APPENDIX M

Visual Assessment

April 2016

ACWA POWER AFRICA HOLDINGS (PTY) LTD

Visual Impact Assessment for the Bokpoort II Solar Power Project: 75 MW Photovoltaic (PV1) Solar Facility

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REPORT

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Golder Associates

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ACRONYMS

Abbreviation	Description
AC	Alternating current
CSP	Concentrated solar power
DC	Direct current
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
DNI	Direct Normal Irradiation
DoE	Department of Energy
EIA	Environmental Impact Assessment
GIS	Geographic Information System
IFC	International Finance Corporation
LOWMA	Lower Orange Water Management Area
LV	Low voltage
MAP	Mean annual precipitation
MV	Medium voltage
MW	Mega watt
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SRTM	Shuttle Radar Topography Mission
VIA	Visual Impact Assessment

1.0 INTRODUCTION

ACWA Power Africa Holdings (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a solar energy facility (Bokpoort II) on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390 (Farm Bokpoort), located 20 km northwest of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

Construction has been completed for the authorised 75 MW concentrated solar power (CSP) parabolic trough development, located on the south western portion of RE of the Farm Bokpoort 390. The authorisation was granted by the Department of Environmental Affairs (DEA) in June 2011 ('Bokpoort I' site).

The location of the proposed Bokpoort II solar development is situated within the area previously assessed in the Environmental Impact Assessment (EIA) for the Bokpoort I site. The Bokpoort I EIA's sensitivity zoning map indicates that the project footprint for the proposed Bokpoort II solar development is in a preferred and acceptable developable area.

ACWA Power has indicated that the development will be funded both locally and internationally and hence the EIA for the proposed development would need to comply with the International Finance Corporation Performance Standards (IFC) 2012 and the Equator Principles.

ACWA Power is proposing to bid under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Each of the applications submitted to the DEA, if authorised, will be tendered in the DoE REIPPP. Only successful bids in the REIPPPP will be considered for development. The applicant is proposing to bid for two (2) 75 MW photovoltaic (PV) solar power plant technology applications, and one (1) 150 MW CSP Tower. The combined power generation capacity of the entire Bokpoort II solar development applications will be 300 MW. However, the final technology choice and MW capacity will be determined through the outcome of the REIPPPP, based on successful bids awarded to ACWA Power.

Golder Associates Africa (Pty) Ltd (Golder) has been appointed to undertake the environmental authorisation including an Environmental Impact Assessment (EIA) for the project. The scoping phase of the project has been completed and the impact assessment phase will incorporate specialist studies for this project. This report documents the Visual Impact Assessment (VIA) specialist study which will form part of the overall EIA for the project.

1.1 Project description

The Bokpoort II project will potentially include two different types of solar power technologies and associated infrastructure, depending on the final application/s. The visual impact would differ for the proposed PV and the proposed CSP Tower projects, based on the vastly different heights and footprints of the infrastructure within the relatively flat landscape. For this reason, the DEA has therefore requested that the PV1, PV2 and CSP Tower infrastructure each be assessed separately within stand-alone specialist reports. The proposed 75 MW PV1 solar facility, applicable to the associated EIA report is therefore assessed in this document.

1.1.1 Photovoltaic solar facility

The Photovoltaic (PV) solar power plant converts the sun's energy directly into electrical energy. The PV plant will consist of 75 MW photovoltaic solar arrays. The general position of the PV plant is shown in Figure 2-1. The facility consists of the following main functional groups (Figure 2-2):

- Solar generator comprised of polycrystalline PV modules (JINKO Solar modules JKM 310Wp) that will be able to deliver up to 75 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid. The inverter is a HSC2160S Solar Station manufactured by Helios Systems. The inverter is an 11.28 m high cube container which includes the DC distribution, the inverter, the medium voltage transformer and the medium voltage switchgear;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;

- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes (Figure 2-2):

- Mounting structures for the solar panels will be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
- A new power line which will connect the facility into the national grid via Eskom's existing Garona Substation;
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Associated buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.) and offices.

An example of an installed PV facility is shown in Figure 1-1 and Figure 1-2.

Figure 1-1: The Lesedi Solar Park near Postmasburg in the Northern Cape. This solar park is an example of a Photovoltaic (PV) Solar Power Plant[1]

[1] Sourced from http://mybroadband.co.za/news/wp-content/uploads/2015/02/Lesedi.jpg

Figure 1-2: Example of PV Solar Power Facility's Tracker View[2]

1.2 Project location

The project site is located on the north eastern portion of the Remaining Extent of the Farm Bokpoort. The property is situated 20 km north-west of the town of Groblershoop, within Ward 3 of the !Kheis Local Municipality in the ZF Mgcawu District Municipality in the Northern Cape Province of South Africa (Figure 2-1). Bokpoort is furthermore situated approximately 77 km south-east of Upington, while the Orange River is located approximately 12 km south-west of the site. The approximate centre of the project area is 28°41'59.89"S and 22° 0'35.07"E. The total Bokpoort II project area, designated for the development, comprises approximately 1 500 ha.

The 21 digit Surveyor General code of each cadastral land parcel is provided in Table 1-1 below.

Table 1-1: Location of the proposed activity

Farm Name	SG 21 Digit Code	Physical Address	Comments
Remaining Extent of the Farm Bokpoort 390	C02800000000039000000	Farm Bokpoort 390 Groblershoop	Preferred location of solar development and associated infrastructure
Farm Sand Draai 391 Portion 0	C02800000000039100000	Farm Sand Draai 391 Portion 0 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude
Farm Sand Draai 391 Portion 5	C02800000000039100005	Farm Sand Draai 391 Portion 5 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude

1.3 Delineation of the study area

The study area for the VIA comprises the spatial extent of the project footprint and related activities, as well as an associated buffer area.

A visual impact will be caused by all visible infrastructural components and activities that will take place as part of the project, as well as all areas where the physical appearance of the landscape will be altered by earthworks and construction activities. In these areas, the existing land cover will be replaced or the environment will be physically altered; and will therefore be visually directly impacted upon.

[2] Sourced from http://cdn.aiidatapro.net/media/63/48/df/t780x490/6348dfa42dd64b85fcb0f345befaaef776a3e4df.jpg

The areas from which these proposed landscape alterations are expected to be visible are therefore defined as the study area.

The study area for a typical industry standard VIA is benchmarked at a 10 km radius around the physical footprint of any development project. The distance of 10 km is selected as an average, based on the fact that the human eye normally cannot distinguish significant detail beyond this range.

However, in context of the extent and nature of the PV1 facility within the relatively flat landscape, the study area for this VIA was defined as a 40 km radius around the physical footprint of all surface components of the project (based on the viewshed analysis). For the purposes of this VIA, the term “site” refers to the areas that will be physically affected by the project’s infrastructure and activities. Similarly, the term “study area” refers to the area that will potentially be visually affected by the project and represents the 40 km radius buffer around the visible components of the proposed solar development.

2.0 METHODOLOGY

The VIA specialist study conducted for the purposes of this EIA was conducted following the methodology:

- Describing the landscape character or visual baseline based on:
  - Photographs from a site visit conducted by the environmental team in November 2015; and
  - A review of available aerial photography and topographical maps as well as previous studies, in terms of:
    - Natural elements; and
    - Human-made elements.
- Determining the visual resource value of the landscape in terms of:
  - The topographical character of the site and its surroundings and potential occurrence of landform features of interest;
  - The presence of water bodies within the study area;
  - The general nature and level of disturbance of existing vegetation cover within the study area; and
  - The nature and level of human disturbance and transformation evident.
- Determine the visual absorption capacity of the receiving visual landscape;
- Determining the receptor sensitivity to the proposed project;
- Determine the magnitude of the impact, by considering the proposed project in terms of aspects of VIA, namely:
  - Visibility;
  - Visual intrusion; and
  - Visual exposure.
- Assessing the impact significance by relating the magnitude of the visual impact to its:
  - Duration;
  - Severity; and
  - Geographical extent.
- To recommend mitigation measures to reduce the potential visual impacts of the project.

