Proposed 75 MW Kloofsig Solar PV Energy Facility, Northern Cape – Kloofsig 1

Visual Impact Assessment Report

Report Prepared for

Kloofsig Solar (Pty) Ltd.

Report Number 486618_48V

Report Prepared by

srk consulting

December 2016

Proposed 75 MW Kloofsig Solar PV Energy Facility, Northern Cape – Kloofsig 1

Visual Impact Assessment Report

Kloofsig Solar (Pty) Ltd.

SRK Consulting (South Africa) (Pty) Ltd.
Section A Second Floor
Norfolk House
54 Norfolk Terrace
Westville 3630
South Africa

e-mail: Durban@srk.co.za
website: www.srk.co.za

Tel: +27 (0) 31 279 1200
Fax: +27 (0) 31 279 1204

SRK Project Number 486618_48V

December 2016

Compiled by:

Mr. K Allan (Pr.Sci.Nat)
Senior Scientist

Ms. A Murray-Rogers
Environmental Scientist

Email: KAllan@srk.co.za

Reviewed by:

Mr W Jordaan (Pr.Sci.Nat)
Associate Partner

Authors:

Mr. K Allan and Ms. A Murray-Rogers

Table of Contents

List of Tables

List of Figures

List of Plates

Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Kloofsig Solar (Pty) Ltd (Kloofsig Solar). The opinions in this Report are provided in response to a specific request from Kloofsig Solar to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

DEAT	-	Department of Environmental Affairs and Tourism
EA	-	Environmental Authorisation
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
GIS	-	Geographic Information Systems
GN	-	Government Notice
ha	-	hectares
km	-	kilometres
m	-	metres
magl	-	metres above ground level
mamsl	-	metres above mean sea level
MW	-	Megawatts
NEMA	-	National Environmental Management Act (Act No. 107 of 1998)
R	-	Regional Road
SRK	-	SRK Consulting (South Africa) (Pty) Ltd.
VAC	-	Visual Absorption Capacity
VIA	-	Visual Impact Assessment
WC Guidelines	-	"*Guidelines for Involving Visual and Aesthetic Specialist in EIA Processes*" authored by the Provincial Government of the Western Cape

1 Introduction and Scope of Report

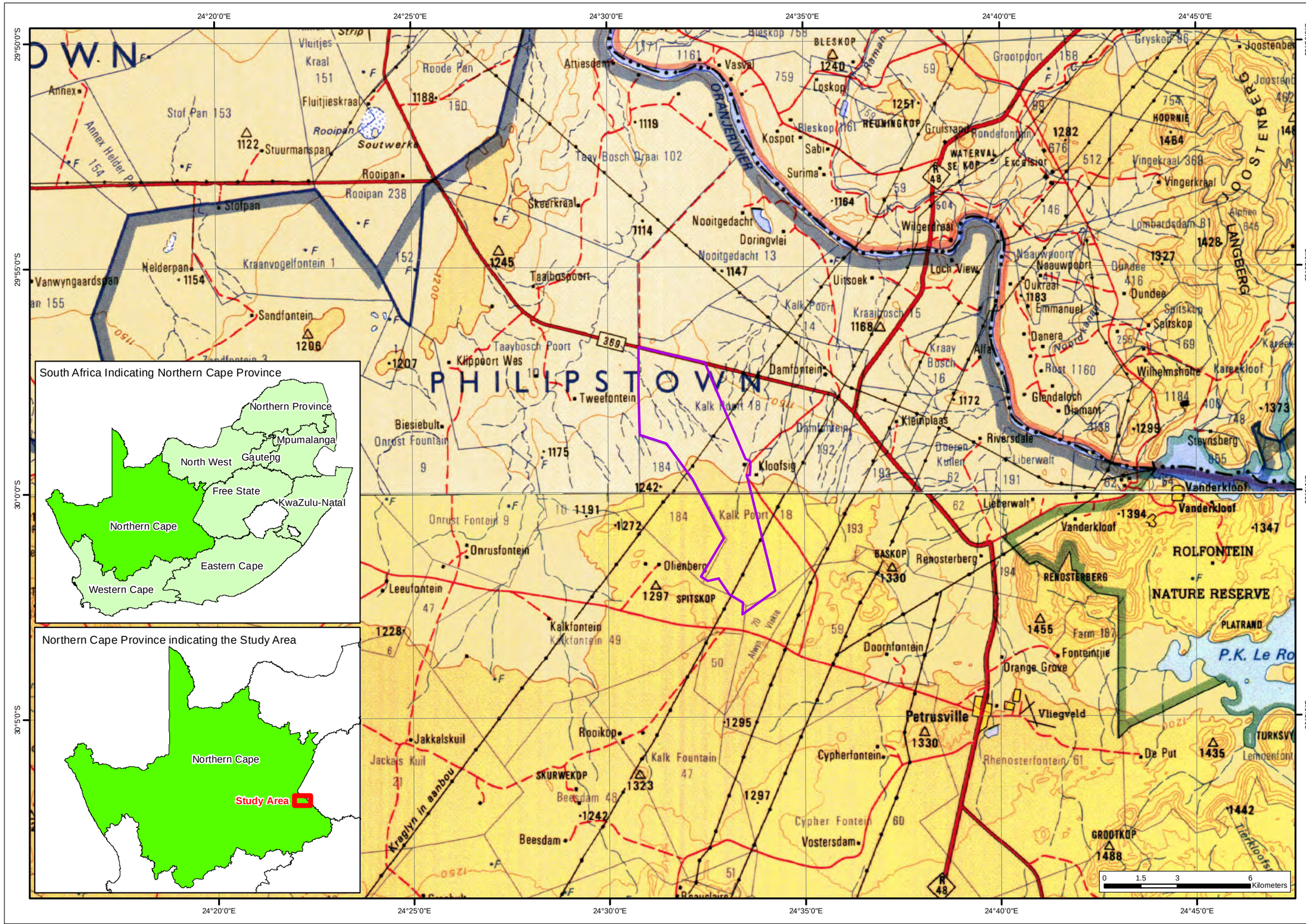
Kloofsig Solar (Pty) Ltd (Kloofsig Solar) proposes to develop a solar photovoltaic (PV) energy facility together with associated infrastructure, in the vicinity of the Petrusville town in the Northern Cape Province of South Africa (Figure 1-1). Kloofsig Solar has appointed SRK Consulting (South Africa) (Pty) Ltd. (SRK) to undertake an Environmental Impact Assessment (EIA) process, in terms of the National Environmental Management Act (Act No. 107 of 1998) (NEMA), for this proposed development.

The rationale behind the proposed solar facility is the need for additional energy generation as a result of the increasing demand in South Africa, whereby reducing the pressures on non-renewable resources. The proposed development consists of three project phases, including Kloofsig 1, Kloofsig 2 and Kloofsig 3). Each project phase will have a power generation capacity of 75 Megawatts (MW), totalling a combined power generation capacity of 225 MW (Figure 1-2). The proposed facility will cover a total area of approximately 970 hectares (ha). For technical reasons, the project phases have been split and Environmental Authorisation (EA) is being applied for each phase separately.

As part of the EIA process for **Kloofsig 1**, a Visual Impact Assessment (VIA) is required to assess the potential visual impact the proposed PV energy facility may have on viewers in the area. This assessment considered both the magnitude of the visual impact, rated and guided by the Western Cape VIA Guidelines (WC Guidelines) (Oberholzer, 2005), and the significance of the visual impact (rated according to prescribed methodology). In addition to the existing mitigation measures built into the facility design, additional measures are proposed to manage visual impacts and are summarised as recommendations at the end of this report.

In terms of the NEMA 2014 EIA Regulations, Government Notice (GN) R982 of 04 December 2014, all specialist studies undertaken as part of an EIA, are required to comply with Appendix 6 of the notice. A table summarising the legal requirement for all specialist studies, indicating the relevant Sections of this report which meet the requirements is attached in Appendix 1.

Copies of the Curriculum Vitae of the project team involved in compiling this report are attached in Appendix 2.



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Revision: A Date: 02 11 2016

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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

SITE LOCALITY

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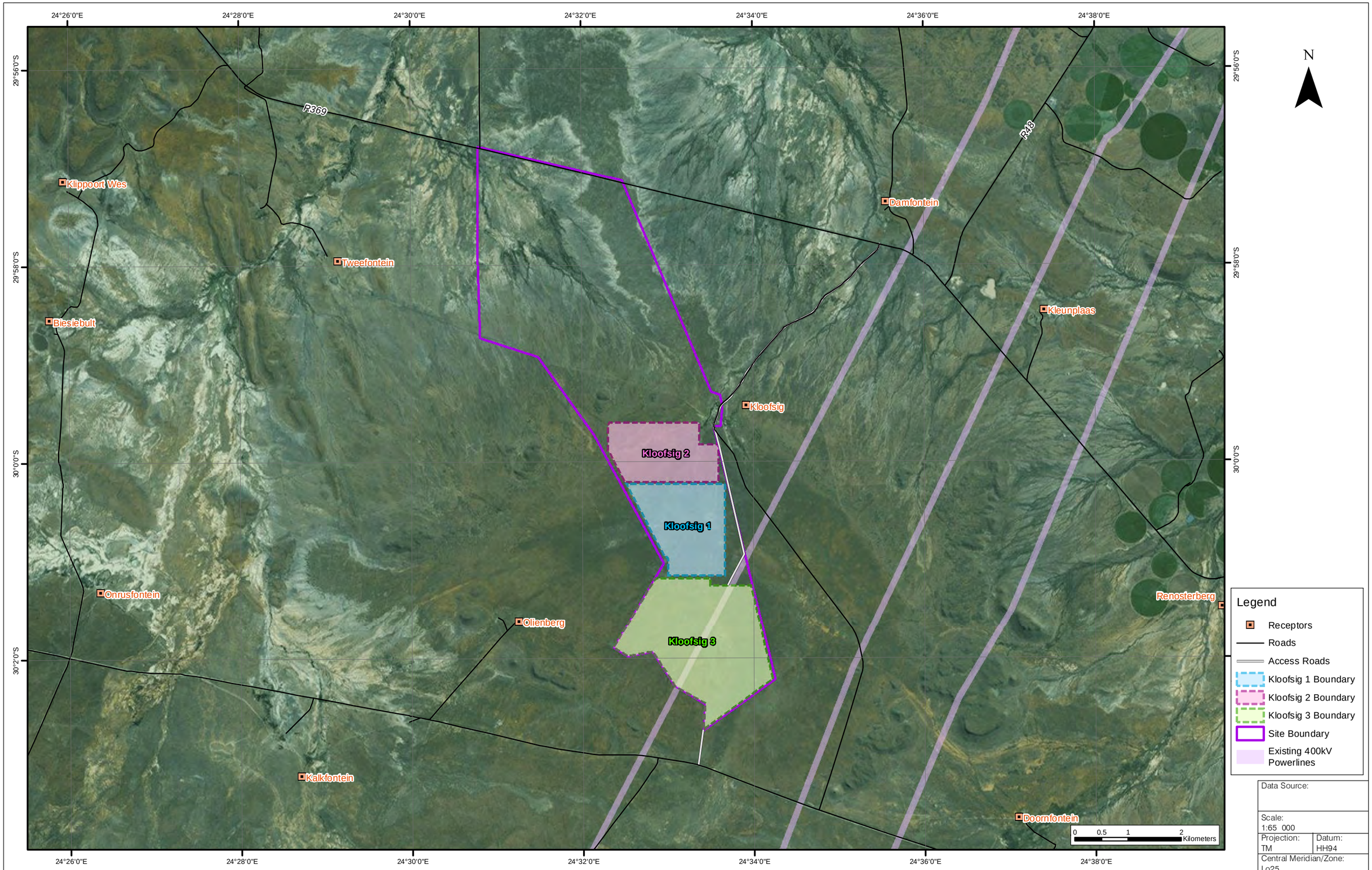

