor which would potentially be adversely impacted by the proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. The adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the wind turbines into a 'view', which may affect the 'sense of place'. Thus receptors of visual impacts in areas / landscapes where the current visual character of the environment is part of the appeal of an area, and thus has a socio-economic importance are likely to be considered as sensitive receptors.

A distinction must be made between receptor locations and sensitive receptor locations – the proposed wind and solar facility may be visible from receptor locations, but these receptors may not necessarily be adversely affected by any visual intrusion associated with the facility. Sensitive receptor locations typically include areas of human habitation and recreational activities, whereas receptor locations are commonly movement corridors, such as roads.

Very few scattered farmsteads / homesteads were identified within the study area (both in the surrounding area and on the proposed development site), which are used to house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly natural setting and the proposed development may alter scenic vistas of the Renosterberg Mountain Range experienced from these dwellings. The degree of visual impact experienced will vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).

- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

Motorists travelling along the R388 between Hope Town and De Aar and along R48 as they approach De Aar from Philipstown are likely to be visually exposed to the proposed wind and solar development. People travelling along this road section will not necessarily be adversely affected by the visual intrusion of the wind and solar energy facility, as the roads do not form part of any major tourism routes and are mainly used by local farmers (Figure 7). Although the mountainous terrain will screen portions of the proposed development site from these roads, wind turbines located on the plateau and eastern and southern edges of the escarpment are expected to be highly visible from the R388 and R48.