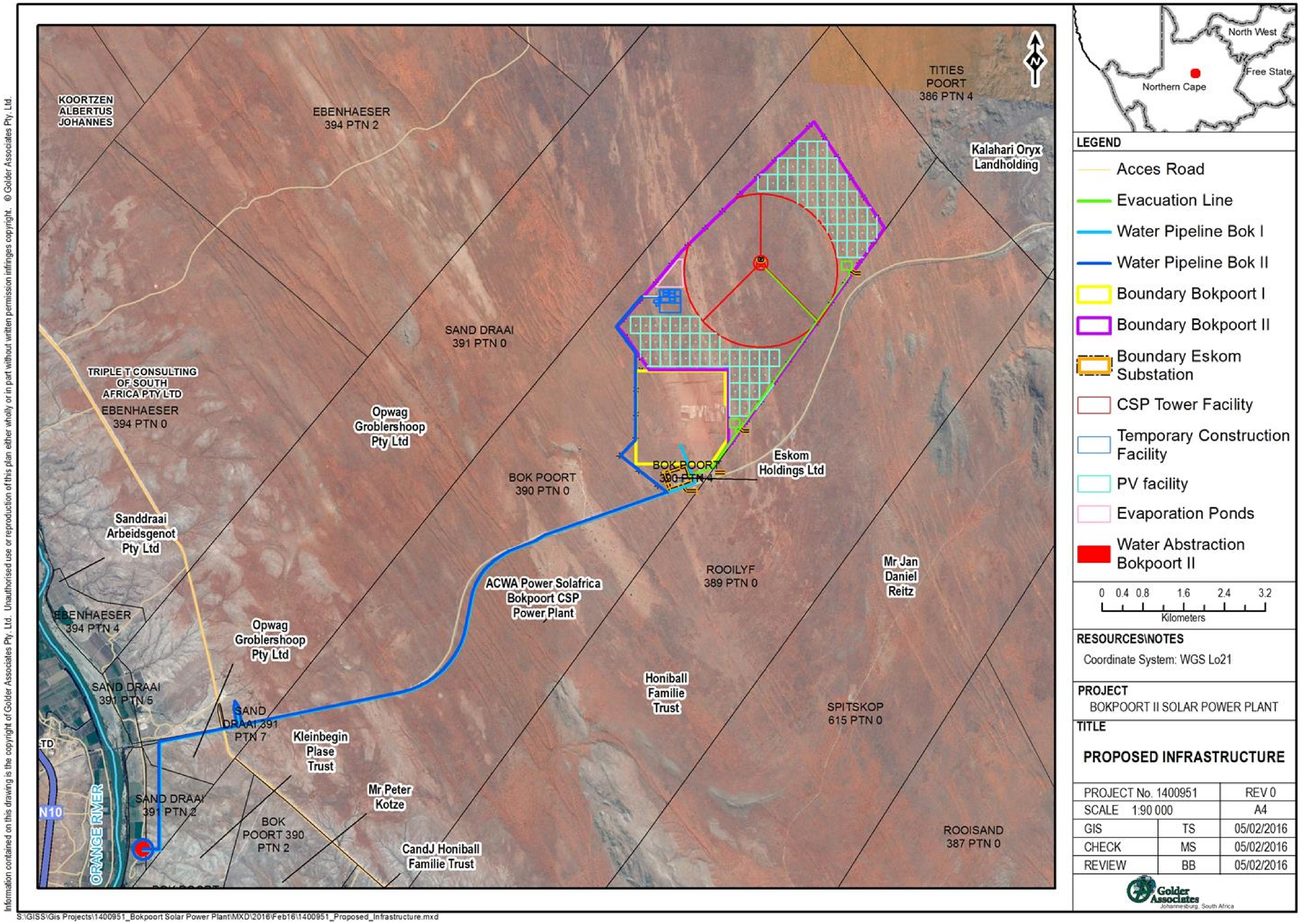

Figure 2-1: Project layout map of the proposed Bokpoort II Solar Development

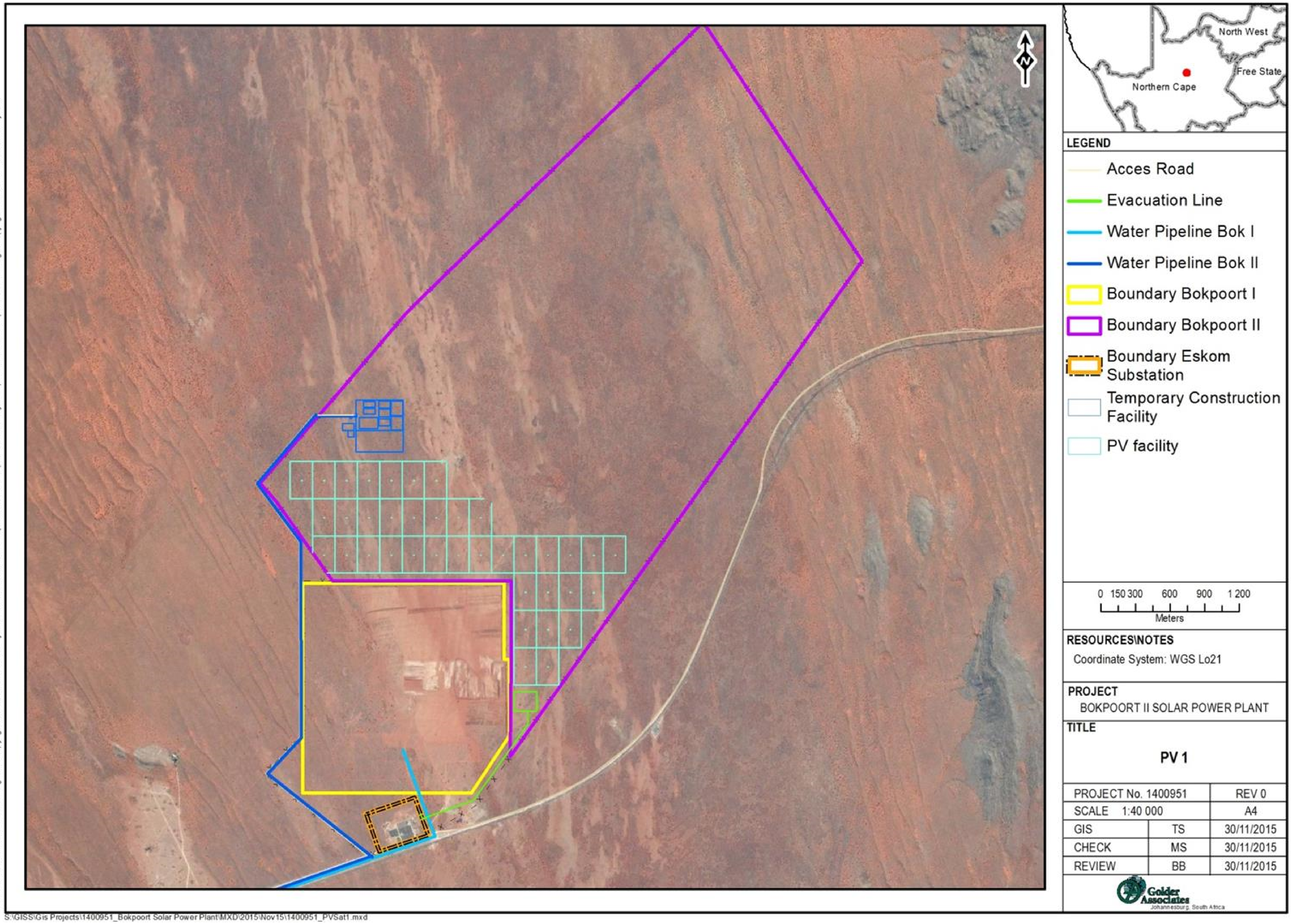

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Figure 2-2: Proposed 75 MW Photovoltaic (PV1) Solar Infrastructure

3.0 ASSUMPTIONS AND LIMITATIONS

The following assumptions and qualifications are relevant specifically to the field of VIA and the findings of this study:

- Determining the value, quality and significance of a visual resource or the significance of the visual impact that any activity may have on it, in absolute terms, is not achievable. The value of a visual resource is partly determined by the viewer and is influenced by that person's socio-economic, cultural and specific family background and is even subject to fluctuating factors such as emotional mood. This situation is compounded by the fact that the conditions under which the visual resource is viewed can change dramatically due to natural phenomena such as weather, climatic conditions and seasonal change.

  Visual impact cannot therefore be measured simply and reliably, as is for instance the case with water, noise or air pollution. It is therefore impossible to conduct a visual assessment without relying to some extent on the expert professional opinion of a qualified consultant, which is inherently subjective. The subjective opinion of the visual consultant is however unlikely to materially influence the findings and recommendations of this study, as a wide body of scientific knowledge exists in the industry of visual impact assessment, on which findings are based; and

- Due to the conceptual nature of the layout and designs used for the proposed project, the findings of this report are of a general nature and proposed mitigation may need to be reviewed and updated when final site layout drawings have been produced for the actual project implementation.

4.0 VISUAL BASELINE

The visual baseline assessment was based on photographs that were taken on separate occasions by other specialists during the scoping phase, as well as on Google Earth imagery of the project area and its surroundings. Specific attention was given to the following, and any aspects of interest noted, in order to determine the visual resource value of the study area:

- The nature of the existing vegetation cover in terms of its overall appearance, density and height and level of disturbance;
- The general topographical character of the study area including prominent or appealing landforms and their spatial orientation in terms of the project sites;
- The nature and level of human transformation or disturbance of the study area;
- The location, physical extent and appearance of water bodies within the study area, if present; and
- The perceived level of compatibility of existing land uses in terms of the study area and each other.

This section provides a brief overview of the visual baseline environment and context in which the proposed project will take place.

4.1 Study area landscape character

Landscape character is a description of the natural (physical and biological) and human-made (land use) attributes within the study area. This description is primarily from an objective, visually-orientated perspective and does not specifically address the underlying ecological or physical processes within the landscape.

4.1.1 Topography

The project area is located within the Kalahari variation of the Savanna Biome and is densely covered by grasses, shrubs and trees. The general project area is relatively flat and can be characterised by dunes (parallel crests) and lowlands toward the northern region, and irregular plains in the southern region. The project area slopes toward the Orange River in a south-eastern direction. Part of the Korannaberg foothills is comprises a small section of the site extreme northern section of the study area, characterized by the presence of boulders, high slopes and mountainous topography. The elevation of the project site ranges from the highest point of 1 110 m located at the southeast corner of the Remaining Extent of the Farm Bokpoort 390, to the lowest point of around 950 m on the northern end of the Bokpoort farm.

The surrounding area is dotted with farm houses, with an informal settlement located approximately 14 km away. The nearest town is Groblershoop approximately 20 km south-east of the site.

Figure 4-1: Characteristics of the Bokpoort II Project Area. The first image represents a view from the Northern property boundary looking in a southerly direction towards the existing Bokpoort facility visible in the far distance. The second image represents a view

4.1.2 Hydrology

Rainfall is scarce and the mean annual precipitation (MAP) generally averages between 260 mm and 340 mm per year, while evaporation is extremely high, due to the high temperatures, which can reach 35 - 40ºC in summer. Daily average summer temperatures range between 24⁰C and 26⁰C with winter temperatures ranging between 11⁰C and 13⁰C. Humidity is highest during the winter months.

The Orange River located west and southwest of the project area is the predominant perennial surface water feature in the vicinity of the proposed development. The site is closest to the section of the river falls in the Lower Orange Water Management Area (LOWMA). The Orange River is main source of water for the ZF Mgcawu (previously referred to as the Siyanda) District and !Kheis Local Municipality. The ZF Mgcawu District Environmental Management Framework cited that the evaporation rate in the LOWMA is estimated at 3 000 mm which is much higher than the MAP. The banks of the Orange River are heavily used for irrigated agriculture.

Satellite imagery indicates some ephemeral drainage lines in the southern part of the proposed site, but these areas are only expected to contain flowing water during periods of exceptionally high rainfall. There are no significant wetlands, estuaries, Ramsar Sites or major dams present within the immediate vicinity of the study site. One seasonal pan occurs approximately 3 km north of the Garona Substation and the Bokpoort I EIA indicates a 200 m 'no development area' buffer demarcated around the pan. The smaller riparian systems in the region are impacted upon by livestock where natural habitats are grazed intensively.

4.1.3 Vegetation cover[3]

The study area is located in the Savanna Biome, with two principal natural vegetation types predicted to occur (Mucina & Rutherford 2006), namely:

- Kalahari Karroid Shrubland with low vegetation on flat gravel plains; and
- Gordonia Duneveld which is characterised by parallel dunes with open shrubland and ridges of grassland.

The project area is characterised by relatively flat rolling plains with dunes (parallel crests) and lowlands toward the northern region, and irregular plains in the southern region. Part of the Korannaberg foothills is located in the extreme northern section of the study area, comprising a small section of the site, characterized by the presence of boulders, high slopes and mountainous topography.

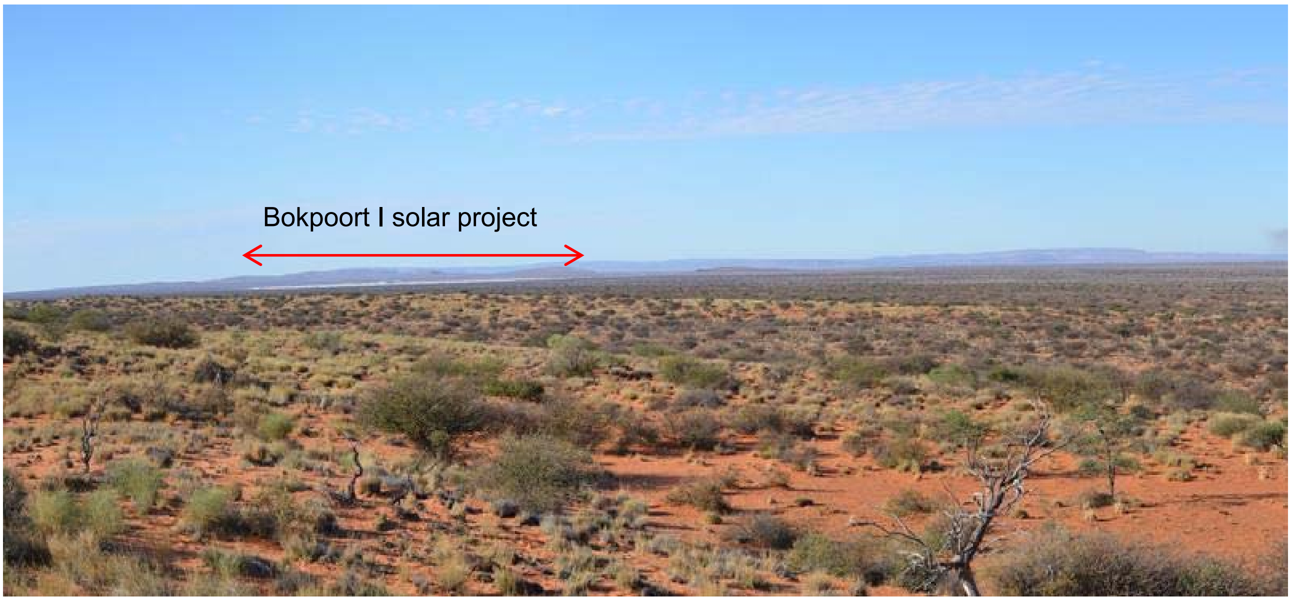

Figure 4-2: View showing the Farm Bokpoort 390 with the Bokpoort I Solar Project in the distance

4.1.4 Land cover and land-use

Land use in the study area mainly consists of agricultural activities within the Orange River floodplain and surrounding areas, as well as game farming. The soil specialist deducted that at the project site, the agricultural potential of the soils are low given the hot and dry climatic conditions and the rapid drainage of the soil types and occasional occurrence of dunes. The only areas indicated as high potential, falling outside of the project area footprint, are in the alluvial zones close to the Orange River, where irrigation is also used.