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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

AERIAL IMAGE SHOWING THE ORIENTATION OF THE PROPOSED FACILITY

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Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
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Revision: A Date: 02 11 2016

1.1 Objectives of the Study

The objectives of the visual investigation are to:

- Gain a detailed understanding of the baseline visual environment.
- Determine and assess the visual impacts (including cumulative impacts) to receptors and resources as a result of the proposed development.
- Determine and assess any visual impact related issues that may have been raised by Interested and Affected Parties (I&APs) during the Environmental Assessment Process.
- Identify potential environmental management measures, where possible, that could mitigate negative and enhance positive visual benefits.
- Assist in the provision of feedback on visual impact related matters to stakeholders, where necessary.

1.2 Terms of Reference

The purpose of this VIA is to assess the potential visual impacts on the surrounding landscape as a result of the proposed PV energy development. This is to ensure that potential visual impacts are adequately addressed in the EIA and associated documentation for the project. Furthermore, this VIA aims to identify adequate measures which should be implemented, to mitigate against any potentially adverse visual impacts on the surrounding visual environment, as a result of the proposed establishment of **Kloofsig 1**.

Due to the absence of guidelines regarding VIA's in the Northern Cape Province, this VIA is based upon the "*Guidelines for Involving Visual and Aesthetic Specialist in EIA Processes*" authored by the Provincial Government of the WC Guidelines, as well as SRK's knowledge and expertise in conducting visual impact studies.

For this study, the terms of reference are to:

- Determine areas that will be visually exposed to the proposed infrastructure associated with **Kloofsig 1**.
- Determine the landscape character and the sense of place of the study area.
- Investigate the potential visual impacts of the proposed development.
- Describe and assess the specific visual impacts of the proposed development from selected identified critical areas and view fields.
- Identify potential adverse visual effects that the proposed development may have on the surrounding landscape and provide recommendations for mitigation.

1.3 Project Team

Details of the project team members involved in the assessment are indicated in Table 1-1 below.

Table 1-1: Details of Project Team

Team Member	Qualifications	Details
Wouter Jordaan	BSc (Hons) Geography & Environmental Management – 1999 BSc, Earth Sciences, Geography & Zoology – 1998 Aspects International Environmental Auditors Course, Associate Auditor, Institute of Environmental Management and Assessment – 2005	Wouter is employed at SRK, with the designation of Associate Partner and Principal Scientist. Wouter holds a BSc Honours in Geography and Environmental Science. Wouter has been involved in the field of Environmental Science and GIS for the past 14 years, specializing in: • Project management of complex environmental impact assessments for industries, mines and the energy sector; • Environmental liability assessment and due diligence; • Environmental compliance auditing; • Section 30 Emergency Incident Compliance; • Closure and rehabilitation planning; • GIS and remote sensing; • Visual impact assessments; and • Crime prevention through environmental design (CPTED) projects for municipalities. Wouter has been involved in undertaking technical and quality reviews on VIA reports for over ten years, and has assisted with the report finalisation as well as providing a detailed technical and quality review of this report.
Keagan Allan	BSc Geographical Science – 2003 BSc (Honours) Geographical Science and Environmental Management – 2004 MSc Geographical Science (Cum Laude) – 2007	Keagan is an employee at SRK, with the designation of senior Geographic Information Systems (GIS) Specialist. He is registered with the South African Council for Natural Scientific Professions as a Geospatial Scientist (Reg. Number: 400185/13). Keagan completed his MSc at the University of KwaZulu-Natal, where he focused on Remote Sensing and GIS and was awarded Cum Laude. Over the past 9 years, Keagan has been involved in the following fields of expertise: • GIS, more specifically data collection and manipulation; modelling of various spatial data for VIA and Ground Water management and database management, • GIS Development – using Visual Basic scripting to develop tools for use within the ESRI ArcMap environment; • GIS in Environmental Management Frameworks – using Visual Basic in conjunction with GIS techniques to generate information for use in the GIS reporting in an EMF study; • Remote Sensing (RS) more specifically the use of remotely sensed images in the classification of various landuse types. Keagan was responsible for managing this project, providing strategic direction on this project, modelling processes, and technical review of this report.

Team Member	Qualifications	Details
Andrea Murray-Rogers	BSocSci (Hons), Geography and Environmental Management, University of KwaZulu-Natal - 2009 BSocSci Geography and Environmental Management, University of KwaZulu-Natal - 2008 Aspects International Environmental Auditors Course, Associate Auditor, Institute of Environmental Management and Assessment – 2012 Lakes Environmental AERMOD Air Dispersion Modelling Course - 2014	Andrea is an employee at SRK, with the designation of Environmental Scientist and GIS Specialist. Andrea holds a BSocSci Honours degree in Geography and Environmental Management, and is currently undertaking her MSc in Environmental Science, focusing on the Visual Impact Assessment Methodology used in South Africa. Andrea has been involved in the field of GIS relates projects environmental management for the past 6 years. Her expertise includes: • Making use of GIS for spatial analysis to aid planning & decision making; • Undertaking specialist VIA studies; • Environmental Assessments and Management Plans; • Environmental Compliance Auditing; • Atmospheric Emissions Licence Applications; • Water Use License Applications; and • Research & report writing. Andrea was responsible for undertaking the site work for this project and drafting of this report.

Copies of the Curriculum Vitae highlighting the VIA experience of the personnel involved in compiling this report are attached in Appendix 2.

1.4 Methodology and Approach to the Assessment

Due to the absence of guidelines regarding VIA's in the Northern Cape Province, this VIA is based upon the "*Guidelines for Involving Visual and Aesthetic Specialist in EIA Processes*" authored by the Provincial Government of the Western Cape (WC Guidelines) (Oberholzer, 2005). Based on the WC Guidelines, the proposed development requires a Level 3 VIA assessment, for which the following methodology was applied to meet the terms of reference in the most objective way:

- Identification of data requirements and collation of data. This included acquiring spatial data on topography (contours), existing visual character and quality, details and plans of the proposed development, as well as other background information to:
  - Become familiar with the project site and its surroundings;
  - Verify the desktop spatial analysis undertaken;
  - Identify possible visual receptors; and
  - Identify and assess viewing points and visibility.
- A geo-spatial raster analysis[1] of all the processed data was conducted to provide an estimate of the **magnitude** of the visual impacts of the following attributes:
  - Visual Exposure (viewshed) and viewing distance;
  - Visibility;
  - Visual Absorption Capacity (VAC);
  - Landscape / townscape integrity;
  - Sensitivity of viewing receptors; and
  - Mitigation measures to reduce the overall visual impact to acceptable levels.

1.5 Approach to the Assessment

Due to the subjective nature of the VIA process, emphasis has been placed on an environmentally accepted methodology and rating criteria to ensure that the results are clearly stated and transparent. Furthermore, all ratings are motivated and, where possible, judged against explicitly stated and objective criteria. The assessment needs to be accurate and a number of techniques were used in the analysis to ensure reliability and credibility.

In order for a visual impact to occur there has to be a viewer and an object that invokes a response by the viewer. The response can either be negative or positive. The potential areas of influence[2] were delineated and compared against the viewshed (area of visual influence) in this VIA model. Based on this model, potential influence areas that would not be visually influenced by the proposed development were not assessed further. Those falling within the areas of influence were investigated in further detail by means of a site visit, a baseline comparison and further computer simulations and impact modelling using a GIS[3] modelling package.

The study focuses mainly on the construction and operational impacts that the proposed development may have on the landscape and to a lesser extent on the impacts during decommissioning, closure and post-closure. However, these impacts cannot be ignored and recommendations of mitigation measures for all phases of the project are provided and should be taken into consideration during drafting of the Environmental Management Plan (EMP) for the site. This report is intended to be contextualised with the EIA report and other specialist studies undertaken for the project.

1 Using raster (data with cell based information) in conjunction with spatial information an analysis of the potential visual impacts can be undertaken

2 Areas of influence include suburbs / residential areas, roads, office blocks, recreational areas and tourist attractions.

3 The GIS package that was used is an ESRI ArcGIS 10.3 Spatial Analyst and 3-D Analyst Package.

1.6 Assumptions and Limitations

The following assumptions and limitations are relevant to the study:

- The drawings (including the designs of the structures, site layout and height of the structures) were supplied electronically on 21 September 2016 and are assumed to be up to date, accurate and will remain unchanged for the duration of the VIA and EIA.
- The layouts as provided to Andrea Murray-Rogers (SRK) by Nicola Rump and Jennifer Verseput (SRK) on 21 September 2016, were used to undertake the VIA analysis.
- No photograph montages have been included in this report, as at the time of this assessment, the design of the PV arrays was still under consideration.
- A site inspection was undertaken on 31 October 2016 (Spring), to:
  - Become familiar with the site and its surroundings;
  - Verify the desktop spatial analysis undertaken;
  - Identify possible visual receptors; and
  - Identify and assess viewing points (affected communities) and visibility.
- The contour interval used in the analysis was between 2 and 10 metres (m).
- The viewshed illustrates the area from which the proposed development is likely to be visible. It does not take local undulations, existing vegetation and man-made structures into account. Due to the large interval of the contours, many of the undulations or natural landscape features smaller than between 2 and 10 m high in surrounding areas could be lost. This means that the proposed development may not be visible from everywhere within the viewshed, as the development may be obscured by other existing infrastructure, vegetation or small/localised variations in the topography.
- A VIA, by nature, is not a purely objective or a quantitative process, but is dependent on the subjectivity of the judgments made. Where subjective judgments are required, appropriate criteria and motivations have been clearly stated.
- The significance of the impact has been calculated using a combination of the Hassell Matrix[4] and the prescribed impact rating methodology for the project.