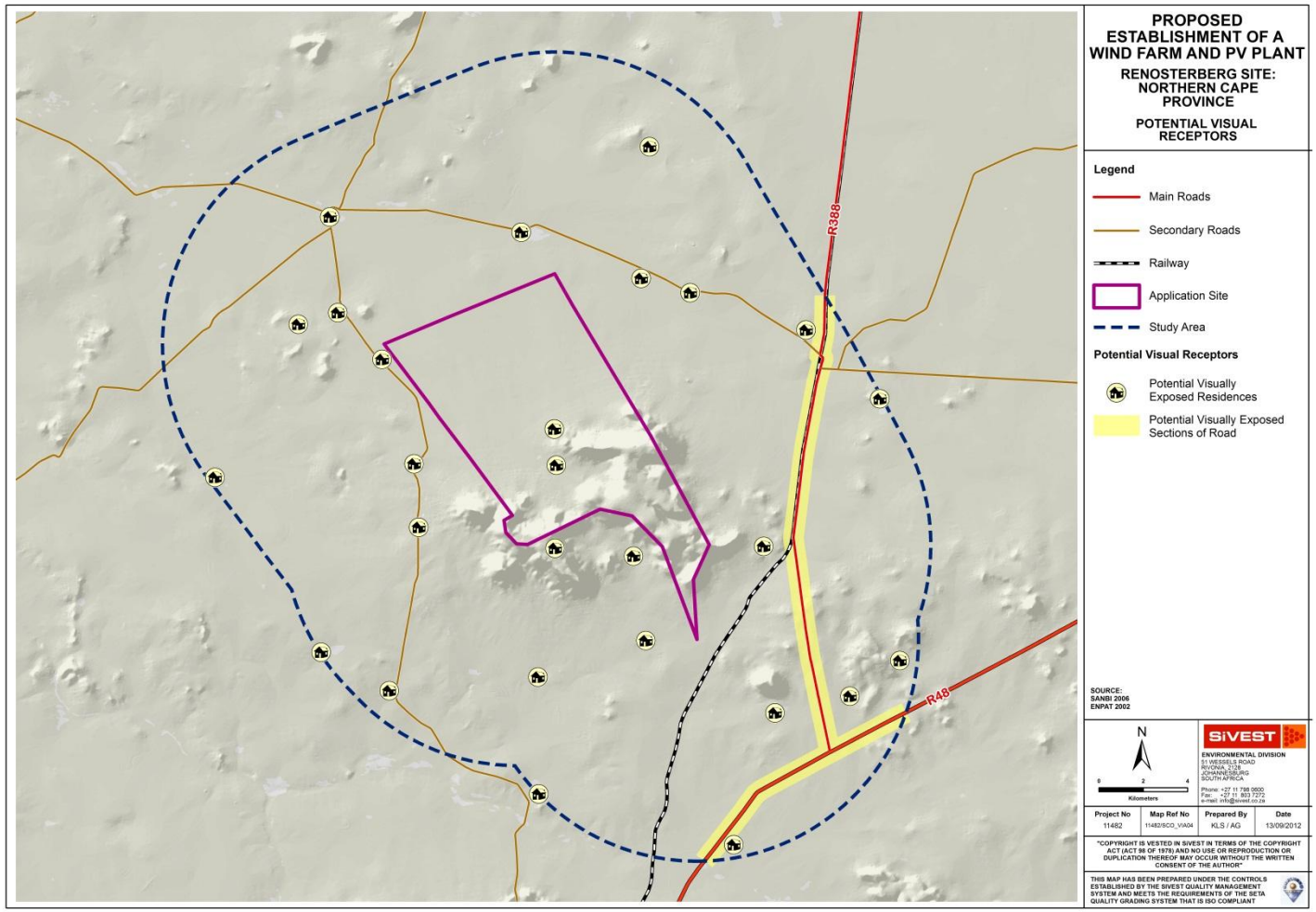


Figure 7: Map showing potential visual receptors within the study area

The nearest human settlement to the development site is the town of De Aar, which is located approximately 20km to the south of the proposed development site. It is not regarded as a visual receptor as people residing within this town are situated too far away to be visually exposed to the development.

Farmhouses within the boundaries of the proposed site and in the surrounding area may be exposed to day and night time visual impacts associated with the proposed wind energy facility (Figure 7). These farmsteads may be sensitive receptor locations, depending on the sensitivity of the people that inhabit them to visual impacts and the value placed by these people on the natural characteristics of the area.

The sensitivity of the farmsteads and nearby sections of the R388 and R48 to visual impacts will need to be clarified and further assessed in the impact phase visual study. This will be done by further assessing the tourism significance of the local routes, the scenic value of the area and the potential sensitivity of people residing within these farmsteads to the visual intrusion associated with the proposed wind farm and PV plant.

It is important to note that visual impacts are only experienced when there are receptors present; thus in a context where there are no human receptors or viewers present there are unlikely to be any visual impacts.

6 VISUAL SENSITIVITY ANALYSIS / MAPPING EXERCISE

During the scoping phase, all project specialists were requested to indicate environmentally-sensitive areas within the development site. This exercise was undertaken to inform the design of the development layout within the application site.

The aim of the assessment was to identify those parts of the application site where locating turbines, PV panels or other associated infrastructure would result in the greatest probability of visual impacts on potentially sensitive visual receptors, and should be precluded from the proposed development i.e. areas within the application site that should be avoided.

Different spatial characteristics were utilised to identify these visually sensitive areas within the proposed application site. In order to reduce the direct visual impact of the proposed turbines (especially those related to shadow flicker), a buffer of 500m is recommended around all farmsteads located on or near the proposed development site. These buffers should be treated as exclusion zones in which no infrastructure, in particular turbines, should be allowed to be developed.

As previously mentioned the visual prominence of a tall structure such as a wind turbine or PV panel would be exacerbated if located on a ridge top or high lying plateau. The Renosterberg Mountain Range with its steep slopes is a visually prominent feature within the relatively flat terrain of the greater surrounds. As viewed from the R48, R388 and surrounding

farmsteads, this portion of the site forms an escarpment like feature, and any infrastructure placed on this higher lying terrain is likely to be at least partially visible, depending on the localised topographical variations. In addition, any infrastructure (particularly wind turbines) placed on the edges of the Rensoterberg Mountain Range would be highly visible and potentially intrusive when viewed from the R48, R388 and surrounding farmsteads. It is therefore, recommended that the development be precluded from the high lying areas on the top of the Renosterberg Mountain Range, particularly the escarpment edges from where the visual prominence will be exacerbated.

Based on the above factors, a preliminary visual sensitivity map has been compiled (Figure 10). A GIS-based analysis should be undertaken to determine the extent of the viewshed during the EIA phase visual study and to refine the visual sensitivity map.