Figure 4-3: Agricultural fields in the Orange River floodplains

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[3] ACWA Bokpoort Biodiversity Impact Assessment Report, Golder Associates Africa (Pty) Ltd, 2016

Current land use on the Remaining Extent of the Farm Bokpoort 390 consists of domestic livestock grazing (cattle, sheep and game) and the Bokpoort I Solar Power Project. The Farm Sand Draai 391 Portions 0 and 5 have been earmarked for the proposed water pipeline route, but this route falls within an existing servitude used by the Bokpoort I solar facility. The neighbouring farm, Portion 4 of the Farm Bokpoort 390 to the northwest of the proposed site, forms the lower part of the Kalahari Oryx landholding which operates as a game reserve and lodge. There are numerous farmsteads which occur in a distinct linear pattern alongside the Orange River to the south east of the site.

The Korannaberg foothills in the extreme northern section of the study area forms part of the Koranna Mountain Range extending into the eastern Free State and leading up to Lesotho. This range consists of sandstone ravines and rolling grasslands which are frequented by tourists due to its high scenic appeal. According to an adventure tourist site, the Korannaberg is a nature lover's playground with extensive grasslands, lush valley forests and rocky terrain (Ventures, 2016).

Several small towns occur intermittently along the N10 national road between Groblershoop and Upington to the north of the project sire. Residential settlements in the study area include:

- The town of Groblershoop is located approximately 9 km south-east of the eastern boundary of the Farm Bokpoort 390;
- The urban settlement (township) of Wegdraai, which is located on the western side of the Orange River on the Farm Boegoeberg 48;
- Numerous farmhouses and farm labourer houses on the northern and southern banks of the Orange River. These are residences related mainly to the sultana grape farms;
- The main farmhouse on the Remaining Extent of the Farm Bokpoort 390 is situated on a hill in the central portion of the farm; and
- The main farmhouse on the Farm La Gratitude is situated 5 200 m east of the north-eastern corner boundary of Bokpoort.

4.2 Study area visual resource value

Visual resource value refers to the visual quality of elements of an environment, as well as the way in which combinations of elements in an environment appeal to our senses. Studies in perceptual psychology have shown an affinity for landscapes with a higher visual complexity, rather than homogeneous ones (NLA, 2004). Furthermore, based on research in terms of human visual preference (Crawford, 1994), landscape quality increases when:

- Prominent topographical features and rugged horizon lines exist;
- Water bodies such as streams or dams are present;
- Untransformed indigenous vegetation cover dominates; and
- Limited presence of human activity, or land uses that are not visually intrusive or dominant prevail.

Further to these factors, Table 4-1 indicates criteria used for visual resource assessment. The assessment combines visual quality attributes (views, sense of place and aesthetic appeal) with landscape character and gives the landscape a high, moderate or low visual resource value.

When assessing the value of a landscape as visual resource, it is also necessary to consider the landscape in the context where it is located. Although a specific landscape may be less impressive than others located far off or in other countries, it may still be considered appealing because of its specific attributes compared to other landscapes nearby. In this way, what may be commonplace when placed in another visual context may be special or exceptional when viewed within its present setting.

Table 4-1: Visual resource value criteria

Visual resource value	Criteria
High (3)	Pristine or near-pristine condition/little to no visible human intervention visible/ characterised by highly scenic or attractive natural features, or cultural heritage sites with high historical or social value and visual appeal/areas that exhibit a strong positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive to change.
Moderate (2)	Partially transformed or disturbed landscape/human intervention visible but does not dominate view, or is characterized by elements that have some socio-cultural or historic interest but that is not considered visually unique/scenic appeal of landscape partially compromised/noticeable presence of incongruous elements/areas that exhibit positive character but which may have evidence of degradation/erosion of some features resulting in areas of more mixed character. These landscapes are less important to conserve, but may include certain areas or features worthy of conservation.
Low (1)	Extensively transformed or disturbed landscape/human intervention is of visually intrusive nature and dominates available views/scenic appeal of landscape greatly compromised/visual prominence of widely disparate or incongruous land uses and activities/areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

A summary of the visual resource value of the study area is discussed below. Taking the factors tabulated above (Table 4-1) into consideration, the likely visual resource value of the study area can at this stage be summarised as follows:

- Topography: The general project area is relatively flat and can be characterised by dunes (parallel crests) and lowlands. The more prominent landforms are expected to be visually distinctive and therefore likely have a higher visual resource value, as follows:
  - Flat, rolling plains: moderate visual resource value;
  - Dunes (parallel crests): high resource value;
  - Orange River floodplains: moderate visual resource value; and
  - Korannaberg foothills: high resource value.
- Hydrology: The Orange River, located west and southwest of the project area, is the predominant perennial surface water feature in the vicinity of the proposed development. There are some ephemeral drainage lines in the southern part of the proposed site, but these areas are only expected to contain flowing water during periods of exceptionally high rainfall. There are no significant wetlands, estuaries, Ramsar Sites or major dams present within the immediate vicinity of the study site. One seasonal pan occurs approximately 3 km north of the Garona Substation. The visual resource value of the study area hydrology is therefore likely to be low;
- Vegetation cover: The study area is characterised by low vegetation on flat gravel plains and parallel dunes with open shrub land and ridges of grassland. The site area is used for grazing land predominately consists of dense shrubs and small trees. The existing Bokpoort I solar facility has disturbed vegetation on the adjacent farm. There are few visually distinct groupings of vegetation which occur. The visual resource value of the study area vegetation cover is therefore expected to be moderate; and

- Land use: Current land use on the Remaining Extent of the Farm Bokpoort 390 is domestic livestock grazing (cattle, sheep and game) and the Bokpoort I Solar facility. Land use in the study area consists of agricultural activities within the Orange River floodplain and surrounding areas as well as game farming. The neighbouring farm, Portion 4 of the Farm Bokpoort 390 to the north west of the proposed site forms the lower part of the Kalahari Oryx game farm which operates as an exclusive international wilderness-based hunting destination and game-farm. The agrarian landscape character has a specific sense of place which is expected to appeal to most viewers, and is therefore considered to be of high resource value.

In summary, the visual resource value of the study area is expected to range from moderate to high. However, higher value areas likely occur along the Korannaberg foothills and mountain range, where the pronounced topography, greater occurrence of indigenous vegetation and lower levels of landscape transformation create greater visual variety and interest. These high value areas are located to the extreme north of the study area at a distance greater than 40 km.

Table 4-2: Visual resource value determination

Visual baseline attribute	Topography	Water bodies	Vegetation	Land uses
Visual resource value score	3 (high)	1 (low)	2 (moderate)	2 (moderate)
Total				**8 (moderate)**

Where:

- 4 – 6 = Low;
- 7 – 9 = Moderate; and
- 10 – 12 = High.

Based on the above score ranges, the overall visual resource value of the study area (8) is rated as moderate, but containing elements of high resource value, most notably the neighbouring farm which is part of the Kalahari Oryx game farm which operates as a high-end game farm and lodge. The northern edge of the project area also indicates high resource value along the Korannaberg foothills and mountain range.

When one considers the sense of place that the overall landscape evokes, the aesthetic value of the game reserve on the north western boundary of the study area could possibly attract eco-tourists who are currently frequent daily visitors.

4.3 Visual absorption capacity

Visual absorption capacity (VAC) can be defined as “an estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality” (Oberholzer, 2005). The ability of a landscape to absorb development or additional human intervention is primarily determined by the nature and occurrence of vegetation cover, topographical character and human structures.

A further major factor is the degree of visual contrast between the proposed new project and the existing elements in the landscape. If, for example, a visually prominent industrial development already exists in an area, the capacity of that section of landscape to visually “absorb” additional industrial structures is higher than that of a similar section of landscape that is still in its natural state. VAC is therefore primarily a function of the existing land use and cover, in combination with the topographical ruggedness of the study area and immediate surroundings.

The surrounding area has been transformed from open grazing land to now include the Bokpoort I Solar facility and game farming. The combination of a flat topography with low shrubs and trees makes the viewing distance extensive. The project area is limited to solar power as the main infrastructure intrusion which has altered the landscape and with the flat topography the area is rated as having a low VAC.

Figure 4-4: View of the Bokpoort I Solar Facility (first image) and view of the Kalahari Oryx game farm (second image)

4.3.1 Visual absorption capacity weighting factor

In order to account for the fact that visual impacts are expected to be more intrusive in landscapes with a lower VAC than in those with a higher VAC (regardless of the visual quality of the landscape), a weighting factor is incorporated into the impact magnitude determination, as indicated in Table 4-3.

Table 4-3: Visual absorption capacity weighting factor table

Visual resource value of receiving landscape	Low VAC	Medium VAC	High VAC
High resource value	High (1.2)	High (1.2)	Moderate (1.0)
Medium resource value	High (1.2)	Moderate (1.0)	Low (0.8)
Low visual resource value	Moderate (1.0)	Low (0.8)	Low (0.8)

The visual resource value of the study area has been determined to be moderate (section 4.2), whilst the VAC of the study area has been rated as low (section 4.3). Hence, a **High (1.2)** weighting factor in terms of VAC is applied during the impact assessment.

4.4 Visual receptor sensitivity

4.4.1 Receptor groups

Potential viewers, or visual receptors, are people that might see the proposed development, as visual impact is primarily an impact concerned with human interest. Receptor sensitivity refers to the degree to which an activity will actually impact on receptors and depends on how many persons see the project, how frequently they are exposed to it and their perceptions regarding aesthetics. Receptors of the proposed solar development can be broadly categorised into two main groups, namely:

- People who live or work in the area and who will frequently be exposed to the project components (resident receptors);
- People who travel on roads through the area, and are only temporarily exposed to the project components (transient receptors); and
- Air travellers (transient receptors).

Potentially sensitive viewer locations include places of residence, work, leisure (including tourism), and travelling routes. The study area consists of farmlands with limited farming infrastructure, farm access roads, railway line, Eskom power line and the Bokpoort I Solar facility.

Residential receptors

The main household structures within the surrounding area are mainly farmhouse residents but there are 9 schools, 3 mines/quarry and 77 other built structures in the 40 km radius study area. Based on the project information at this stage, a total of 3 785 resident receptors/structures are potentially affected by the visual intrusion of the 75 MW PV1 solar facility (as presented in Table 4-4). It is expected that there will be multiple people at these structures during daytime, when the visual intrusion is expected to be at its highest. The table below is extrapolated from Eskom 2009 data which is dated, so this total number of affected structure would potentially since have increased.

Table 4-4: Distance of residential receptors to project infrastructure

Distance (radius around infrastructure)	Rooftop type	Number affected	Total number of structures affected within the radius around the project
0 - 5 km	Household	7	7
5 - 10 km	Household	15	15
10 - 20 km	Household	630	636
	School	2	
	Mine/Quarry	3	
	Other built-up	1	
20 - 40 km	Household	3 044	3 127
	School	7	
	Other built-up	76	
Grand total			***3785***

Source: Rooftop count from Eskom SBC Data, 2009

The PV1 project is anticipated to affect less than a third of that estimate as the viewshed (Figure 5-1) indicates the impact would be most felt by residents living within 0 – 5 km from site and along the Orange River within a 20 – 40 km radius in the south east quadrant of the study area.

Transient receptors

The roads in the study area range between national roads (N10, N14) and provincial road (R64), untarred secondary roads (Loop 16) and farm access roads which cross the project site area. There is a railway line which passes south east of the site and asses across the lower part of Portion 0 of the Farm Bokpoort 390.

The N10 runs parallel to the Orange River on the west bank. Tourists are attracted by the Orange River Wine Route as well as other destinations such as the Augrabies National Park which are access through these national roads. Travellers on the N10 fall within the visual impact area for PV1, PV2 and CSP tower.