4 The HASSELL matrix has been developed from “The Visual Management System (VMS)” produced by Litton(1968) primarily used for the U.S. Forest Service (1973) and the US Bureau of Land Management (1980).

2 Description of the proposed development

As a result of the increasing energy demand in South Africa, Kloofsig Solar are proposing to establish a solar PV energy facility. The proposed facility is expected to cover an area of approximately 970 ha on Portion 0 of Farm 18, Kalkpoort, in the vicinity of the Petrusville town in the Northern Cape Province of South Africa.

The proposed development has been split into three project phases:

- **Kloofsig 1** (*subject of this report*) – is located at the centre of the site, and includes an 8.5 kilometre (km) 132 kilovolt (kV) powerline and substation site. This will enable the facility to connect to the grid at the existing 132 kV powerline running to the south-east of the site. An on-site substation and short connection to the 400 kV powerline crossing the site is also proposed – this is intended to support all three phases of the development should they be developed.
- Kloofsig 2 – is located on the northern section of the site, and includes an on-site substation and connection to the 400 kV powerline crossing the site, as described for Kloofsig 1.
- Kloofsig 3 – covers the southern portion of the site, connecting to the common infrastructure as described in Kloofsig 1.

2.1 Study Area

The study area is located within the Northern Cape Province, approximately 10 km north-west of the town of Petrusville and 20 km south-east of the town of Orania, within the Pixley Ka Seme District Municipality. According to the 2011 National Biodiversity Assessment, the study area falls within the Nama Karoo biome, more specifically the Upper Karoo Bioregion and is dominated by small karroid shrubs. The proposed development lies south of the R369, with the farms surrounding the proposed development are predominately used for livestock and game management. The closest neighbouring communities include the villages of Kloofsig, Petrusville and Orania, with surrounding farmsteads including Olienberg, Onrusfontein, Tweefontein, Kleunplaas, Kalkfontein Damfontein and Doornfontein.

2.2 Proposed Infrastructure

The main components of the proposed facility, for each of the proposed phases, are shown in Figure 2-1 and include:

- Solar panels (fixed or tracking) – these will be mounted onto arrays/modules and arranged in clusters.
- Underground low voltage cables linking the solar panels within a cluster to an inverter.
- Substation sites – a 132 kV collector substation site will be set up for each phase of the project. The sites are expected to cover an area of approximately 1 ha. A central switching substation, covering an area of approximately 12.4 ha is also proposed, to service all three phases of the project, allowing for the connection to the existing 400 kV overhead powerline. Kloofsig 1 is expected to include a second switching substation located in the south-east of the site.
- Underground powerlines from the inverter substations to a central collector substation, for each phase.
- A 132 kV above ground powerline with a maximum tower height of 24 meters above ground level (magl).
- A 33 kV underground powerline with Supervisory Control and Data Acquisition.
- Laydown areas and construction camp. A laydown area has been set aside for each phase of the project.
- Administration facilities including offices, ablution facilities and store room facilities.

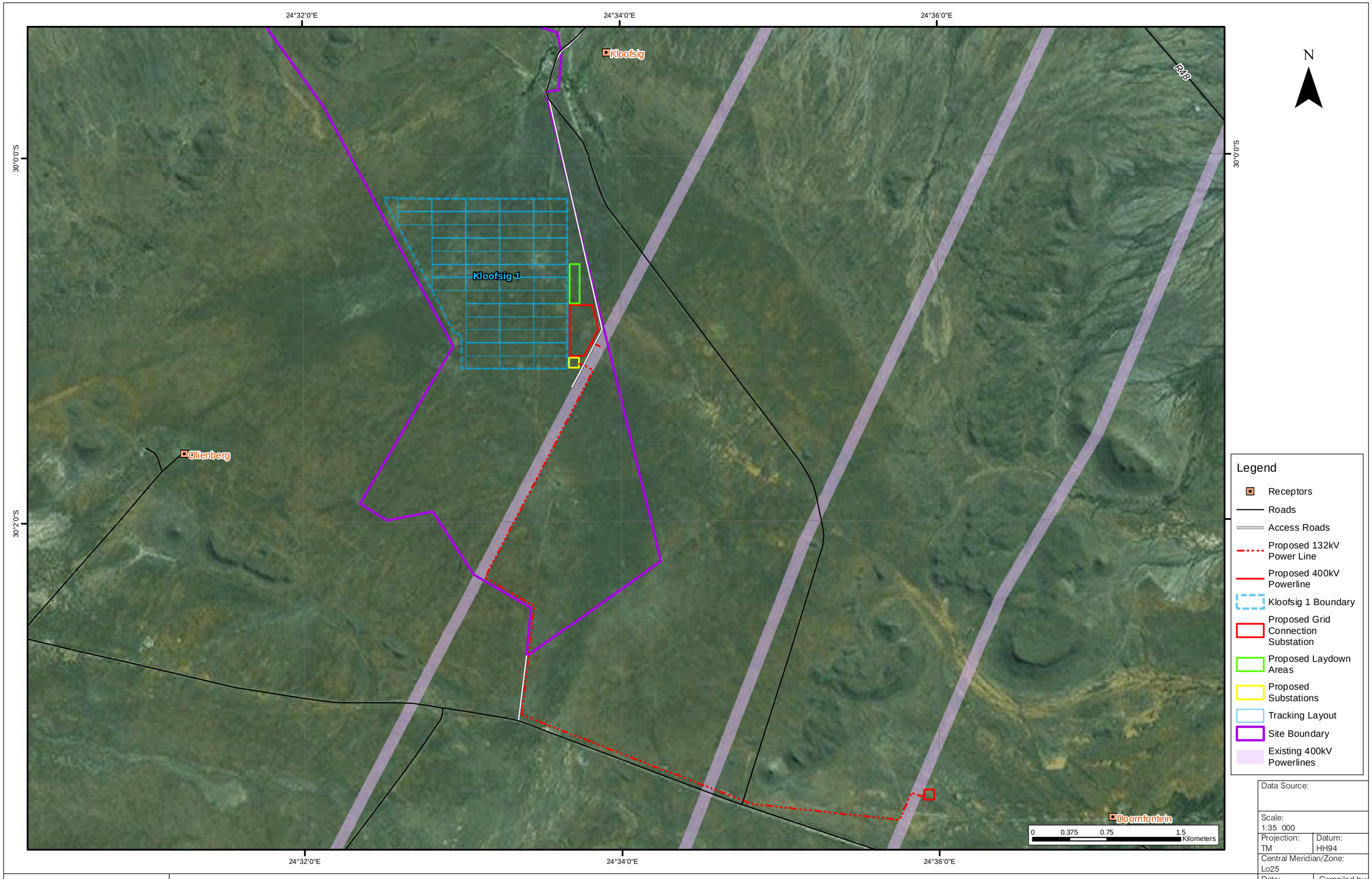
- Internal and access roads linking the site to the Regional Road (R) 369, as well as a connection between the site and the secondary road running to the south of the proposed development area.
- Water supply infrastructure.
- Wastewater treatment, in terms of a septic tank and soak away system.
- Solid waste management infrastructure.

The construction phase of the project is expected to take between 12 and 18 months. The PV panels are designed to operate continuously for more than 20 years, after which can either be decommissioned or refurbished for an additional operating period. Panels are required to be cleaned four times a year.

2.3 Modelled Infrastructure

The infrastructure assessed during this VIA is described below. It should be noted that the infrastructure associated with the proposed solar facility was not assessed individually, as it is not expected to have a significant visual impact on the surrounding landscape. Section 6 of this report does however describe potential mitigation measures for aspects of this infrastructure.

- Solar Panels: the solar panels associated with **Kloofsig 1** are proposed within the centre of the project site, which is approximately 6 km south of the R369, covering an area of approximately 244 ha. The panels will be mounted onto arrays, standing approximately 2 magl.
- Powerlines: an 8.5 km overhead 132 kV powerline running to the south-east of the site, from the solar panels to proposed substation site is proposed. Tower positions of this powerline are anticipated to be approximately 24 magl.
- Substation: a 132 kV substation site is proposed to the south-east of the site, with a short connection to the existing 400 kV overhead powerline. The substation is expected to cover an area of 1 ha, and the highest point of the substation is expected to be 24 magl. An additional switching station, approximately 5.5 km south-east of the site is proposed, due to the uncertainties regarding the future capacity of the 132 kV connection from the proposed project to the existing powerline,– it is intended that only one of the powerline connection options will be developed, depending on grid capacity available.



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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

SITE LAYOUT OF THE PROPOSED KLOOFSIG 1

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Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
Project No: 486618	Fig No: 2-1

Revision: A Date: 02 11 2016

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2.4 Summary of the Main Structural Components

The section that follows outlines some of the parameters and assumptions made for assessing the visual impacts these components might have on the surrounding landscape.

In order to understand the impact a structure may have on a receptor (viewer) it is important to understand what the structure will look like. The following key considerations are usually taken into account when assessing the probable visual impact on a receptor:

- **Height:** The higher the structure or facility is, the wider the visual envelope (viewshed) will be. The height of a structure may be mitigated / shielded by the topography of the surrounding area, man-made features or by natural features. The opposite is also true as the lack of the abovementioned "mitigation" or "shielding" may increase the visibility of the structure. Visually the perception of the height of a building or structure is partially a function of the spatial interaction between topography, height of existing man-made features and the height of natural features, such as trees and shrubs in the vicinity of the infrastructure.
- **Surface area:** The combination of the total surface area and the degree of visibility of the site has an impact on receptors. A smaller surface / face-area / cross-sectional area may reduce visibility from areas further away from the infrastructure and, hence could reduce the potential visual impact the site may have. A larger surface / face / cross-sectional area will obstruct views which would previously have been visible and may lead to a more significant impact.
- **Arrangement of construction:** A staggered configuration, such as a powerline (as an example), ensures that the infrastructure might "blend" into the surrounding environment. Solid structures (retaining walls / buildings) are more obstructive and visible over a larger area.
- **Arrangement of colours:** The colour of infrastructure has an important function as it could either add emphasis on the structure, or it could assist in hiding / camouflaging it. It is therefore important that structures or buildings are painted with neutral colours which should be consistent with the colours of similar structures in the wider area.
- **Boundary with the environment:** The site earmarked for development may change the appearance of the natural area in which it is located. It is therefore important to retain as many natural features as possible, such as the landscape and vegetation surrounding the site, where it does not pose a health or safety risk from an operational perspective.

Table 2-1 summarises how the main infrastructural components were modelled in GIS for the assessment of their visual impacts in terms of their heights, surface area and arrangement.