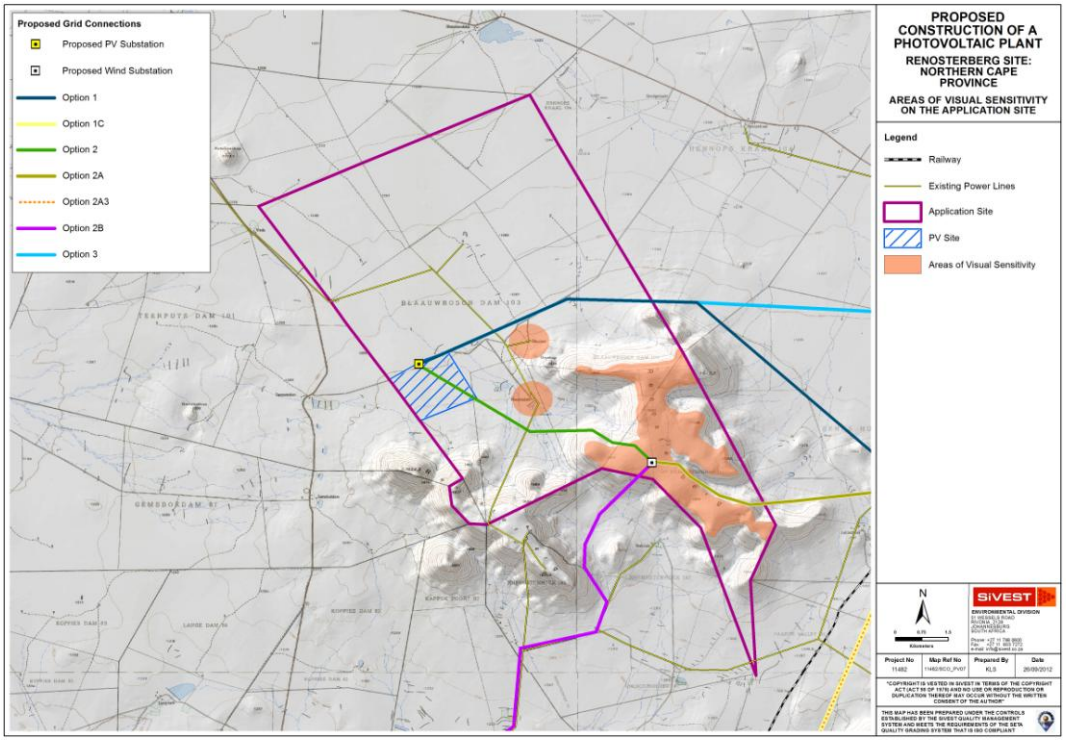


Figure 8: Map showing areas of visual sensitivity within the study area

7 IDENTIFICATION OF POTENTIAL VISUAL ISSUES

The following potential visual issues / impacts are expected to occur due to the erection of a wind and solar energy facility on the proposed development site near De Aar:

- The natural visual character of the surrounding area could be altered as a result of numerous proposed wind turbines and PV panels being erected.
- Motorists travelling on the R388 between Hope Town and De Aar and along R48 between Philipstown and De Aar, could be adversely affected by the visual intrusion of the development.
- Locating the wind farm on the high lying plateau of the Renosterberg Mountain Range, would result in the facility being highly visible for great distances, thus altering the scenic quality of the surrounding area.
- People residing within close proximity to proposed wind turbines could be negatively impacted as a result of shadow flicker.
- Locating the development on the Renosterberg Mountain Range, would result in access roads being constructed to transport the turbine components up to these areas as well as access roads being required to access these areas once the facility is operational. Positioning an access road on these steep slopes, would likely 'cut' into the side slope and create a prominent linear feature or 'scar' that texturally contrasts sharply with the natural hillside vegetation.
- The visual intrusion of the proposed development could adversely affect farmsteads / homesteads on and around the proposed site.
- The aviation lighting placed on top of each wind turbine would create a network of red lights in the night-time sky and could potentially alter the night-time visual environment.

It should also be noted that a number of grid connection options are being planned to connect the proposed wind farm and PV facility onto the national grid. These are indicated in Figure 9 and Figure 10 below.