Glare from the reflective surface of the PV panels can be a major potential hindrance to aircraft, especially if large numbers of aircraft frequently travel along routes in close proximity to the object causing the reflection. The project area would however not be in the pathway of international air planes. Glare would potentially impact on low flying small aircraft such as crop dusters, tourist charters and helicopters. The Kalahari Oryx Game Reserve has a landing strip to accommodate international guests with their own private planes. Tourist activities such as micro lighting adventure tours along the Orange River may experience potential glare from the combined Bokpoort I and II projects. As a result, air travellers are rated as being moderately sensitive to the proposed project.

4.4.2 Receptor sensitivity and incidence

The visual receptor sensitivity and incidence can be classified as high, moderate or low, as indicated in Table 4-5.

Table 4-5: Visual sensitivity criteria

Number of people that will see the project (incidence factor):	
Large	Towns and cities, along major national roads (e.g. thousands of people)
Moderate	Villages, typically less than 1 000 people
Small	Less than 100 people (e.g. a few households)
Receptor perceived landscape value (sensitivity factor):	
High	People attach a high value to aesthetics, such as in or around a game reserve or conservation area, and the project is perceived to impact significantly on this value of the landscape.
Moderate	People attach a moderate value to aesthetics, such as smaller towns, where natural character is still plentiful and in close range of residency.
Low	People attach a low value to aesthetics, when compared to employment opportunities, for instance. Environments have already been transformed, such as cities and towns.

The following ratings have therefore been applied to the identified visual receptor groups:

- Resident receptors: Resident receptors comprise only a small number of people (incidence factor) living around the Remaining Extent of the Farm Bokpoort 390 where the proposed project infrastructure will be located and the Farm Sand Draai 391 where the proposed pipeline route will extend. The immediate surroundings are predominantly grazing land, game farming and the Bokpoort I Solar Facility. The larger group of farmers and community settlements in the entire study area is expected to attach a high value (sensitivity factor) to the project and is therefore given a **high** sensitivity rating; and
- Transient receptors: It is expected that the majority of people that travel in/through the study area are residents, tourists to the Kalahari Oryx game farm and Transnet employees. There are also tourists who travel through this area to visit the Korannaberg foothills which is a major tourist attraction in the region. Accordingly, they constitute a moderate number of people (incidence factor).

  However, as the vicinity in which the site is located is adjacent to the already existing Bokpoort I solar facility, it is likely that at least some of the travellers (mainly tourists) will attach a high degree of value to the transformed rural visual setting of the proposed project (sensitivity factor). Hence, this receptor group has also been given a **high** sensitivity rating.

Based on the above, a moderate number of people (incidence factor) are expected to be visually affected by the project and the overall perceived landscape value (sensitivity factor) will also be high.

4.4.3 Receptor sensitivity weighting factor

To determine the magnitude of a visual impact, a weighting factor that accounts for receptor sensitivity is determined (Table 4-6), based on the number of people that are likely to be exposed to a visual impact (incidence factor) and their expected perception of the value of the visual landscape and project impact (sensitivity factor).

Table 4-6: Weighting factor for receptor sensitivity criteria

		Number of people that will see the project (incidence factor)		
		Large	Moderate	Small
Receptor perceived landscape value (sensitivity factor)	High	High (1.2)	High (1.2)	Moderate (1.0)
	Moderate	High (1.2)	Moderate (1.0)	Low (0.8)
	Low	Moderate (1.0)	Low (0.8)	Low (0.8)

Based on the receptor sensitivity assessment (section 4.4.2) and the above criteria, a high weighting factor (1.2) in terms of this aspect is applied during the impact magnitude determination.

5.0 IMPACT ASSESSMENT

5.1 Impact identification

The following potential visual impacts that may occur during the construction, operational and decommissioning/closure phases of the project have been identified. Note that for the purposes of this assessment, the potential impacts of the construction and operational phases have been grouped together, as they are expected to be largely similar in nature, although of greater magnitude during operations.

5.1.1 Construction and operational phases

- Reduction in visual resource value due to presence of PV panels and other related surface infrastructure;
- Formation of dust plumes as a result of construction activities;
- Glare from reflective surfaces during the day; and
- Light pollution at night.

5.1.2 Decommissioning and closure phase

- Reinstatement of visual resource value due to dismantling of PV panels and other surface infrastructure and subsequent rehabilitation of footprint areas; and
- Visible dust plumes during rehabilitation.

5.2 Impact magnitude criteria

The magnitude of a visual impact is determined by considering the visual resource value and VAC of the landscape within which the project will take place, the receptors potentially affected by it, together with the level of visibility of the project components, their degree of visual intrusion and the potential visual exposure of receptors to the project, as further elaborated on below.

5.2.1 Theoretical visibility

The level of theoretical visibility (LTV) is defined as the sections of the study area from which the proposed project or its constituent elements may be visible. This area was determined by conducting a viewshed analysis and using Geographic Information System (GIS) software with three-dimensional topographical modelling capabilities, including viewshed and line-of-sight analyses (cross-sections).

The basis of a viewshed analysis is a good Digital Elevation Model (DEM). No detailed elevation data (contours) were available for the study area; therefore the 30 m Shuttle Radar Topography Mission (SRTM) data (NASA, 2014) was used. The viewshed was modelled on the above mentioned DEM using Global Mapper 15® software. The receptor height was set to 1.5 m for most of the area where available, and 40 km area surrounding the site was used. In this fashion, the LTV based on the results of the viewshed analysis was then rated as shown in Table 5-1.

Table 5-1: Level of visibility rating

Level of theoretical visibility of project element	Visibility rating
Less than a quarter of the total project study area	Low
Between a quarter and half of the study area	Moderate
More than half of the study area	High

The viewshed (refer to Figure 5-1) was developed from the proposed site layout and the following heights were assumed:

- Substations: 10 m;
- PV panels: 4 m; and

- Offices - single storey building.

Based on the results, the following conclusions regarding theoretical visibility of each project component were arrived at:

5.2.1.1 Construction and operational phase impacts

- Photovoltaic (PV1) panels and associated surface infrastructure: The PV panels will be positioned on the southwest portion of the Bokpoort II project area (Figure 2-1, Figure 2-2) and northwest of the existing Bokpoort I solar facility. The height of the panels is expected to be 4 metres. Based on the viewshed analysis presented in Figure 5-1, the PV1 infrastructure will be 95% visible in a 0 - 5 km radius and 60% in the 5 -10 km radius around the project site. In the 40 km radius of the study area, the panels will be 35% visible in the south east quadrant of the study area. Taking the topography and vegetation around the river into consideration, the panels would be visible on the eastern bank of the Orange River and east of the N10 national road. The LTV for PV1 is expected to be **moderate** within the overall study area;

- Formation of dust plumes: During construction and operations, especially during dry and windy conditions, it is expected that activities on site will result in airborne dust plumes, which may be visible over great distances, often far greater than the activity that is causing it. For this reason, the level of visibility of dust plumes associated with construction and operations is expected to be **high**;

- Glare from reflective surfaces during the day: In general, solar projects elicit the impact of glare on the surrounding area. The intensity of glare anticipated from the PV panels would potentially impact on air traffic in the study area. The area of PV1 is 250 ha, which is a significant footprint area for reflective infrastructure. The air traffic anticipated in the study area is mainly smaller aircraft and tourist activities which would fly closer to the ground than the international flights so these would experience the glare impact of this project. The Kalahari Oryx Game Reserve has a landing strip to accommodate international guests with their own private planes. Therefore the LTV is rated as **high** for this nature of project; and

- Light pollution at night: The degree to which light pollution will be visible is expected to be concentrated to the area of the PV1 solar facility, as most of the fixed/permanent lighting will occur here, although lighting of operational areas and vehicle lights will also play a role. The expected lighting at the tower during the night is also for safety measures for aircraft. For this reason the level of visibility of light pollution is expected to be **moderate** during the construction and operational phases.

5.2.1.2 Rehabilitation and closure phase impacts

- Dismantling of surface infrastructure and subsequent rehabilitation of footprint areas: During the decommissioning phase the surface infrastructure will be removed and the affected footprint areas will be rehabilitated. Hence, the LTV for this activity will be similar to that of the surface infrastructure during operations and is rated as being **moderate**; and

- Dust plume: Rehabilitation activities are also expected to cause airborne dust, however at a lower frequency, smaller scale and much shorter time period than during operations. Nevertheless, the visibility of this impact is still expected to be **high** within the study area.

5.2.2 Visual intrusion

Visual intrusion deals with how well the project components fit into the ecological and cultural aesthetic of the landscape as a whole. An object will have a greater negative impact on scenes considered to have a high visual quality than on scenes of low quality because the most scenic areas have the "most to lose".

The visual impact of a proposed landscape alteration also decreases as the complexity of the context within which it takes place, increases. If the existing visual context of the site is relatively simple and uniform any alterations or the addition of human-made elements tend to be very noticeable, whereas the same alterations in a visually complex and varied context do not attract as much attention. Especially as distance increases, the object becomes less of a focal point because there is more visual distraction, and the observer's attention is diverted by the complexity of the scene (Hull, R.B and Bishop, I.E, 1998). The expected level of visual intrusion of each of the project components is assessed below.