Table 2-1: Brief Description of the main components considered in the Visual Impact Assessment

Component	Height used in modelling (magl)	Arrangement used in modelling
Solar Panels	2	From the information made available during the assessment, the solar panels are expected to be mounted onto arrays at a height of 2 magl.
Powerlines	24	Due to the powerline tower positions being undefined at the time of the study, it was assumed that the powerline span would be an average of 200 m. Based on the information provided, the powerline pylons are expected to be 24 magl.
Substation	24	From the information provided, the the highest and potentially most visible point of a substation is expected to be 24 magl.

3 Criteria Used to Evaluate the Current Visual Landscape

Due to the subjective nature of VIA's, a number of criteria have been used to describe the visual aspects of the environment. The criteria evaluate the current visual landscape and the potential changes to the landscape that the proposed development may have.

The following criteria can be used to describe the visual landscape of an area:

- **Visual Character:** Visual character is descriptive and non-evaluative, which implies that it is based on defined attributes that are neutral. A change in visual character cannot be described as having positive or negative attributes until it is compared with the viewer response to that change. Therefore, the probable change caused by the development is assessed against the existing degree of change caused through development within the surrounding area.
- **Sense of Place:** Our sense of a place depends not only on spatial form and quality but also on culture, temperament, status, experience and the current purpose of the observer (Lynch, 1992). Central to the idea of 'sense of place' or *Genus Loci* is identity. An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places within the area.
- **Visual Quality:** Visual quality is evaluated by identifying the vividness, intactness and unity present in the viewshed. This approach to evaluating visual quality can also assist in identifying specific methods for mitigating specific adverse impacts that may occur as a result of a project.

These criteria are combined with an assessment of the magnitude of the impact to determine its severity, it must however be noted that the sense of place is used to inform the potential sensitivity of a viewer and does not have its own rating. Criteria used in the determination of the magnitude, which are discussed in more detail in Section 4, include:

- **Viewshed:** The viewshed indicates areas where the development components will potentially be visible from. This is established through spatial modelling.
- **Viewing Distance and Visibility:** The distance of a viewer from the proposed development is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an object diminishing / attenuating as the distance between the viewer and the object increases. This is a measurement of how visual impacts are modified by distance. The effect of the scale of the proposed development, topography, vegetation, weather, and distance, in turn alters the degree of a visual effect.
- **Visual Absorption Capacity (VAC):** The VAC is the potential for the area to conceal an object.
- **Landscape Compatibility:** Landscape or townscape compatibility refers to the compatibility of the proposed structure with the existing landscape and townscape.
- **Viewer Sensitivity:** The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon, this is informed by the sense of place of an area. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view, i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists.

In the following section of the report, the magnitude of the visual impact of the proposed development are discussed, in terms of the criteria listed above.

3.1 Visual Character

The study area is located within the Northern Cape Province, approximately 10 km north-west of the town of Petrusville and 20 km south-east of the town of Orania. The surrounding landuses include livestock farming and game management. A number of residential communities including Olienberg, Onrusfontein, Tweefontein, Kloofsig, Damfontein and Doornfontein are also located within the areas surrounding the proposed development.

The proposed Kloofsig 1 is located at an altitude of between 1209 and 1214 metres above mean sea level (mamsl). The topography of the study area is generally flat with gentle sloping areas.

The landuse surrounding the site can be characterised as open grassveld / thicket areas, interspersed with agricultural, livestock and game management farms and eco-tourism.

The study area can be divided into distinct 'land types' each with a dominant landscape character. These land types are:

- Agriculture;
- Villages, Communities, Farmsteads / built environment;
- Rural / grazing; and
- Semi-natural areas.

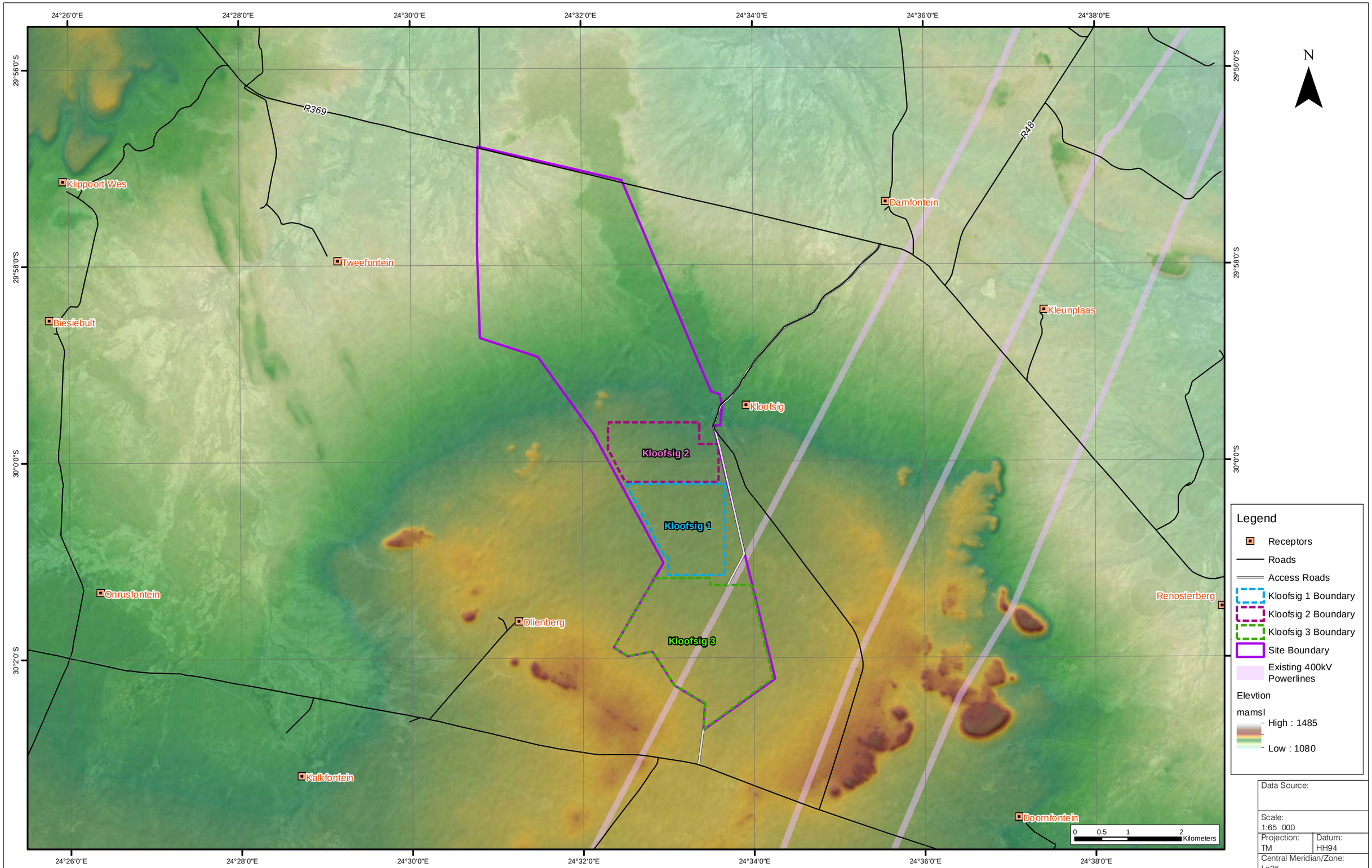
Section 4 of this report assigns a numerical value for each of the components of the proposed development, based on the landuse character in which they are located, calculated on the rating Hassell matrix tabulated in Table 3-1 below.

Table 3-1: Landuse Character Rating System

Description	Value	Typical Character / Use
Unmodified landscape/natural	5	No / minimal impact associated with the actions of man. National parks, coastlines, pristine forest areas.
Natural transition landscape	4	A changing landscape character associated with the interface between natural areas and modified rural / pastoral or agricultural zones.
Modified rural landscape	3	Typical character is rural landscape, defined by field patterns, forestry plantations and agricultural areas and associated small-scale roads and buildings.
Transition landscape	2	Transitional landscape associated with the interface between rural, agricultural area and more developed suburban or urban zones.
Highly modified landscape, urban/industrial.	1	Substantially developed landscape. High levels of visual impact associated with buildings, factories, roads and other related infrastructure.

The visual character of study area can be described as being a modified grassveld / thicket (refer to Plate 3-1), interspersed with agricultural activities. In terms of the rating system presented in Table 3-1, the visual character of the study area can therefore be described as being a **Natural Transition landscape (4)**, attributed to the various agricultural zones coupled with the open fields of indigenous vegetation.

Plate 3-1: View towards the proposed Solar Facility from the R369



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Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
Project No: 486618	Fig No: 3-1

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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

TOPOGRAPHY AROUND THE STUDY AREA

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Revision: A Date: 02 11 2016

3.2 Sense of Place

Our sense of a place depends not only on spatial form and quality but also on culture, temperament, status, experience and the current purpose of the observer (Lynch, 1992). Central to the idea of 'sense of place' or *Genus Loci* is identity.

An area will have a stronger sense of place if it can easily be identified, that is to say if it is unique and distinct from other places. Lynch defines 'sense of place' as "the extent to which a person can recognise or recall a place as being distinct from other places – as having a vivid or unique, or at least a particular, character of its own" (Lynch, 1992:131).

The sense of place, in the areas surrounding the proposed development, ranges between natural and farmlands. The sense of place, of the areas surrounding the proposed development, is thus considered to be that of agricultural practises.

3.3 Visual Quality

Visual quality is evaluated by identifying the vividness, intactness and unity present in the viewshed. This approach to evaluating visual quality can also help identify specific methods for mitigating specific adverse impacts that may occur as a result of the project.

Aesthetic value is an emotional response derived from our experience and perceptions. As such, it is subjective and difficult to quantify in absolute terms. Studies in perceptual psychology have shown that humans prefer landscapes with higher complexity (Crawford, 1994). Landscape quality can be said to increase when:

- Topographic ruggedness and relative relief increases.
- Water forms are present.
- Diverse patterns of grassland and trees occur.
- Natural landscape increases and man-made landscape decreases.
- Where landuse compatibility (coherence) increases.

Thus visual quality decreases when elements deter from the natural environment and, hence, influence the wider area of influence in a negative way. Elements that decrease the visual quality of an area include "visual clutter" and man-made features including, but not limited to:

- Roads and bridges.
- Dense developments and high buildings.
- Commercial facilities.
- Mines, factories, stacks, etc.