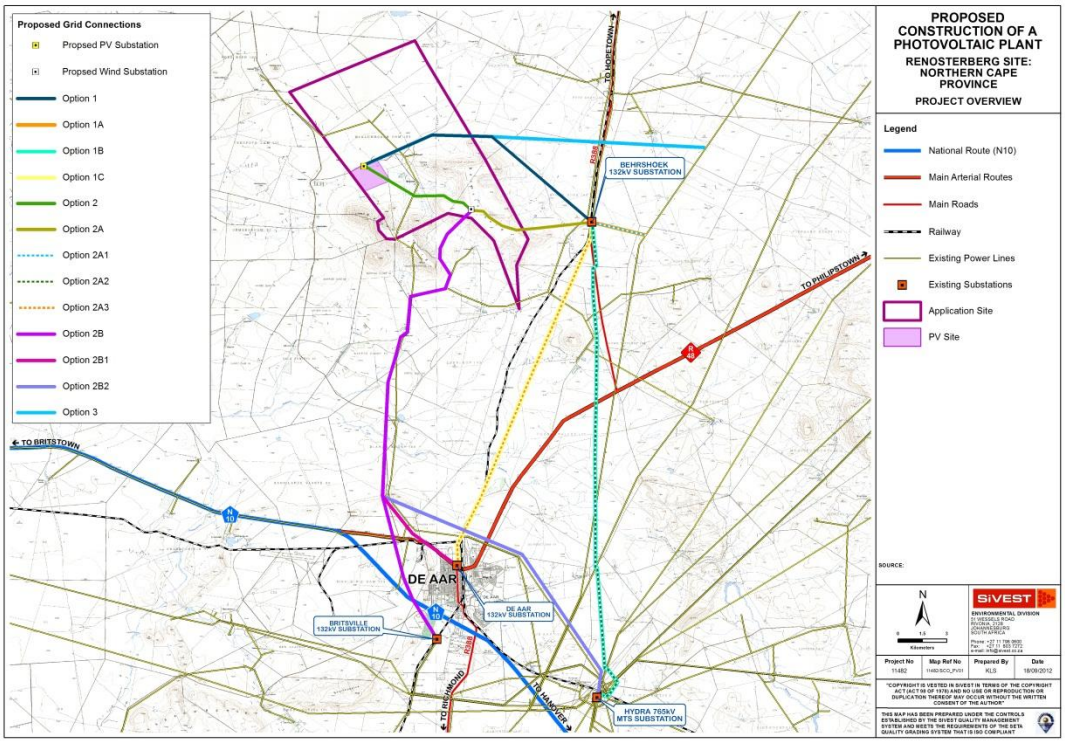


Figure 9: Map showing the grid connection options for the proposed PV plant

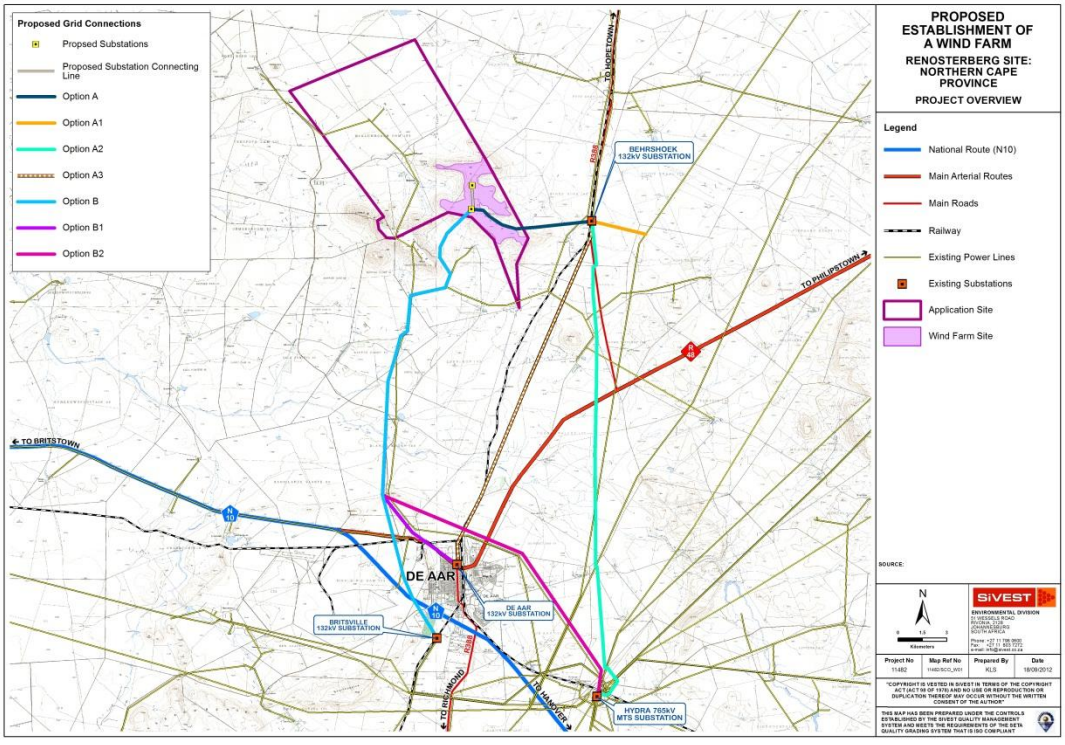


Figure 10: Map showing the grid connection options for the proposed wind farm

The visual impact of the proposed overhead power line options would extend beyond the study area (i.e. 10km radius from the application site) assigned for this visual assessment. As such, the visual impact of the proposed power line options will be investigated in more detail during the EIA-phase visual assessment, once the grid connection options have been finalised. At this stage, the following potential visual issues / impacts may occur due to the erection of an overhead power line, which is being proposed to connect the proposed wind and PV facility onto the Eskom grid near De Aar:

- The natural visual character of the surrounding area could be altered should the proposed power line traverse natural areas where other existing infrastructure is not present.
- Motorists travelling on the R388 between Hope Town and De Aar, along the R48 between Philipstown and De Aar, and along the N10 between Britstown, De Aar and Hanover could be adversely affected by the visual intrusion of the development.
- Routing the power line in such a manner that it runs either along the plateau or diagonally down the Renosterberg Mountain Range, would result in the power line breaking the horizon. This would result in it being much more visible than if not viewed against the backdrop of the open sky. The power line would be particularly visible from the R388 if aligned to run down the eastern or southern slopes.
- Locating the proposed power line on the Renosterberg Mountain Range, could result in access tracks being constructed and servitudes being cleared which would likely 'create a prominent linear feature or 'scar' that texturally contrasts sharply with the natural hillside vegetation.
- The visual intrusion of the proposed power line could adversely affect farmsteads / homesteads located in close proximity to the power line in natural settings, where other existing infrastructure is limited.

Each of the above potential visual impacts, identified through the scoping-phase visual assessment will be explored in further detail in the EIR-phase visual impact assessment. At a preliminary level, it is expected that the hilly terrain would visually restrict most views toward any part of the development located in the lower lying areas of the development site. Any part of the development located on the high lying plateau would result in it being highly visible from the R388, R48 and many surrounding farmsteads / dwellings. The extent of the visual impact on people residing within these dwellings and travelling along these access roads will need to be confirmed by further assessment.

A summary of the visual-related issues associated with the proposed development are provided in Table 2 below.

Table 2: Visual Impact Summary

ISSUE	Visual Impact of the proposed Wind Farm and PV facility
DISCUSSION	Wind turbines are extensive in terms of their scale and height and can be visually intrusive, especially in visually sensitive environments, and where potentially sensitive visual receptors are present. Solar power plants have an extensive spatial coverage and can be visually intrusive especially when located in untransformed natural settings. Majority of the surrounding area has a natural scenic visual character due to the uninhabited nature of the area and the visual appeal of the Renosterberg Mountain Range. Any structure located on these high lying areas would be highly visible from the surrounding area. Conversely, the mountainous terrain may shield certain parts of the application site from potential sensitive receptor locations to the south and east.
EXISTING IMPACT	There is a very low level of existing visual impact.
PREDICTED IMPACT	- Potential alteration of the natural visual character of the site by introducing numerous wind turbines PV panels or by routing the proposed power line in natural areas where other existing infrastructure is not present; - Visual intrusion of the development on motorists travelling along the R388 between Hope Town and De Aar and along R48 between Philipstown and De Aar; - Potential visual intrusion of the proposed power line on motorists travelling along the N10 between Britstown, De Aar and Hanover; - Alteration to the scenic quality of the surrounding area, should the wind farm be located on the high lying plateau of the Renosterberg Mountain Range; - Potential impact of shadow flicker on people residing within close proximity to proposed wind turbines; - Potential creation of a prominent linear feature or 'scar' that texturally contrasts with the natural hillside vegetation, should roads be constructed to access the high lying areas of the Renosterberg Mountain Range or should the power line be routed along the plateau or diagonally down the mountain; - Potential visual intrusion and breaking of the horizon by routing the proposed power line either along the plateau or diagonally down the Renosterberg Mountain Range; - Visual intrusion of the development that could adversely affect farmsteads / homesteads in close proximity; and - Potential alteration of the night-time visual environment by the

	aviation lighting placed on top of each wind turbine that would create a network of red lights in the night-time sky.
EIA INVESTIGATION REQUIRED	Yes
CUMULATIVE EFFECT	None anticipated at this stage.