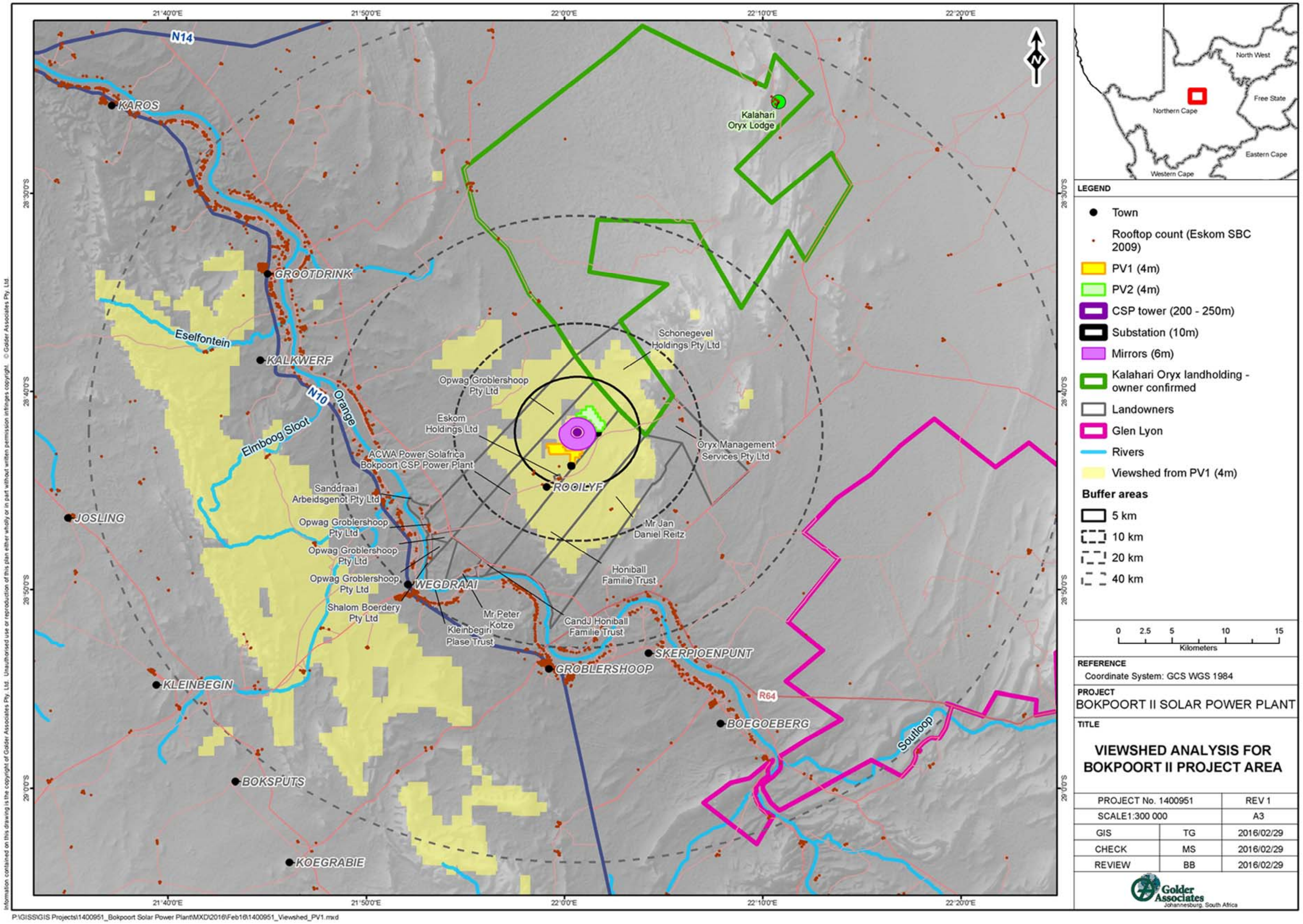

Figure 5-1: PV1 viewshed analysis

5.2.2.1 Construction and operational phase impacts

- Photovoltaic (PV1) panels and associated surface infrastructure: The reflective surfaces of the panels and the shiny metal infrastructure would contrast sharply with the neutral colour and flat landscape. The panels would be 4 m in height which is higher than the existing trees and shrubs of the study area. Their shapes and form are in contrast to the visual context of the study area hence, the level of visual intrusion of the panels is expected to be **high**;
- Formation of dust plumes: Dust plumes are often one of the more socially objectionable impacts in terms of potential health risks and as a nuisance factor. It is also related to the degradation of the visual amenity value of the surrounding landscape from a resident receptor perspective. This visual impact is especially relevant in a greenfields setting, where ambient air quality is still relatively pristine and the surrounding landscape has not been affected by dust fallout yet. Based on the nature of the project, the generation of dust is limited to the construction and operation of the PV1 and associated infrastructure. According to the Air Quality Impact Assessment, this dust plume is not expected to influence the neighbouring farm houses. For this reason, this impact is expected to be **moderately** intrusive from a visual perspective;
- Glare from reflective surfaces during the day: The glare off all infrastructure surfaces is considered intensely intrusive to the natural visual context of the study area. The existing Bokpoort I solar facility is smaller and already elicits a significant intrusion footprint of the landscape. Therefore the addition of the PV1 solar facility is expected to have a **high** level of intrusion; and
- Light pollution at night: As with dust pollution, light pollution can be a highly objectionable night-time impact in rural landscapes where large-scale development activity does not occur yet. Based on the existing Bokpoort I solar facility impact on night time light pollution, this impact has been rated as being **moderately** intrusive unless mitigated.

5.2.2.2 Rehabilitation and closure phase impacts

- The dismantling and removal from site of surface infrastructure and subsequent rehabilitation of footprint areas will result in a positive visual impact compared to that of construction and operations, and to a large extent reinstate the original visual character of the affected footprint areas. Hence, the resultant level of visual intrusion of the end state of these areas is expected to be **negligible**; and
- Dust plume: As is the case during operations, visible dust plumes during rehabilitation are expected to be **moderately** intrusive, although expected to occur less frequently.

5.2.3 Visual exposure

The visual impact of a normal development diminishes at an exponential rate as the distance between the observer and the object increases – refer to Figure 5-2. Relative humidity and fog in the area directly influence the effect. Increased humidity causes the air to appear greyer, diminishing detail. Thus, the impact at 1 000 m would be 25% of the impact as viewed from 500 m. At 2 000 m it would be 10% of the impact at 500 m. The inverse relationship of distance and visual impact is well recognised in visual analysis literature (Hull, R.B and Bishop, I.E, 1998) and was used as important criteria for this study.

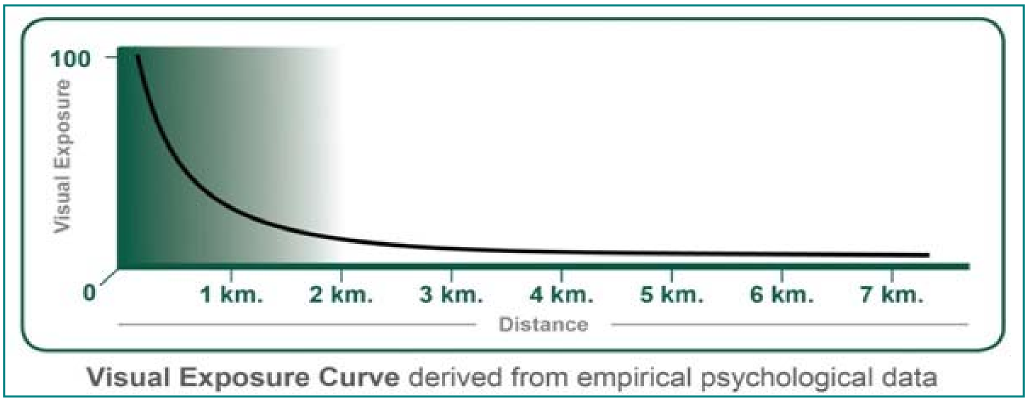

Figure 5-2: Visual exposure graph

Thus, visual exposure is an expression of how close receptors are expected to get to the proposed interventions on a regular basis. For the purposes of this assessment, close range views (equating to a high level of visual exposure) are views over a distance of 500 m or less, medium-range views (equating to a moderate/medium level of visual exposure) are views of 500 - 2 km, and long range views are over distances greater than 2 km (low levels of visual exposure).

5.2.3.1 Construction and operations impacts

All identified surface infrastructure impacts: Table 4-4 in section 4.4.2 of this report presents the proximity of visual receptors to the surface infrastructure. There are 7 resident receptors (small number of farmsteads) located within 0 - 5 km east of the proposed PV1 infrastructure. However, the majority of visual receptors are located further than these elements, within the 20 - 40 km radius. Potential transient visual receptors would be from the access roads surrounding the area, namely the N10 and the N14. For the purposes of this assessment visual exposure in terms of all identified impacts has therefore been rated as being **moderate** as most receptors are located within 25 – 50% of the study area radius away from the project.

5.2.3.2 Rehabilitation and closure phase impacts

- All identified impacts: As is the case with the construction and operations phase impacts, the majority of visual receptors will be located or travel pass more than 5 km from the main project elements and visual exposure to the rehabilitation/closure related impacts is therefore rated as **low**.

5.3 Impact magnitude methodology

The expected impact magnitude of the proposed project was rated, based on the above assessment of the visual resource value of the site alternatives, as well as level of visibility, visual intrusion, visual exposure and receptor sensitivity as visual impact criteria. The process is summarised below:

- *Magnitude = [(Visual quality of the site x VAC factor) x (Visibility + Visual Intrusion + Visual Exposure)] x Receptor sensitivity factor*

  Thus: *[(1 x Factor 1.0) x (1 + 1 + 1)] x Factor 1 = 3.*

From the above equation the maximum magnitude point (MP) score is 38.9 points.

The possible range of MP scores is then categorised as indicated in Table 5-2.

Table 5-2: Impact magnitude point score range

MP Score	Magnitude rating
20.1≤	High
13.1-20.0	Moderate
6.1-13.0	Low
≤6.0	Negligible

5.4 Impact magnitude determination

Based on the visual resource, VAC, receptor sensitivity and impact assessment criteria assessed in the preceding sections, the magnitude of the various impacts identified was determined for each phase of the project. Consequently, the impact magnitude determination for the construction and operational phases and for the rehabilitation and closure phase is presented in Table 5-3 and Table 5-4 respectively.

Table 5-3: Construction and operational phases - impact magnitude summary

Visual impact	Study area visual resource value	VAC weighting factor	Level of visibility	Visual intrusion	Visual exposure	Receptor sensitivity factor	Impact magnitude point score
Reduction in visual resource value due to presence of PV panels and other related surface infrastructure	2	1.2	2	3	2	1.2	20.2 (high)
Formation of dust plumes	2	1.2	3	2	2	1.2	20.2 (high)
Glare from reflective surfaces during the day	2	1.2	3	3	2	1.2	23 (high)
Light pollution at night	2	1.2	2	2	2	1.2	20.2 (high)

(*Where for: visual resource value, visibility, visual intrusion and visual exposure: high=3; moderate=2; low=1; and receptor sensitivity: high = factor 1.2; moderate = factor 1; low = factor 0.8.*)**

Table 5-4: Rehabilitation and closure phase - impact magnitude summary

Visual impact	Study area visual resource value	VAC weighting factor	Level of visibility	Visual intrusion	Visual exposure	Receptor sensitivity factor	Impact magnitude point score
Reinstatement of visual resource value due to dismantling of PV panels and other surface infrastructure and subsequent rehabilitation of footprint areas	2	1.2	2	0 (negligible)	2	1.2	11.5 (low)
Visible dust plumes during rehabilitation.	2	1.2	3	2	1	1.2	17.3 (moderate)

(*Where for: visual resource value, visibility, visual intrusion and visual exposure: high=3; moderate=2; low=1; and receptor sensitivity: high = factor 1.2; moderate = factor 1; low = factor 0.8.*)**

5.5 Impact significance rating methodology

The significance of the identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998).

This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Table 5-5: Ranking scales for assessment of occurrence and severity factors

Probability	Duration
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8-15 years)
2 - Low probability	2 - Short-term (0-7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 - None	
Scale	**Magnitude**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

- **SP (significance points) = (magnitude + duration + scale) x probability**

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions.

5.6 Impact significance determination

Using the above criteria, the results of the impact significance assessment before and after mitigation, for the construction and operations as well as rehabilitation and closure phase impacts, are presented in Table 5-6 and Table 5-7 respectively. Consequently mitigation measures for the various identified impacts are, where applicable, discussed in section 0.

5.6.1 Construction and operations

Table 5-6: Construction and operational phase impact assessment before and after mitigation

Potential visual impacts: construction and operation phase	Visual significance											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
1. Reduction in visual resource value due to presence of PV1 panels and other related surface infrastructure	8	5	2	5	75	High	8	4	2	5	70	Moderate
2. Formation of dust plumes as a result of construction activities	8	2	2	3	36	Moderate	6	2	2	2	20	Low
3. Glare from reflective surfaces during the day	8	4	3	5	75	High	8	4	3	5	75	High
4. Light pollution at night	8	4	2	4	56	Moderate	6	4	2	3	36	Moderate

5.6.2 Decommissioning and closure

Table 5-7: Decommissioning and closure phase impact assessment before and after mitigation

Potential visual impacts: decommissioning and closure phase	Visual significance											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
1. Reinstatement of visual resource value due to dismantling of PV panels and other surface infrastructure and subsequent rehabilitation of footprint areas	4	4	2	5	50	Moderate	N.A. (decommissioning and rehabilitation measures constitutes visual mitigation)					+
2. Visible dust plumes during rehabilitation	6	2	2	4	40	Moderate	4	2	1	3	24	Low

5.7 Cumulative impacts

The cumulative impact assessment describes the project in terms of the degree to which it will contribute to existing similar negative impacts or act as potential catalyst for similar impacts within the study area.

The baseline assessment has found the study area to be partially transformed by the Bokpoort I Solar facility activities. The Visual Impact Assessment compiled in 2010 for the Bokpoort I solar facility states that, "The selected trough technology in itself is highly visible when exposed, but due to the terrain the CSP site is unlikely to be visible from a wide area. The viewshed analysis indicates that most of the CSP components will not be visible from existing viewer locations (less than 10 km) and that only tall structures (20 – 30 m) might be visible from exposed locations. Its remote location also puts the facility out of range of prominent views, since most viewer locations occur beyond 10 km from the site." The viewshed below (Figure 5-3) indicated the visibility of the highest infrastructure on the Bokpoort I solar facility site. There was no differentiation from this viewshed to the other surface infrastructure viewsheds for Bokpoort I.