Visual Quality is largely subjective, therefore adapted from the United States Department of Transport: Visual Impact Assessment for Highway Projects (1981) and the Landscape Institute with the Institute of Environmental Management and Assessment (2002), visual quality can be calculated as per Equation 3-1 below, where:

Vividness *is defined as the extent to which a landscape is memorable – this is associated with the distinctiveness, diversity, and contrast of visual elements.*

Intactness *is defined as the integrity of visual order within the landscape, as well as the extent to which the landscape is free from visual intrusions.*

Unity *is defined as the extent to which visual intrusions are sensitive to the existing landscape.*

$$Visual\ Quality = \frac{Vividness + Intactness + Unity}{3}$$ .... Equation 3-1

Visual Quality was calculated according to Equation 3-1, based on the following rating criteria specified in Table 3-2, from High (5) to Low (1).

Table 3-2: Visual Quality rating criteria

Rating	High (5)	Medium (3)	Low (1)
Vividness	The visual impression received is highly memorable, as contrasting landscape elements combine to form distinctive visual patterns.	The visual impression received is moderately memorable, with some distinctive patterns moderately defined landscape or landforms are present.	The visual impression received is of low memorability. Little visual pattern is formed because landscape elements do not combine to from a striking or distinctive pattern.
Intactness	There is high visual integrity between the natural and man-made landscape to the extent that the landscape is free from visual encroachment.	There is an average visual integrity between the natural and man-made landscape. Some visual encroachment on to the landscape is present.	There is low visual integrity between the natural and man-made landscape features. Visual encroachment onto the landscapes very apparent.
Unity	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade and natural elements blend together.	The visual elements of the landscape join to form a moderately coherent, harmonious visual pattern. Manmade elements blend with natural elements; however the visual order is disrupted.	Visual resources do not join together to form a coherent harmonious visual pattern. Manmade elements do not have a visual relationship to natural landforms or landcover patterns and visual order is lacking.

The visual quality of the study area is calculated and described in Table 3-3, based on Equation 3-1 and the rating criteria presented in Table 3-2.

Table 3-3: Visual Quality rating for the proposed development

Criteria	Rating	Description
Vividness	3	The study area can be described as having a moderately memorable impression, based on the interspersed natural and agricultural activities. Thus the vividness of the area is described as being **Medium**.
Intactness	3	The intactness of the area is described as **Medium**, due to the surrounding area having vast open areas together with various agricultural practises.
Unity	5	The study area can be described as having a **High** unity, as the agricultural areas and natural zones are considered to be moderately coherent, where the natural zones tend to blend with the man-made infrastructure.
Calculation	$Visual\ Quality = \frac{3 + 3 + 5}{3} = 3.7\ (\boldsymbol{MEDIUM - HIGH})$	

4 Analysis of the Magnitude of the Visual Impact

4.1 Introduction

The following section outlines the assessment that was undertaken to determine the **magnitude** of the visual impact for the proposed development. Visual impacts associated with the proposed development and the cumulative impacts of these were assessed.

Various factors were considered in the assessment, as indicated in Section 3, including:

- Visual exposure of the development in terms of the viewshed;
- Visibility and viewing distance;
- Visual absorption capacity;
- Integrity with existing landscape / townscape; and
- The viewer's sensitivity to change.

These criteria are explained further in the following sections and are used to calculate the magnitude of visual impact, presented in Table 4-5 and Table 4-6.

4.2 Visual Exposure

4.2.1 Elements Considered in Determining Visual Exposure

Visual exposure is determined by an objects "zone of visual influence" or how visible an object may be in the landscape. The visual exposure of an object can be broken down into two elements:

- Firstly, how exposed is the object to the surrounding area? This can be determined by the topography in which the object is; and
- Secondly, how exposed are viewers to the object? This can be determined through topography and landuse in which the viewer is situated.

The following section outlines how both of these elements were used in determining the overall visual exposure of the proposed development.

The topography of an area can limit or expose the visibility of an object. In order to assess how topography influences the visual exposure of a feature, a predictive model known as a "viewshed" is used.

A viewshed model uses topography datasets to predict where in the landscape a given feature may be visible. This model assumes that the surface is smooth (not taking into account vegetation and man-made objects). Due to this, site verification of the viewshed is required.

Table 4-1 below outlines a set of Visibility Criteria that were used to rank how visible the proposed development may be from the selected viewpoints. Each of the viewpoints identified in Figure 4-1 have been rated according to visual exposure criteria, which is a combination of ratings in Table 4-1 and verification through a site visit. Each of the viewpoints has been rated according to the Visibility Criteria ranking.

Table 4-1: Visibility criteria (Exposure)

Visibility Ranking – moderated by site visit verification			
Not Visible	Marginally Visible	Visible	Highly visible
Final Visibility Criteria (Exposure Rating)			
1	2	4	5

The visibility rankings were then applied to assess the visual exposure of each of the chosen viewpoints to assess what measure of screening any vegetation and man-made features may have on the visibility of the proposed development. These viewpoints were chosen based upon their position in both the landscape and inside the visible areas of the viewshed. Attempts were made to choose representative viewpoints from various angles and distances from the proposed development. The findings from the Visibility Criteria assessment are summarised in Table 4-2 below as a combination of the rankings identified in Table 4-1, Figure 4-1 and the site visit.

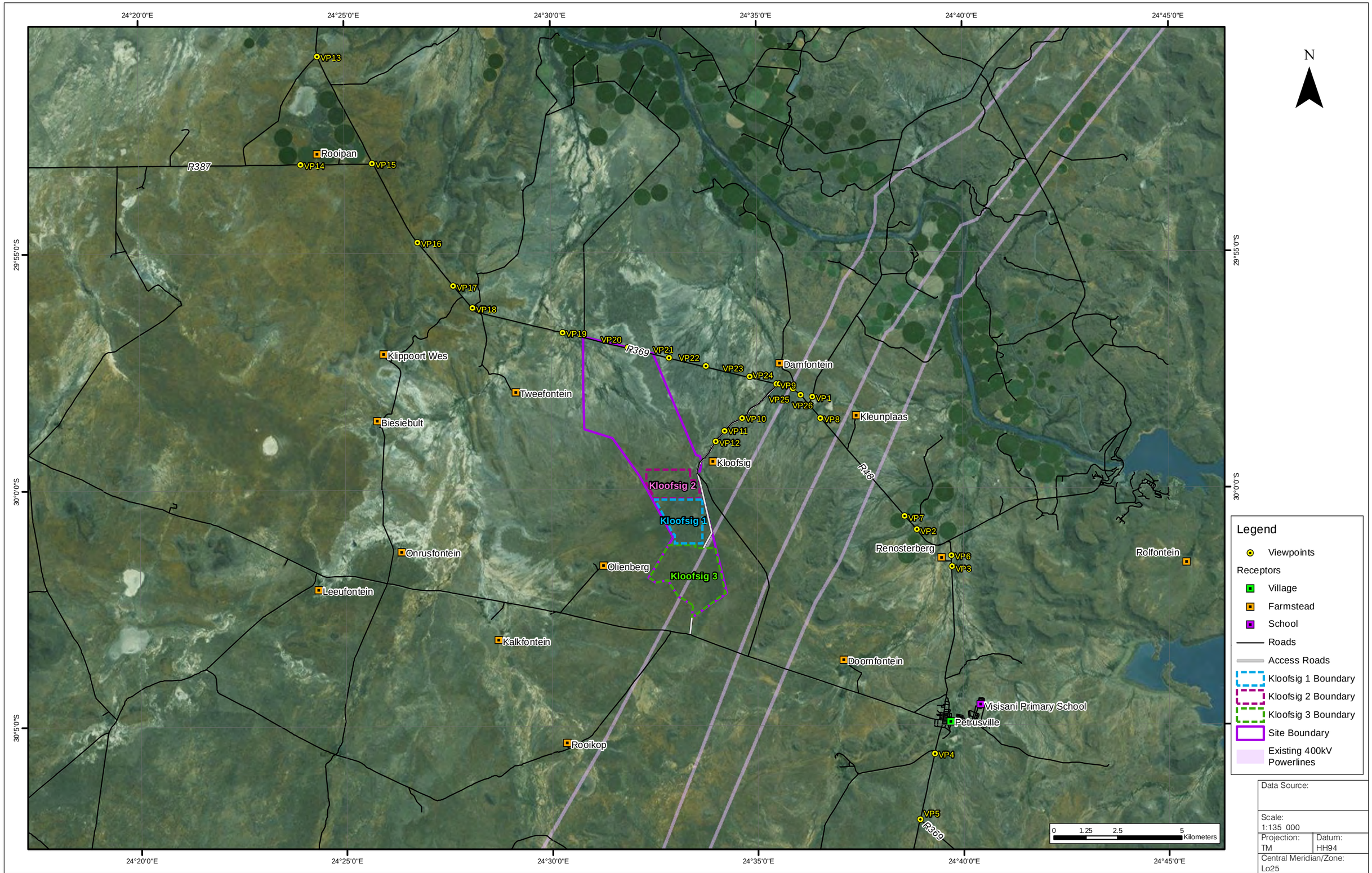
Appendix 4 contains details of the assessment of the viewpoints. In total, 26 viewpoints were assessed during the site visit to provide a representation of the potential visibility of the proposed PV energy facility.

The viewpoints chosen reflect a summary of the proposed development on the surrounding viewers. Appendix 5 presents the photographs taken from each of the viewpoints, highlighting the potential views towards the proposed development.

Table 4-2 summarises the average visibility of the 26 viewpoints based on the ratings presented in Table 4-1.

Table 4-2: Summarising the Visibility Rating (Exposure Rating) for the proposed development

Component	Arrangement used in modelling	Rating
Solar Panels (Kloofsig 1)	Based on the proposed positioning of the proposed infrastructure, the visibility rating can be described as being **marginally visible** – viewers situated in close proximity to the proposed development, specifically in the south of the development site, are expected to be more exposed to the development than viewers located in other directions. This is attributed to the topography as well as the vegetation within the surrounding area, which is expected to shield viewers from the facility.	**2.6**
Powerlines		**1.9**
Substation		**1.8**



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Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
Project No: 486618	Fig No: 4-1

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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

LOCATION OF VIEWPOINTS IN THE STUDY AREA

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Revision: A Date: 02 11 2016

4.3 Viewing Distance and Visibility

The distance of a viewer from the proposed project area is an important determinant of the magnitude of the visual impact. This is due to the visual impact of an object diminishing / attenuating as the distance between the viewer and the object increases. This is a measurement of how visual impact is modified by distance. The effect of scale of the proposed development, topography, vegetation and weather, changes with distance, and in turn changes the degree of visual effect.

Hull and Bishop, 1988 identify the inverse relationship between viewing distance and visual impact, this relationship can be described as an exponential decrease in impact as the distance from the site increased. Figure 4-3 and Figure 4-4 shows this relationship.