8 CONCLUSIONS

A scoping-level study has been conducted to identify the potential visual impact and issues related to the development of a wind farm and PV plant near De Aar in the Northern Cape Province. The majority of the study area has a scenic natural rural visual character with a moderate visual sensitivity. The visual impact of the proposed wind and solar development is likely to impact residents of surrounding farmsteads and motorists travelling along N48 and R388, therefore these are regarded to be potentially sensitive visual receptors. The sensitivity of the receptor locations will need to be confirmed through further assessment in the next phase of the study. The nature of the visual impacts associated with a wind farm and PV plant development of this size on a receptors in the study area could be significant.

Accordingly, further assessment will be required in the EIA-phase to investigate the sensitivity of the receptor locations to visual impacts associated with the proposed development and to quantify all impacts that would result.

8.1 Methodology for Further Assessment

The focus of the EIA-phase will be to undertake a more detailed, GIS-based assessment of both the magnitude and significance of the visual impact of the proposed development in both a day-time and night-time context.

This assessment will focus on areas where potential sensitive receptors are located. Detailed GIS-based assessment will be used to identify the visual envelope of the areas potentially exposed to visual impacts associated with the proposed wind and solar energy facility. Should data be available, digital terrain models will be generated for the areas of focus. This analysis will be conducted using the ArcView 10, Spatial Analyst and 3D Analyst extensions where necessary. The analysis will rely on the generation of viewsheds from sensitive receptor locations to identify the extent to which the wind and solar power plant would be visible from these points. A further assessment of the intensity of potential visual impact, expressed in terms of bands of differing visual significance will be undertaken. Site visits would allow for the correction and refinement of the analysis.

The overall significance of visual impacts associated with the proposed wind and solar energy facility will be assessed through a rating matrix. Once this has been undertaken, measures to mitigate potential visual impacts will be identified, and if practical, site and layout alternatives within the study area will be considered and suggested to minimise visual impact of the proposed development.

A separate rating matrix will be used to assess the visual impact of the proposed development on the visually sensitive receptors, as identified. This matrix would be based on the distance of a receptor from the proposed development, the primary focus / orientation of the receptor, the presence of screening factors and the visual character of views from the receptors and degree to which the development would conform with the nature visual environment. Thereafter, the alternatives will be comparatively assessed, in order to ascertain the preferred alternative from a visual perspective.

Interested and Affected Parties will be consulted through the public participation process, and if necessary through a detailed consultation process in order to establish how the proposed solar energy facility will be perceived from the various receptor locations and the degree to which this impact will be regarded as negative.

It is envisaged that the main deliverable of the study would be the generation of a spatial databases / maps indicating the zones of visual impact and visualization imagery, as well as a detailed report indicating the findings of the study.

9 REFERENCES

Bishop, I.D., & Miller, D.R., 2006. Visual assessment of off-shore wind turbines: The influence of distance, contrast, movement and social variables, Renewable Energy 32 814–831.

Breedlove, G., 2002. A systematic for the South African Cultural Landscapes with a view to implementation. Thesis – University of Pretoria.

Devine-Wright, P., Beyond NIMBYism: towards an Integrated Framework for Understanding Public Perceptions of Wind Energy, Wind Energy (Online Journal).

http://www.panoramio.com/

Moseley,S., and Naude-Moseley,B., 2008. Getaway Guide to the Karoo, Namaqualand and Kalahari, Sunbird.

Mucina, L., and Rutherford M.C., (eds) 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Oberholzer, B. 2005. *Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 F. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

Shadow Flicker: http://www.ecotricity.co.uk

Thayer, R.L., Hansen, H., 1998. Wind on the land: renewable energy and pastoral scenery vie for dominance in the siting of wind energy developments. Landscape Architecture; 78: 69–73.

Treasure Karoo Action Group website: http://treasurethekaroo.co.za/

UNESCO. 2005. Operational Guidelines for the Implementation of the World Heritage Convention. UNESCO World Heritage Centre. Paris.

Warren,C.R., Lumsden, C.,O' Dowd, S., & Birnie, R.V., 2005. 'Green On Green': Public Perceptions of Wind Power in Scotland and Ireland, Journal of Environmental Planning and Management,Vol. 48, No. 6, 853 – 875.

SiVEST Environmental Division
51 Wessels Road, Rivonia. 2128. South Africa
PO Box 2921, Rivonia. 2128. South Africa

Tel + 27 11 798 0600
Fax +27 11 803 7272
Email info@sivest.co.za
www.sivest.co.za

Contact Person: Andrea Gibb
Tel No.: +27 11 798 0638
Email: andreag@sivest.co.za