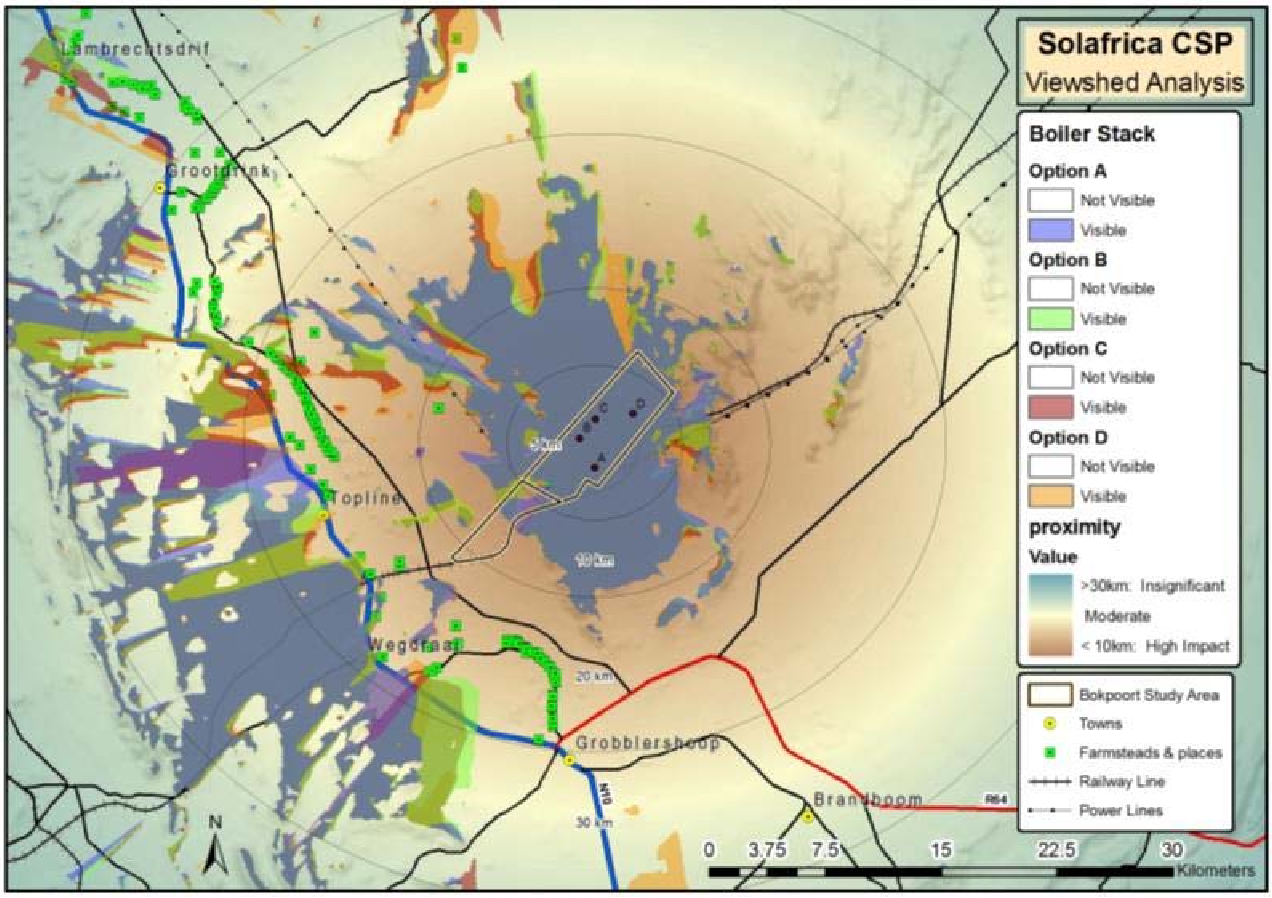

Figure 5-3: Bokpoort I boiler stack (30 m) viewshed (2010)

In comparison the Bokpoort II PV1 solar power project has a height of 4 m with a surface area of 250 ha which is smaller than the Bokpoort I solar facility which has the highest infrastructure at 30 m and a surface area of approximately 350 ha. The difference in magnitude of the entire Bokpoort II solar facility is substantial due to the visibility of the CSP and Heliostat Solar Field with heights of 250 m and 6 m respectively.

The cumulative impact of the project in terms of visual intrusion is therefore expected to be moderate to high, as the project will introduce a larger amount of manmade infrastructure into a visual landscape that is relatively non-transformed. In terms of glare the project is expected to have a high cumulative impact, as the additional 250 ha of PV1 increases the intensity of the glare within the study area.

Cumulatively, the proposed 150 MW CSP Tower facility with heliostat mirror field has a footprint of 900 ha which elicits aspects of glare and 250 m tower height and the addition of 250 ha of PV2 panels also impacts visually on the surrounding environment. These aspects of the Bokpoort II Solar facility (PV1, PV2 and CSP Tower) in conjunction with the existing Bokpoort I Solar facility project will have a high cumulative impact to the great study area. It is also possible that similar projects may in future be approved in the event that this project is approved.

The Northern Cape has been identified as one of the best places in the world to harness solar radiation. Figure 5-4 shows the currently know environmental authorisation applications for solar power developments in the vicinity of the towns of Upington, Postmasburg, Groblershoop and Prieska (south of the map area) as obtained from the database on the website of the Department of Environmental Affairs.

Table 5-8 summarises the project information pertaining to the solar development environmental authorisation applications received by the DEA up to the end of the 4th Quarter of 2015. The solar development for which environmental authorisations have been submitted to the DEA vary in solar technology, generation capacity and status of approval.

The projects are in different phases of approval and it is important to note that, even though a number of the projects listed in Table 5-8 have been granted environmental authorisation, due to the required approval process of the REIPPP Programme to which each project will be subjected, not all of the authorised projects will be constructed.

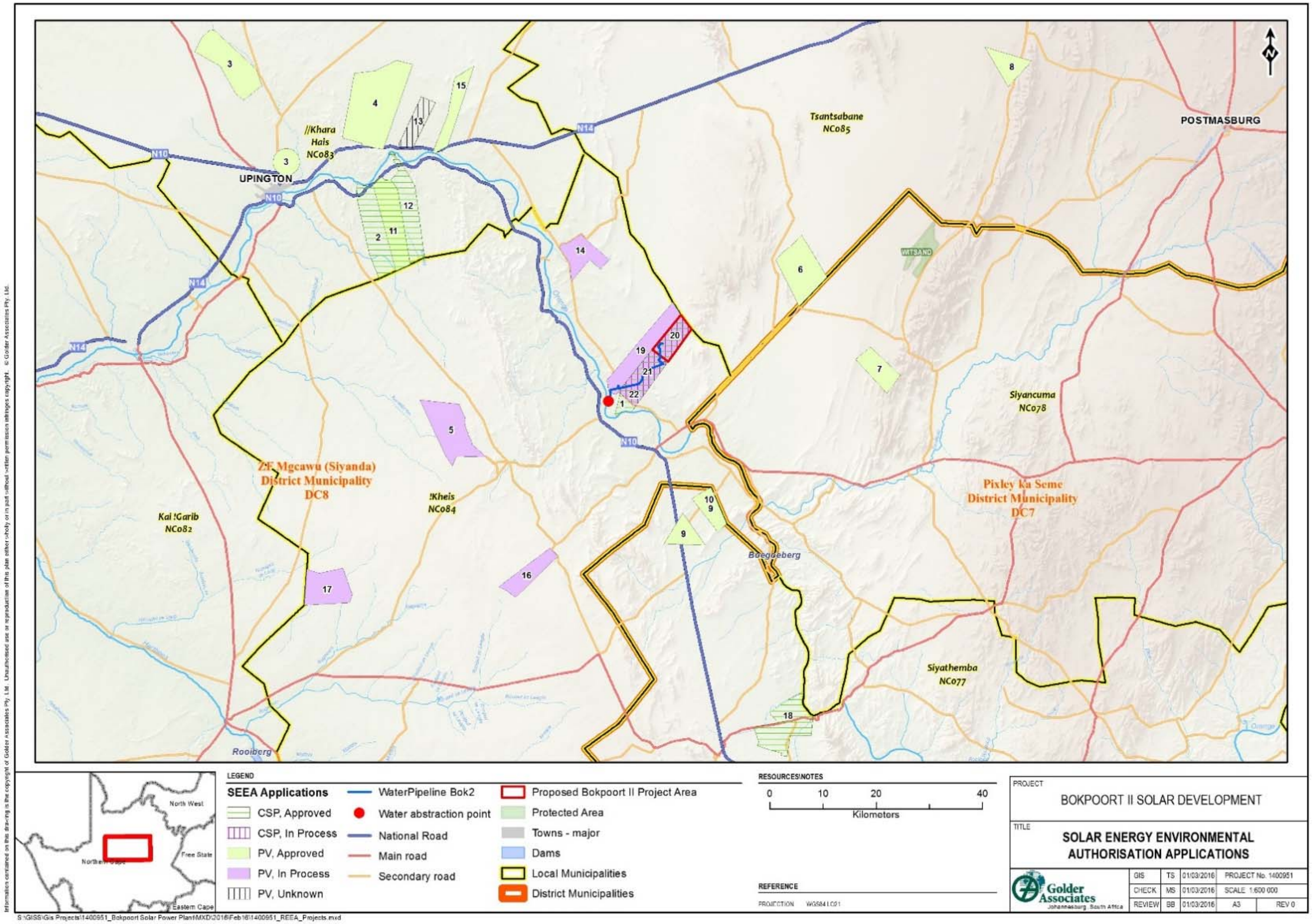

Figure 5-4: Solar Energy Development Environmental Authorisation Applications in the Bokpoort II project area (Department of Environmental Affairs, 2016)

Table 5-8: Solar Energy Development Environmental Authorisation Applications in the Bokpoort II project area (Department of Environmental Affairs, 2016)

ID No.	DEA Ref No.	Project Title	Applications Received	Applicant	Technology	Megawatt	Project Status
1	12/12/20/1920	Proposed 75 MW Concentrating Solar Thermal Power Plant and Its Associated Infrastructure in the Siyanda District, Northern Cape Province.	2010/05/06	Solafrica Thermal Energy Pty Ltd	Solar CSP	50	Approved
2	12/12/20/2056/A2	Proposed construction of the Illanga Solar Thermal Power Plant, Karoshoek Solar Thermal Park.	2014/06/06	Ilangalethu Solar Power Pty Ltd	Solar CSP	-	Approved
3	12/12/20/2146	The Proposed Establishment of a Photovoltaic (PV) Installation at the Upington Airport, Northern Cape Province.	To review	ACSA PV	Solar PV	8.9	Approved
4	12/12/20/2169	The Construction of a 25 MW Photovoltaic Solar Energy Facility on a Site North-East of Upington, Northern Cape Province.	2012/11/15	Upington Solar Pty Ltd	Solar PV	25	Approved
5	12/12/20/2198	Proposed Construction of a Photovoltaic (PV) Solar Energy Facility on the Farm Kleinbegin, South East of Upington, Northern Cape Province.	2011/02/01	Vanguard Solar Pty Ltd	Solar PV	50	In Process
6	12/12/20/2583	The Proposed Inyanga Energy Project 6 on Portion 15 of the Farm O'poort 384, Kheis Local Municipality, Northern Cape Province.	2011/11/01	Islandsite Investment 519 Pty Ltd	Solar PV	75	Approved
7	12/12/20/2647/48	Proposed Construction of Three (3) 75 MW Arriesfontein Photovoltaic Solar Power Plants: Phase 1, 2 and 3, on the Farm Arriesfontein 267 Barkley Wes Rd, Kgatelopele Local Municipality, Northern Cape.	2011/11/01	Solar Reserve South Africa Pty Ltd	Solar PV	75	Approved
8	12/12/20/2649	Jasper Power Company.	2011/11/01	Solar Reserve South Africa Pty Ltd	Solar PV	75	Approved
9	14/12/16/3/3/1/658	The Proposed Prieska Solar Power Plant, Within the Siyathemba Municipality, Northern Cape.	2012/07/20	Maxwell Moss and Associates	Solar PV	19	Approved