Viewsheds do not take into account the distance from site a viewer may be in determining the visibility of the proposed feature. A method, known as the Fuzzy Viewshed, attempts to take into account the distance a viewer is from the proposed site. Equation 4-1 (Ogburn, 2006) defines the equation used to determine the possible impact of a feature in the landscape, where:

μ = fuzzy viewshed

$d_{vp->ij}$= distance of object from the viewpoint

b_1 = maximum distance from viewpoint of clear visibility

b_2 = distance from viewpoint at which visibility drops to 50%

For this instance, and based upon the Hassell Matrix, the definition of where a feature may become 50% less visible was 1km.

$$1 \; for \; d_{vp \rightarrow ij} \leq b_1$$

$$and$$

$$\mu(x_{ij}) = \frac{1}{\left(1+2\left(\frac{d_{vp \rightarrow ij} - b_1}{b_2}\right)^2\right)} \; for \; d_{vp \rightarrow ij} > b_1$$

.... Equation 4-1

Figure 4-3 indicates the Fuzzy Viewshed generated for the proposed development. All viewsheds generated for the proposed development, are included in Appendix 3.

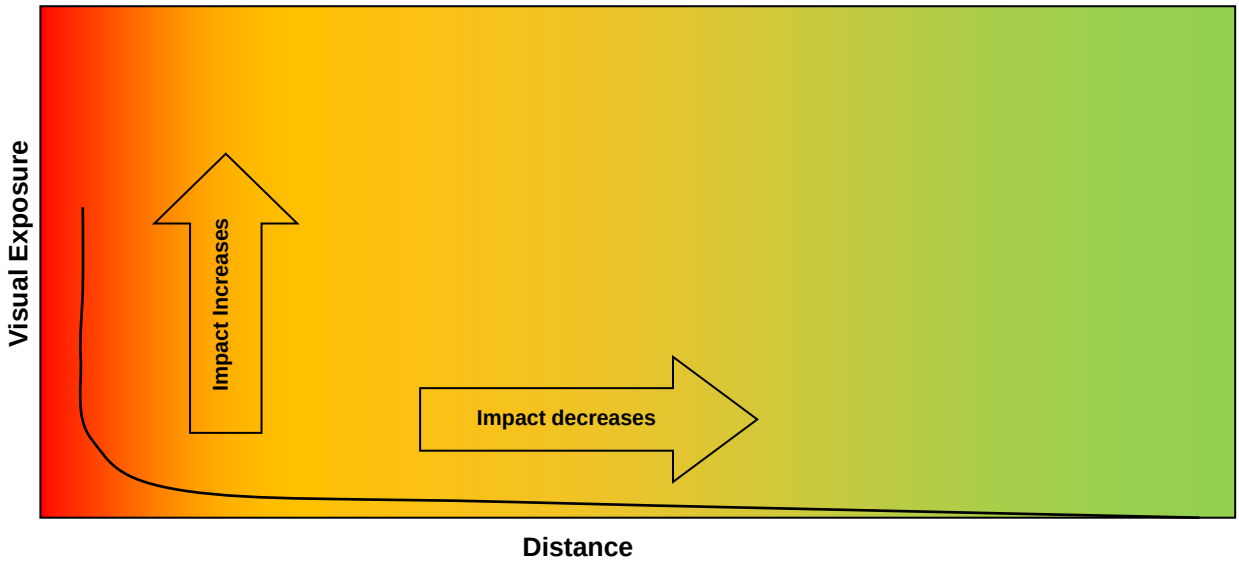


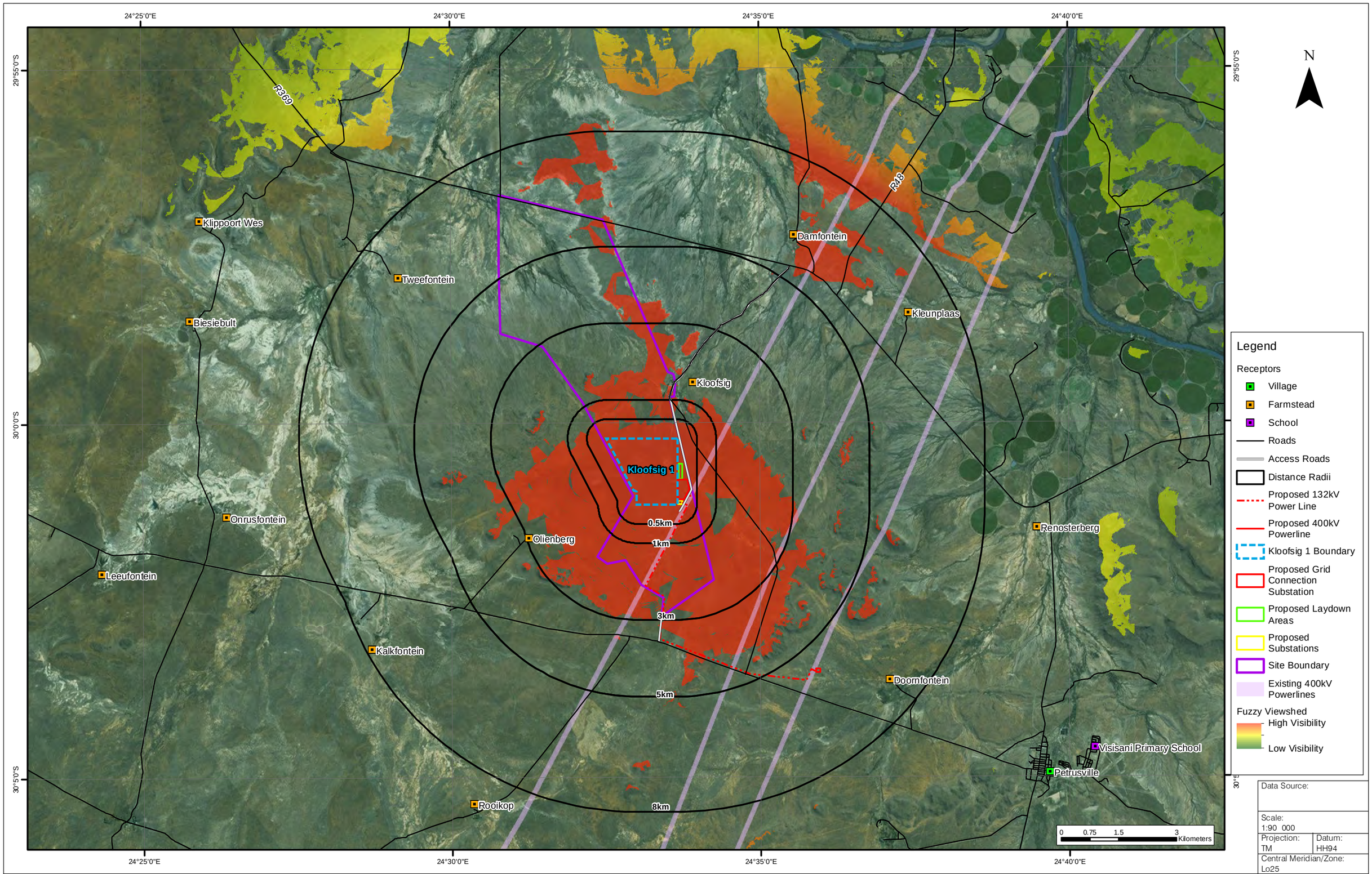
Figure 4-2 Depiction of how impact decreases with an increase in distance from a site (after Hull and Bishop, 1988)

The following rating system (Table 4-3) has been incorporated spatially with the viewshed to address the factor of distance between a viewer and an object. Using the chosen viewpoints, it is possible to create a representative ranking for viewing distance and visibility for the proposed development.

Table 4-3: Distance Rating System

Location of development (Summarising from the chosen Viewpoint)	Category	Value	Description
0 to 0.5 km	Adjacent	5	Adjacent – The development can clearly be seen. Usually on the property boundary or property grounds.
0.5 km to 1 km	Foreground	4	This is the zone in which details such as colour, texture and form can be appreciated. Objects in this zone are highly visible unless obscured by other landscape features, existing structures or vegetation.
1 km to 3 km	Middle ground	3	The zone which occupies the area “between” detail and indistinct colour and line discernment. Objects in this zone can be classified as visible to moderately visible unless obscured by other elements within the landscape.
3 km to 5 km	Distant middle ground	2	This zone is discerned by means of line and colour. Texture and form are generally not seen. Objects in this zone can be classified as marginally visible to not visible. Areas beyond 3 km are usually not investigated as the impact would be negligible on these areas.
5 km and greater	Background	1	Background – Not Visible (Proposed development can hardly / not be seen).

The proposed solar panels can be described as falling within the **Middle Ground Category (3)**, as the proposed infrastructure can be classified as being only moderately visible from various areas within the study area. The proposed powerlines and substation can be described as falling within the Distant **Middle Ground Category (2)**, as it was noted from the site visit that the powerlines and substation are only expected to be marginally visible from certain points in the landscape, and not visible from others in the study area. However, it should be noted that due to the topography of the area together with existing vegetation, that views towards the proposed development may be obscured from various points within the landscape.



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VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

FUZZY VIEWSHED OF PROPOSED KLOOFSIG 1

Data Source:	
Scale: 1:90 000	
Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
Project No: 486618	Fig No: 4-3

Revision: A Date: 02 11 2016

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4.4 Visual Absorption Capacity

The VAC is the potential for the area to conceal / mitigate the impact of the proposed development through natural or man-made features in the landscape. Factors contributing to the VAC include:

- Topography and vegetation that is able to provide screening and increase the visual absorption capacity of a landscape.
- The degree of urbanisation compared to open space. A highly urbanised landscape is better able to absorb the visual impacts of similar developments.
- An interrelated landscape comprising a unified environment.
- The scale and density of surrounding developments.

Visual absorption within the wider area of influence will further be provided by:

- Residential areas (villages, community areas, farmsteads) which may reduce the visibility of the site to people residing in the centre or towards the back of the residential area.
- The existing road infrastructure between viewpoints further than 2 km away.
- Powerlines, railway lines etc.

The VAC is rated from high (1) to low (5) based on the capacity of the environment to absorb the visual impact of the facility. The VAC will be high when the environment can hide the development and as such, the colour of a facility can also determine its VAC. The VAC will be low in areas where the topography is flat and natural features such as trees, koppies and mountains are absent.

The immediate area surrounding the proposed development is generally flat, beyond which are undulating hills. Due to this topography and the vegetation within the area, the VAC is rates as being **Medium (3)**. The existing vegetation is expected to shield view of the development from various positions in the surrounding area.

4.5 Landscape / townscape compatibility

Landscape or townscape compatibility refers to the compatibility of the proposed infrastructure with the existing landscape or townscape. The landscape / townscape compatibility of the proposed structures and infrastructure were rated based on the following criteria specified in Table 4-4.