ID No.	DEA Ref No.	Project Title	Applications Received	Applicant	Technology	Megawatt	Project Status
10	14/12/16/3/3/1/909	Proposed expansion of the Prieska solar power plant within Siyathemba Municipality, Prieska, Northern Cape.	2012/08/01	Maxwell Moss and Associates (Pty) Ltd	Solar PV	19	Approved
11	14/12/16/3/3/2/292	The Karoshoek Concentrating Photovoltaics or Parabolic Dish (Cpvpd) 1-4 Facilities East of Upington within the Khara Hais Local Municipality in the Northern Cape Province.	2012/03/08	FG Emvelo Energy Pty Ltd	Solar PV	25	Approved
12	14/12/16/3/3/2/293	The proposed establishment of the Karoshoek Linear Fresnel 1 (LF 1) facility located on site 1.1 located 30 km East of Upington in the Northern Cape.	2012/03/08	FG Emvelo Energy Pty Ltd	Solar CSP	100	Approved
13	14/12/16/3/3/2/532	Proposed Moipax solar project, Khara Hais Municipality, Northern Cape.	2013/04/09	Moipax Pty Ltd	Solar PV	250	Status unknown
14	14/12/16/3/3/2/571	The Proposed Kheis Solar Park 1 PV project on a site South East of Upington within the !Kheis Local Municipality, Northern Cape Province.	2013/08/28	Gestamp Asetym Solar South Africa Pty Ltd	Solar PV	75	In Process
15	14/12/16/3/3/2/619	Proposed renewable energy generation project on Portion 1 of the Farm Avondale No. 410, Gordonia RD, Khara Hais Local Municipality, Avondale 2 Solar Park.	2014/01/17	Tita Energy (Pty) Ltd	Solar PV	75	Approved
16	14/12/16/3/3/2/625	Proposed renewable energy generation project, Kenhardt RD, !Kheis local municipality, ZF Mgcawu District Municipality, Northern Cape.	2014/01/01	Ansolgenix (Pty) Ltd	Solar PV	-	In process
17	14/12/16/3/3/2/712	Proposed construction of the Boven PV1 75 MW in Kenhardt, Northern Cape.	2014/05/01	Mulilo Renewable Project Developments (Pty) Ltd	Solar PV	-	In process
18	14/12/16/3/3/2/729	Proposed Solar Power Generation Plant on Portion 2 and Portion 7 of the Farm Rietfontein 11, Northern Cape Province.	2015/03/02	Kameelboom Solar Power Plant Pty Ltd	Solar CSP	125	Approved

ID No.	DEA Ref No.	Project Title	Applications Received	Applicant	Technology	Megawatt	Project Status
19	14/12/16/3/3/2/738	Proposed Solafrica Sand Draai 75 MW PV Project in !Keis LM.	2014/08/29	Solafrica Photovoltaic Energy (Pty) Ltd	Solar PV	75	In Process
20	14/12/16/3/3/2/881	Proposed Bokpoort II 75 MW Photovoltaic Development (PV1) on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	PV	75	In Process
21	14/12/16/3/3/2/880	Proposed Bokpoort II 75 MW Photovoltaic Development (PV2) on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	PV	75	In Process
22	14/12/16/3/3/2/879	Proposed Bokpoort II 150 MW CSP Tower Development on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	CSP Tower	150	In Process
23	14/12/16/3/3/2/521	The proposed 1 GW Siyathemba solar park, Northern Cape Province	2013/03/26	Central Energy Fund (Soc) Ltd	Solar PV	1000	In Process

6.0 MITIGATION AND MONITORING MEASURES

Visual mitigation of a solar development can be approached in two ways, and usually a combination of the two methodologies is most effective. The first option is to implement measures that attempt to reduce the visibility of the sources of a visual impact. Thus an attempt is made to "hide" the source of the visual impact from view, by placing visually appealing elements between the viewer and the source of the visual impact.

The second option aims to minimise the degree or severity of the visual impact itself, and usually involves altering the source of the impact in such a way that it is smaller in physical extent and/or less intrusive in appearance. This can be done by decreasing the size of disturbances such as stockpiles, dumps and buildings or by shaping, positioning, colouring and/or covering them in such a way that they blend in with the surrounding scenery to a certain degree. For instance, the visual impact of an artificial landform can be reduced somewhat by shaping it in an appropriate fashion, covering it with topsoil, re-seeding it with indigenous grasses, etc.

However construction and especially operational mitigation possibilities are very limited for the proposed 75 MW PV1 solar facility as well as the potential additional Bokpoort II project facilities (150 MW CSP Tower, 75 MW PV 2 solar facility), as a result of the large footprint and/or vertical height of the infrastructure, the flat almost featureless topography as well as the functional/operational requirements of the installations, namely maximising unobstructed exposure to available sunlight.

Given the long expected operational lifespan of the installation, visual mitigation will therefore only be possible if and when the facility is ever decommissioned and dismantled, and the resultant footprint areas rehabilitated.

6.1 Construction phase

Construction-related impacts are secondary impacts associated with the erection of the surface infrastructure and initial stripping of topsoil; and should be mitigated in the following ways:

6.1.1 Dust pollution

The following standard measures associated with proposed solar development activities should be implemented, as well as any further measures recommended in the air quality impact assessment section of the EIA report:

- Water down access roads and large bare areas as frequently as is required to minimise airborne dust;
- Place a sufficiently deep layer of crushed rock or gravel at vehicle and machinery parking areas; and
- Apply chemical dust suppressants if deemed necessary.

6.1.2 General measures

- Maintain the construction site in a neat and orderly condition at all times;
- Create designated areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities;
- Limit the physical extents of areas cleared for material laydown, vehicle parking and the like as much as possible and rehabilitate these as soon as is feasible; and
- Repair unsightly and ecologically detrimental erosion damage as soon as possible and re-vegetate these areas using a suitable mix of indigenous species.

6.2 Operations phase

A very limited number of feasible visual mitigation options during operations exist in terms of the PV panels, CSP Tower and associated surface infrastructure. The focus should therefore be on preventable sources of nuisance and visual disturbance such as dust and light pollution. A number of measures to improve the appearance of artificial landforms and structures are also proposed.

6.2.1 Surface infrastructure

The nature of solar power projects has the reflective PV panels, reflective surface on the top of the tower and mirrors which cannot be mitigated in terms of glare.

6.2.2 Light pollution at night

- Utilise security lighting (if feasible) that is movement activated rather than permanently switched on, to prevent unnecessary constant illumination during night-time;
- Plan and optimise the lighting requirements of the facilities to ensure that lighting meets the need to keep the site secure and safe, without resulting in excessive illumination;
- Reduce the height from which floodlights are fixed as much possible while still maintaining the required levels of illumination;
- Identify zones of high and low lighting requirements, focusing on only illuminating areas to the minimum extent possible to allow safe operations at night and for security surveillance;
- Avoid up-lighting of structures by rather directing lighting downwards and focussed on the area to be illuminated; and
- Fit all security lighting with 'blinkers' or specifically designed fixtures, to ensure light is directed downwards while preventing side spill. Light fixtures of this description are commonly available for a variety of uses and should be used to the greatest extent possible.

6.2.3 Dust pollution

Operational mitigation measures are as per the recommendations for the construction phase and as per the measures stipulated in the Air Quality Impact Assessment section of the EIA report.

6.2.4 Architectural measures

- To reduce the visual intrusion of the buildings, roofing and cladding material should not be white or shiny (e.g. bare galvanised steel that causes glare);
- Construct and/or paint offices and workshop buildings in colours that are complementary to the surrounding landscape, such as olive green, light grey, grey green, blue grey, dark buff, rust, ochre variations of tan; and
- Utilise construction materials that have matt textures where possible.

6.2.5 Site-wide and general measures

- Shape slopes and embankments to a maximum gradient of 1:5 and vegetate, to prevent erosion and improve their appearance.

6.3 Decommissioning and closure phase

Given the requirement for power generation to support continued economic growth in the country it is not envisaged that the project would be decommissioned in the foreseeable future. However in the event that the requirement should arise, it is recommended that best-practice methods will be followed regarding decommissioning, closure and subsequent rehabilitation of the entire site, which would include the following:

- Dismantle and remove all visible surface infrastructure during decommissioning;
- Re-shape all footprint areas to be as natural in appearance as possible;
- Conduct on-going monitoring and maintenance of the rehabilitated areas to ensure that they establish successfully and that erosion does not occur;
- Continuously assess condition of vegetation cover of rehabilitated areas for adequate cover density and species composition. Due to the unpredictable nature of vegetation growth the effectiveness of the re-vegetation will only become apparent after several years. Where specimens die, grow poorly or do not effect sufficient coverage the cause of the problem should be established and the afflicted specimens replaced, or a more suitable alternative established, based on a case-to-case basis; and
- Employ control measures to eradicate weedy and alien invader plant species as required.

7.0 CONCLUSION

In summary, it can be stated that the study area is of moderate to in some instances high visual resource value and that the proposed project will impact negatively on the visual environment, specifically as the study area is transformed grazing land, game farming in character with very limited existing development activity. The proposed 75 MW PV panels and associated infrastructure are expected to cause a significant visual impact, as these elements will be expansive and highly visible within the study area. Secondary impacts such as dust emission, glare and lighting at night will also occur. Given the general location and operational requirements of the facilities operational mitigation measures are also very limited and, visual mitigation will largely be limited to construction phase, and during de-commissioning should this occur.

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APPENDIX A

Document Limitations

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Golder Associates

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/2/881
NEAS Reference Number:	DEAT/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718, 2009

PROJECT TITLE

Proposed 75 MW Photovoltaic Development (PV1) on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop in the !Kheis Local Municipalitly, Northern Cape.

Specialist:	Priya Ramsaroop		
Contact person:	Golder Associates Africa (Pty) Ltd		
Postal address:	P.O. Box 6001, Halfway House		
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Professional affiliation(s) (if any)			

Project Consultant:	Golder Associated Africa (Pty) Ltd		
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4.2 The specialist appointed in terms of the Regulations_

I, Priya Ramsaroop , declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Golder Associates Africa Pty Ltd

Name of company (if applicable):

18 April 2016

Date:

Marie Schlechter
Senior Environmental Scientist
GOLDER ASSOCIATES AFRICA (PTY) LTD
PO Box 6001
Halfway House, 1685
South Africa

03 May 2016

Dear Ms Schlechter

Re: Independent Review: Visual Impact Assessment for the Bokpoort ll Solar Power Project: 75 MW Photovoltaic (PV1) Solar Facility; Golder Report No: 1400951-300607-11; DEA Reference Number: 14/12/16/3/3/2/8881

1. Background

ACWA Power Africa Holdings (Pty) Ltd is proposing to establish a solar power facility (Bokpoort ll) on the north-eastern portion of the Remaining Extent of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

The Bokpoort ll project has three separate components namely:

- 75MW Photovoltaic (PV1) Solar Facility,
- 75MW Photvoltaic (PV2) Solar Facility and
- 150MW CSP Tower Facility.

Each of these three proposed projects occupies different parts of the same site and is subject to their own environmental impact assessment process and standalone specialist study. NLA has been commissioned by Golder Associates to carry out an independent review of the Visual Impact Assessment for the Bokpoort ll Solar Power Project of each of the proposed three projects. This review relates to the **75MW Photovoltaic (PV1) Solar facility.**

2. Aim of the review

The main aim of this independent review is to appraisal the report compiled for the 75 MW Photovoltaic (PV1) Solar Facility compiled by Golder Associates (April 2016).