Table 4-4: Landscape / townscape compatibility rating criteria

High (1)	Moderate (3)	Low (5)
The development: • Is consistent with the existing land use of the area; • Is highly sensitive to the natural environment; • Is consistent with the urban texture and layout; • The buildings and structures are congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is similar to what exists.	The development: • Is moderately consistent with the existing land use of the area; • Is moderately sensitive to the natural environment; • Is moderately consistent with the urban texture and layout; • The buildings and structures are moderately congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is moderately similar to what exists.	The development: • Is not consistent with the existing land use of the area; • Is not sensitive to the natural environment; • Is very different to the urban texture and layout; • The buildings and structures are not congruent / sensitive to the existing architecture / buildings; and • The scale and size of the development is different to what exists.

According to the rating methodology outlined in Table 4-4 the consistency of the proposed development with the existing landuse of the area can be determined. Table 4-5 presents the findings of the landscape compatibility of the proposed development.

Due to the area predominately consisting of agricultural activities and natural vegetation, the proposed solar panels are considered to be of **Low (5)** compatibility with the surrounding landuse. It should be noted however, that large existing powerlines traverse the area within close proximity to the proposed development, therefore making the proposed powerlines and substation **Moderately (3)** compatible with the surrounding landuse.

4.6 Sensitivity of Viewers

The sensitivity of viewers is determined by the number of viewers and by how likely they are to be impacted upon. Sensitivity is also dependent on the viewer's perception of the area and their ability to adapt to changes in the environment. This can also include how frequently they are exposed to the view i.e. static views from houses would have a higher sensitivity than transient views experienced by motorists.

Residents living in close proximity to the proposed development are considered to be the more sensitive towards the proposed development than those travelling within the study area. Appendix 5 presents photographs taken from each of the viewpoints, denoting potential views towards the proposed development.

The potentially sensitive viewers to the proposed development, as included in Figure 4-3, include:

- Local residences in the villages, communities and farmsteads surrounding the proposed development;
- Local schools within the area; and
- Travellers along the R369 and R48.

The viewer sensitivity is ranked from high (5) to low (1) based on the probable perceptions of the viewers and their willingness to change. The viewer sensitivity for the proposed development is rated as being **Medium (3)**, attributed to the area being largely undisturbed, as well as the evidence of large powerline infrastructure traversing the area.

4.7 Calculation of the Magnitude of the Visual Impacts

The following table (Table 4-5) combines the various factors influencing the visual impacts that the proposed development may have, thereby providing input towards calculating the magnitude of the visual impacts for each element.

Table 4-5: Summary of the magnitude of the Visual Impact of the proposed development

Criteria	Solar Panels	Powerline	Substation	Comments
Visual Character	4	4	4	The visual character of the study area can therefore be described as being a Natural Transition landscape attributed to the various agricultural zones coupled with the open fields of indigenous vegetation.
Visual Quality	3.7	3.7	3.7	The visual quality of the study area was calculated as being Medium-High – as a result of the existing powerline infrastructure and the natural and agricultural areas.
Visual Exposure	2.6	1.9	1.8	Based on the proposed positioning of the proposed infrastructure, the visibility rating can be described as being marginally visible. This is attributed to the topography as well as the vegetation within the surrounding area, which is expected to shield viewers from the facility
Visibility and Distance	3	2	2	Due to the topography and existing powerline infrastructure within the study area, the proposed development are not expected to be visible beyond 3km.
Visual Absorption Capacity	3	3	3	The immediate area surrounding the proposed development is generally flat, beyond which are undulating hills. Due to this and the vegetation within the area, the VAC is considered to be Medium.
Landscape Compatibility	5	3	3	The proposed solar panels are considered to be of low compatibility with the surrounding landuse. However, due to existing powerline infrastructure being evident in study area, the proposed powerlines and substation are considered to be moderately compatible with the surrounding area.
Viewer Sensitivity	3	3	3	Due to the proposed development being situated within an area which is considered largely undisturbed, with evidence of large powerline infrastructure traversing the area, the viewer sensitivity is expected to be decreased.
Magnitude	**3.5**	**2.9**	**2.9**	This magnitude value to taken forward into the impact assessment section of this report as the Severity.

The **magnitude** of the visual impact, which is a subjective measure, is calculated based on an average between all criteria listed in Table 4-5, and are described in Sections 3 and 4. The magnitude is ranked from high (5) to low (1), and has been carried forward to Section 5, representing the Severity rating for the assessment of the visual impact, by means of a quantitative ranking approach on viewers in the surrounding area.

5 Visual Impact Assessment

The following section incorporates the findings of Section 5 and integrates them into a visual impact rating system.

5.1 Introduction to the Impact Assessment

The following section outlines some of the key factors used in the final assessment of the visual impacts of a structure. This assessment is an adaptation of the environmental impact assessment criteria prescribed for all specialists to use during the assessment of impacts associated with the proposed development, however it has been adapted, where necessary, to fit the requirements of visual impact assessment criteria.

The criteria used include:

- Spatial Scope;
- Duration;
- Severity (as calculated in Section 4);
- Frequency of Activity; and
- Frequency of Impact.

The following Sections will expand on each of the criteria used.

5.1.1 Spatial Scope

The spatial scope for each structure is defined as - the geographical coverage (spatial scope) that the proposed structure may influence visually, taking into account the extent of the structure and the nature of the baseline environment is taken into account.

The spatial scope of the impact is rated on the Spatial Scope Rating System, as indicated in Table 5-1 below.

Table 5-1: Spatial Scope Rating System

Spatial Scope of the Impact (Extent)	Value
Activity specific	1
Area specific	2
Whole site/plant/mine	3
Regional	4
National	5

5.1.2 Duration

Duration refers to the length of time that the aspect may cause a change either positively or negatively on the environment.

The visual assessment distinguishes between different time periods by assigning a rating to duration based on the Duration Rating System, as indicated in Table 5-2 below.

Table 5-2: Duration Rating System

Duration of Impact (Temporal Scale)	Value
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

5.1.3 Severity / Magnitude of the Visual Impact

The severity of an environmental aspect is determined by the degree of change to the baseline environment, and includes consideration of the following factors:

- The reversibility of the impact;
- The sensitivity of the receptor to the stressor;
- The impact duration, its permanency and whether it increases or decreases with time;
- Whether the aspect is controversial or would set a precedent; and
- The threat to environmental and health standards and objectives.

The severity of each of the impacts is rated on the following scale:

Table 5-3: Severity Rating System

Severity of Impact (Magnitude)	Value
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5

The severity of the visual impact is derived from the modified Hassell Matrix (Table 4-5), taking into account:

- Visual Character;
- Visual Quality;
- Visual Exposure;
- Visibility;
- VAC;
- Landscape Compatibility; and
- Viewer Sensitivity.

5.1.4 Frequency of the Activity

The frequency of the activity occurring refers to how often the activity would occur.

The Frequency of the activity is calculated in accordance with the Rating System scale, as indicated in Table 5-4 below.

Table 5-4: Frequency of the activity Rating System

Frequency Of Activity / Duration Of Aspect	Value
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5

5.1.5 Frequency of the impact

The frequency of the impact refers to how often a structure impacts or may impact visually, either positively or negatively on the environment.

The Frequency of the impact is calculated in accordance with the Rating System scale, as indicated in Table 5-5 below.

Table 5-5: Frequency of the impact Rating System

Frequency Of Impact	Value
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

5.1.6 Significance Determination

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which has already been assessed. The description and assessment of the aspects and impacts undertaken are presented in a consolidated table (Table 5-5) with the significance of the impact assigned using the process and matrix detailed below. The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the CONSEQUENCE of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the LIKELIHOOD of the impact occurring. The product of CONSEQUENCE and LIKELIHOOD leads to the assessment of the SIGNIFICANCE of the impact, shown in the significance matrix overleaf.

5.2 Method of Assessing the Significance of Visual Impacts

In the following assessment of the significance of the visual impact, the magnitude (or severity) of the impact is qualified with spatial, temporal and probability criteria. These criteria are explained in Table 5-6 below.

Table 5-6: Criteria for Assessing Significance of Impacts

SEVERITY OF IMPACT (magnitude)	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5

SPATIAL SCOPE OF IMPACT (Extent)	RATING
Activity specific	1
Area specific	2
Whole site/plant/mine	3
Regional	4
National	5

DURATION OF IMPACT (temporal scale)	RATING
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

CONSEQUENCE

FREQUENCY OF ACTIVITY / DURATION OF ASPECT	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5

FREQUENCY OF IMPACT	RATING
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

LIKELIHOOD (Probability)

Once the rating criterion as described above is determined, the consequence of the impact is calculated by adding the scores for the first three criteria (Severity, Spatial Scope and Duration). The likelihood of the impact occurring is calculated by adding the scores of the last two criteria (Frequencies of the activity and the impact). The significance is then determined using Table 5-7 overleaf. It must be noted that the ratings are not always completely applicable and requires modification to provide a result in the visual context.

Table 5-7: Significance Impact Rating

LIKELIHOOD (Frequency of activity + Frequency of impact)	**CONSEQUENCE** (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

	High	76 to 150	Improve current management
	Medium High	40 to 75	Maintain current management
	Medium Low	26 to 39	
	Low	1 to 25	No management required

SIGNIFICANCE – CONSEQUENCE x LIKELIHOOD

All anticipated impacts are considered for all phases of the proposed development, namely:

- Pre-construction;
- Construction Phase;
- Operational Phase;
- Decommissioning / Rehabilitation Phase; and
- Post Closure.

Furthermore, impacts are considered in terms of being either:

- **Direct impacts** – impacts caused directly by the activity and generally occur at the same time and at the place of the activity. Direct impacts are usually associated with construction, operation or maintenance of an activity.
- **Indirect Impacts** – indirect or induced changes that may occur as a result of the activity. Indirect impacts include potential impacts that do no manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
- **Residual Impacts** – impacts that remain after taking mitigation measures into account.
- **Cumulative Impacts** – in relation to the activity, means the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with the activity, which in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

5.2.1 Visual Impact Assessment

In order to ensure that the specialists involved in the EIA process conduct their assessments in a manner which is consistent with each other, an EIA methodology table was supplied to all specialists by the EAP. Table 5-8 presents the findings of the visual impact assessment, as per the EIA methodology summary table. It should be noted that visual impacts associated with the proposed development are directly linked to the presence of the proposed development and associated infrastructure within the landscape.

The single significant visual impact of the project is considered to be the **Direct impacts** associated with the **Operational phase**. No indirect visual impacts were identified for any phase of the project. The proposed rehabilitation of the project site aims to reduce the effect of significant residual visual impacts. Mitigation measures, however, have been provided for both the construction, operational and decommissioning phases of the project.