It must be noted that the technical study that NLA has been appointed to appraise had been executed on a project for which Golder is leading the environmental impact assessment. Consequently, Golder has been asked by DEA to provide a third-party independent review of the specialist work completed for this project. It is also important to understand that this review will focus on the work completed in the report (i.e. it is not a technical review of the report itself i.e. writing style etc.) and its findings with a view to expressing an independent opinion on the appropriateness and adequacy of the study conducted by the Golder specialist team.

To this end the reviewer will comment on:

- The appropriateness of the baseline and identification of key issues to be assessed
- The appropriateness of the approach and methodology to the assessment and
- The appropriateness of the impact assessment and mitigation proposed.

3. Independent Review

Baseline and identification of key issues

The visual baseline assessment was based on *'photographs that were taken on separate occasions by other specialists during the scoping phase, as well as on Google Earth imagery of the project area and its surroundings*' (Golder April 2016)[1].

The documented landscape is adequate to describe a baseline from which the value of the study area's visual resource value (rated moderate) can be determined and the context within which the project will take place.

Issues, typical to solar power projects (photovoltaic), that must be addressed in the assessment phase where clearly identified in the report. These were described as:

- Reduction in visual resource value due to presence of PV panels and other related surface infrastructure;
- Formation of dust plumes as a result of construction activities;
- Glare from reflective surfaces during the day; and
- Light pollution at night.

Approach and methodology to the assessment

The approach and method used in the report is appropriate and addresses the issues identified in the baseline phase. It conforms to the minimum industry standards for visual impact assessment and is suitable for the nature of this study. A two 'phased' approach to determine significance of impact was used. The first uses criteria to determine the *magnitude*[2] of the impact. These are visual resource value, Visual Absorption Capacity (VAC), sensitivity of visual receptors, visibility of project components, degree of visual

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[1] The reviewer believes that a site visit by the Visual Specialist himself would have been more appropriate than using 'second' hand information (photography by other specialists) to characterise the landscape and to better understand the potential impacts the project would have.

[2] The reviewer is of the opinion that in synthesising the criteria to assess magnitude of impact, a numerical or weighting system, as used in the report should perhaps be avoided. 'Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement' (Institute of Environmental Assessment and The landscape Institute (1996)). However, in this instance he can confirm that the approach used in the report will not fundamentally change its findings.

intrusion[3] and visual exposure of project components. The second phase integrates the magnitude of impact into Occurrence (probability and duration of the occurrence of impact) Severity (extent and magnitude of impact) criteria.

This approach is common within the industry and of an appropriate standard to rate and assess visual impacts.

Impact assessment and mitigation
The report rates the significance of impact from *moderate* to *high* for the construction and operation phases and *moderate* to *low* (with mitigation) for decommissioning and closure. The report rates the significance of visual impact as:

High for:
- Reduction in visual resource value due to presence of PV panels and other related surface infrastructure - with mitigation this drops to moderate;
- Glare from reflective surfaces during the day – there are not mitigation measures to reduce this impact.

And

Moderate for:
- Formation of dust plumes as a result of construction activities – with mitigation this drops to low;
- Light pollution – with mitigation the significance points drop from 56 to 36 but the rating remains at moderate.

Whilst there is no absolute standard or method for carrying out VIA's in South Africa, the reviewer is of the opinion that the method and findings are appropriate and that the proposed management measures would be effective in reducing the impact in the areas where a reduction is predicted.

Cumulative Impact
The cumulative impact of the proposed three projects is adequately described, contextualized and rated in the report. The cumulative impact of the the entire Bokpoort II solar facility is described as being '*substantial*' and that *'the aspects of the Bokpoort II Solar facility (PV1, PV2 and CSP Tower) in conjunction with the existing Bokpoort I Solar facility project will have a high cumulative impact to the great study area'*.

4. Conclusion

I, the undersigned, have reviewed the report titled Visual Impact Assessment for the Bokpoort ll Solar Power Project: **75 MW Photovoltaic (PV1) Solar Facility; Golder Report No: 1400951-300607-11; DEA**

[3] Whilst visual intrusion is discussed in the report the reviewer believes that in addition to this discussion, photo simulations (photo montages) of the proposed project superimposed on the existing landscape should be included in the report. This computer modelling exercise gives a clear indication to the specialist and the public about the potential impact of the project and goes a long way to adequately informing the significance of impact rating.

Reference Number: 14/12/16/3/3/2/8881, dated April 2016 and confirm that he differs in opinion in a few areas that relate to method and approach and that these have been described in the footnotes.

However, notwithstanding these comments, the reviewer confirms that the report has been written to acceptable National and International Finance Corporation (IFC) Performance Standards and that there is adequate relevant science / data to justify and adequately explain and defend the conclusions made in the report.

Sincerely,

Graham A Young PrLArch
Member: Newtown Landscape Architects cc

Cc: NLA Johannesburg: Yonanda Martin

References:

Golder Associates Africa, *Visual Impact Assessment for the Bokpoort ll Solar Power Project: 75MW Photovoltaic (PV1) Solar Facility; Golder Report No: 1400951-300607-11*, Unpublished report April 2016, Halfway House.

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Graham is a registered landscape architect (SACLAP no. 87001) with interest and experience in landscape architecture, urban design and environmental planning. He holds a degree in landscape architecture from the University of Toronto and has practiced in Canada and Africa where he has spent most of his working life. During his 30 year plus career he has received numerous Institute of Landscape Architects of South Africa and other industry awards. He has published widely on landscape architectural issues and has had projects published both locally and internationally in design journals and books. In addition to being a founding member of Newtown Landscape Architects he is currently a senior lecturer, teaching landscape architecture and urban design at post and under graduate levels, at the University of Pretoria. He has been a visiting studio critic at the University of Witwatersrand and University of Cape Town and was invited to the University of Rhode Island, USA as their 2011 Distinguished International Scholar.

A niche specialty of his is Visual Impact Assessment for which he was cited with an ILASA Merit Award in 1999. He has completed over 250 specialist reports for projects in South Africa, Canada and other African countries. He was on the panel that developed the Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (2005) and produced a research document for Eskom, The Visual Impacts of Power Lines (2009). In 2011 he produced 'Guidelines for involving visual and aesthetic specialists' for the Aapravasi Ghat Trust Fund Technical Committee (who manage the World Heritage Site in Mauritius) along with the Visual Impact Assessment Training Module Guideline Document.

EXPERIENCE: **NEWTOWN LANDSCAPE ARCHITECTS cc.** ***Founding Member***

Current — Responsible for project management, landscape design, urban design, and visual impact assessment.
Senior Lecturer: Department of Architecture, University of Pretoria.

1991 - 1994
1988 - 1989 — **GRAHAM A YOUNG LANDSCAPE ARCHITECT -** ***Sole proprietor***
Designed major transit and CBD based urban design schemes; designed commercial and recreational landscapes and a regional urban park; participated in inter-disciplinary consulting teams that produced master plans for various beachfront areas in KwaZulu Natal and a mountain resort in the Drakensberg.

1989 - 1991 — **CANADA -** ***Free Lance***
Designed golf courses and carried out golf course feasibility studies (Robert Heaslip and Associates); developed landscape site plans and an end-use plan for an abandoned mine (du Toit, Allsopp and Hillier); conducted a visual analysis of a proposed landfill site. .

1980 - 1988 — **KDM (FORMERLY DAMES AND MOORE)** - *Started as a Senior Landscape Architect*

and was appointed Partner in charge of Landscape Architecture and
Environmental
Planning in 1984. Designed commercial, corporate and urban landscapes;
completed
landscape site plans; developed end-use master plans for urban parks, college
and
technikon sites; carried out ecological planning studies for factories, motorways
and a
railway line.

1978 - 1980 **DAYSON & DE VILLIERS - *Staff Landscape Architect***
Designed various caravan parks; designed a recreation complex for a public resort; conducted a visual analysis for the recreation planning of Pilgrims Rest; and designed and supervised the installation of various private gardens.

EDUCATION:

Bachelor of Landscape Architecture, 1978, (BLArch), University of Toronto, Canada;
Senior Lecturer - Department of Architecture, University of Pretoria.

PROFESSIONAL:

Registered Landscape Architect – South African Council for Landscape Architectural Profession (2001);
Board of Control for Landscape Architects of South Africa (1987) – Vice Chairman 1988 to 1989;
Professional Member - Institute of Landscape Architects Southern Africa (1982) – President 1986 - 1988;
Member Planning Professions Board 1987 to 1989;
Member International Association of Impact Assessment;

AWARDS:

//hapo Freedom Park: ILASA Merit Award (2013)

Intermediate Phase (S'kumbuto, Moshate and Uitspanplek), Freedom Park: ILASA Merit Award (2009)

Corniche Bay Resort, Mauritius: ILASA Merit Award (2009)

Torsanlorenzo International Prize, Landscape design and protection 2nd Prize Section B: Urban Green Spaces, for Intermediate Phase Freedom Park (2009)

Phase 1 and Intermediate Phase Freedom Park: Loerie Awards Gold Statue (2008)

Phase 1 and Intermediate Phase Freedom Park: Special Mention World Architecture Festival, Nature Category (2008)

Moroka Park Precinct, Soweto: ILASA Merit Award for Design (2005) and Gold Medal United Nations Liveable Communities (LivCom) Award (2007)

Isivivane, Freedom Park: ILASA Presidential Award of Excellence Design (2005)

Information Kiosk, Freedom Park: ILASA Merit Award for Design (2005)

Moroka – Mofola Open Space Framework, Soweto: ILASA Merit Award for Planning (2005)

Mpumalanga Provincial Government Complex: ILASA Presidential Award of Excellence (with KWP Landscape Architects for Design (2003)

Specialist Impact Report: Visual Environment, Sibaya Resort and Entertainment World: ILASA Merit Award for Environmental Planning (1999);

Gillooly's Farm, Bedfordview (with Dayson and DeVilliers): ILASA Merit Award for Design;

COMPETITIONS:

Johannesburg Inner City Park Design competition – with MMA architects (2009) Finalist and considered "the strongest concept" by the adjudication panel.

Pan African Parliament International Design competition – with MMA architects (2007) Finalist

Leeuwpan Regional Wetland Park for the Ekurhuleni Metro Municipality (2004) Landscape Architectural Consultant on Department of Trade and Industries Building (2002) – Finalist

Landscape Architecture Consultant on Project Phoenix Architectural Competition, Pretoria (1999): Winner;

Mpumalanga Legislature Buildings (1998): Commissioned;

Toyota Fountain (1985): First Prize - commissioned;

Bedfordview Bike/Walkway System - Van Buuren Road (1982): First Prize - commissioned;

Portland Cement Institute Display Park (1982): Second Prize

CONTRIBUTOR / AUTHOR:

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Contributor in Joubert, O, ***10 Years + 100 Buildings – Architecture in a Democratic South Africa*** Bell-Roberts Gallery and Publishing, South Africa (2009)

- Freedom Park Phase 1 and Intermediate Phase (NBGM), Pretoria, Gauteng

Contributor in Galindo, M, ***Collection Landscape Architecture***, Braun, Switzerland (2009)

- *Freedom Park Phase Intermediate Phase* (NBGM), Pretoria, Gauteng

Contributor in Van Ueffelen, C. ***1000 X Landscapes***, Verlagshaus Braun, Germany (2008)

- *Freedom Park Phase 1 and Intermediate Phase* (NBGM), Pretoria, Gauteng
- *Riverside Government Complex* (NLAKWP), Nelspruit, Mpumalanga;
- *Moroka Dam Parks Pre*cinct, Soweto, Gauteng.

Contributor in ***Johannesburg: Emerging/Diverging Metropolis***, Mendrision Academy Press, Italy (2007)

- *Moroka Dam Parks* Precinct, Soweto, Gauteng.

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- *Riverside Government Complex* (KWPNLA), Nelspruit, Mpumalanga;

And numerous publications in industry journals.

***** NLA *****