In terms of cumulative impacts, it should be noted that according to information from the Department of Environmental Affairs, another solar PV energy project is proposed to the south of the proposed Kloofsig development, towards Petrusville. Should both the proposed solar project as well as the Kloofsig project be constricted, it is expected that this will contribute to the cumulative visual impacts in the local area. The designs and layout of the proposed facilities are currently not known and therefore the cumulative impact estimation of additional solar PV energy projects are subjective and cannot be calculated at this stage.

Using the prescribed EIA criteria, the final significance rating for the proposed development has been calculated below (Table 5-8). In terms of mitigation, the proposed mitigation measures (Table 5-9 and Section 6) are means to attempt to reduce the frequency of the ACTIVITY, VISIBILITY and IMPACT. Table 5-9 outlines how mitigation could reduce the overall visual impact of the proposed development.

Based on the above methodology the visual impacts associated with the operation of the proposed development are rated as follows:

- **Scale / Spatial Scope** – from the viewsheds and site visit, it was identified that areas neighbouring the proposed development may be impacted upon. The proposed activities were therefore rated as having a **Whole site (3)** impact. This rating was allocated, as although all activities will be undertaken within the site boundary, visual impacts are expected within the areas surrounding the site due to the nature the proposed development, as well as the removal of vegetation causing contrasting colours in the landscape.
- **Duration** – the duration of the impact will be for the **life of the operation (4)**, provided all infrastructure is removed from the site and the area rehabilitated upon completion. Should the infrastructure not be removed, and the site not rehabilitated, the impact will be **permanent (5)**.
- **Severity** – the severity of the impact is rated without mitigation (refer to Table 4-5) and is adjusted with mitigation.
- **Frequency of the activity** – the frequency of the activity is not entirely appropriate when assessing for a visual impact, but since it is the activity which will potentially cause the visual impact, as well as the removal of vegetation, this is rated as being **daily (5)**.
- **Frequency of the impact** – the frequency of the impact occurring is considered to be **infrequent (3)** due to the location of the proposed facility.

The overall **Significance Rating** for the proposed development, with and without mitigation, of this visual impact study are provided in Table 5-8.

Table 5-8: Comparison of the visual significance rating with and without mitigation (Direct Impacts during Operational Phase)

TYPE OF IMPACT	POTENTIAL IMPACT DESCRIPTION IN TERMS OF ENVIRONMENTAL ASPECTS	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION							Impact Management Objective	IMPACT MANAGEMENT ACTIONS (PROPOSED MITIGATION MEASURES)		IMPACT MANAGEMENT OUTCOME (ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION)						
		Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating		Management and Mitigation Measures	Timeframe	Consequence			Likelihood (Probability)		Significance (Degree to which impact may cause irreplaceable loss of resources)	Significance Rating
		Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact						Severity	Spatial	Duration	Frequency: Activity	Frequency: Impact		
Direct	Visual Impacts associated with the **Kloofsig 1** (Solar Panels)	3.5	3	4	5	3	**84**	**H Improve Current Management**	Decrease the visibility of the proposed development from potentially sensitive receptors	1. Where possible, natural vegetation around the facility must be retained. 2. Where vegetation is to be cleared on site, erosion control measures should be in place, to reduce the potential for visually scarring of the landscape by erosion. 3. Concurrent re-vegetation of the disturbed areas should be considered where possible. 5. During construction and operations, dust control measures should be implemented. 6. If construction or operation is to occur during the night, all lighting should be placed to ensure that excessive light does not escape from the site. 7. During construction and operation, litter control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. 8. External signage should be kept to a minimum, and Where possible should be attached to existing buildings.	During Construction and Throughout Operations	3	2	4	5	2	**63**	**MH Maintain Current Management**
Direct	Visual Impacts associated with the **Kloofsig 1** (Powerlines)	2.9	3	4	5	3	**79.2**	**H Improve Current Management**				2.5	2	4	5	2	**59.5**	**MH Maintain Current Management**
Direct	Visual Impacts associated with the **Kloofsig 1** (Substation)	2.9	3	4	5	3	**79.2**	**H Improve Current Management**				2.5	2	4	5	2	**59.5**	**MH Maintain Current Management**
Various criteria making up the severity (including: Visual Character, Visual Quality, Visual Exposure, Visual Absorption Capacity and Viewer Sensitivity) will remain fixed as they are based upon data derived during the analysis (viewsheds, etc.) as well as the existing landscape. By reducing the visibility of the proposed development, through screening of the facility from residents, by means of vegetation, the overall visibility of the proposed development could potentially be reduced, thereby reducing the spatial scope of the impact as well as the frequency of the impact from occurring (more detailed mitigation measures are provided in Section 6).																		

5.2.2 Kloofsig 1

Using the prescribed environmental impact assessment criteria, the final significance rating for proposed Kloofsig 1 has been calculated as **High**.

As noted in Table 5-8, the significance rating for the proposed Kloofsig 1 can be reduced to **Medium-High**, by reducing the spatial scope of the facility. This can be achieved through shielding local residents from views of the development area. This could be achieved through maintaining vegetation and, where appropriate, establishing vegetation along the boundaries of the facility. This could potentially reduce the frequency of the impact occurring.

The confidence rating on the impact assessment ratings provided is rated as Medium, as a result of the contour intervals used in the analysis and modelling scenarios being between 2 and 10 mamsl.

5.2.3 Impact Assessment Rating Results Description

The significance ratings of the proposed development are considered to be of **Medium-High** significance post-mitigation. This rating can be attributed to the location of the site within the topography of the area, however this is not considered to be a fatal flaw to the project. This is primarily due to the existing landuses surrounding the study area, thus the proposed facility location is considered to be acceptable, and is not considered to be a no-go area from a visual perspective.

Table 5-9 describes the meaning of the impact significance ratings in terms of the Department of Environmental Affairs and Tourism's (DEAT) *Impact Significance Rating, presented in the Integrated Environmental Management, Information Series 5* (2002).

Table 5-9: Categories for the rating of impact magnitude and significance

Significance Rating	Description
High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or some combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur, in the case of advertise impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.
Low	Impact is of a low order and therefore likely to have little real effort. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.
No Impact	Zero impact.

Using the descriptions presented in Table 5-9, a significance rating of **Medium-High** indicates that while the expected visual impact of the proposed development may be significant, it may not be considered substantial in relation to the other impacts which may result from the proposed development. Furthermore, the rating indicates that mitigation is considered to be a feasible and possible mechanism in reducing the potential visual impacts of the proposed development in some areas, however in other areas mitigation is considered to be more difficult.

6 Mitigation and Management Recommendations

6.1 Mitigation

The role of mitigation is critical in finding a design / rehabilitation solution that will be visually acceptable. Potential mitigation measures have been taken into consideration during the design phase, as discussed above and is also provided by natural features in the area. Only effective, economically feasible, appropriate and visually acceptable mitigation measures are recommended and these should form part of an EIA and associated documentation to be implemented should the project be approved. Preliminary and conceptual mitigation recommendations include:

- Natural vegetation, wherever possible, should be retained on and around the proposed mining areas.
- The re-vegetation of the site during the operational phase should be considered only if it does not interfere with operations or pose a risk to the health and safety of people and animals. Vegetation around a structure tends to break the outline of the structure against the landscape and will therefore allow for the structure to be less pronounced. Vegetation can be used to reduce the visual scarring of the landscape and potentially reduce the visual impacts of the proposed development. Opportunities for re-vegetation of the project area should be discussed and determined with a biodiversity specialist.
- If vegetation is to be removed and then re-established, a nursery for the removed vegetation should be created. The nursery will ensure that the vegetation is ready for planting when the time comes for rehabilitation post construction. This will reduce the time required for the vegetation to become re-established. It should be noted that the enabling factor for the potential re-establishment of vegetation within the project site is directly dependant of the availably of water.
- During construction and operation, litter and dust management measures should be in place at all times.
- During construction and operation, the entire site should be kept neat and tidy at all times.
- With regards to lighting, if construction or operation is to occur during the night, all lights used for illumination of the construction area should be faced inwards and have their globes shielded. There will, however, be instances where security considerations make this impossible - the viability of the avoidance of high pole top security lighting, as well as security lighting which is activated by movement along the site boundary, as well as within the site should be investigated.
- External signage should be kept to a minimum and where possible attached to existing buildings to avoid free-standing signs in the landscape.
- Should the infrastructure ever be removed, i.e. upon ceasing of activities on the site, it is important that environment be restored to a condition whereby the natural functioning of the ecosystem can take place.

6.2 Management Guidelines

In order to allow for ease of understanding of the proposed mitigation measures during the varying phases at the proposed development, the following section presents some guidelines to aid in managing the visual impacts as a result of the proposed development. Table 6-1 presents these guidelines.

Table 6-1: Visual Management Guidelines

Phase	Proposed Mitigation Measure
Pre-Construction	• All topsoil removed from the site, prior to construction activities, should be stored for rehabilitation purposes at the site (i.e. the topsoil stockpile). Rehabilitation will aid in ensuring that the visual impacts associated with the activity post operations are reduced.
Construction	• Ensure vegetation along the boundary of the development is maintained, to ensure views towards the development areas are impeded. • Where vegetation is to be cleared on site, erosion control measures should be kept in place to ensure that excessive scarring of the landscape is reduced. • During construction, stringent dust control measures should be implemented to ensure that undue interest is not drawn to the site. This is important in terms of reducing the visibility of the construction activities. • If construction is to occur during the night, all lighting should be kept facing inward. This is to ensure that excessive light does not escape from the construction area. • Investigation into the establishment of vegetation and/or the construction of man-made barriers between the sensitive viewers and the proposed development must be undertaken during the construction and operational phases. • During construction, litter control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. • External signage should be kept to a minimum, and where possible should be attached to existing buildings, to avoid free-standing signage.
Operation	• Low foot level lighting should be used, where possible, and where it is deemed safe. • Physical barriers could be used as shielding or cover to prevent excess light leaving the site. • Where possible, lighting should be faced inward / shielded outward away from the viewers. • During operations, litter and dust control measures should be kept in place to ensure that the site is maintained in a neat and tidy condition. This is important in terms of reducing the visibility of the operation activities. • External signage should be kept to a minimum, and where possible should be attached to existing buildings, to avoid free-standing signage.
Decommissioning and Closure – if applicable at some future date	• Where appropriate, re-establish vegetation within the development footprint areas to allow for the VAC of the area to be increased. • All infrastructure used should be disassembled and removed from site to ensure the site resembles a natural state.

7 Environmental Impact Statement

The overall potential visual impacts of the proposed facility is rated, in terms of the methodology for this assessment, as High (before mitigation) and Medium-High (with mitigation).

In terms of the methodology, an impact, which is rated as Medium-High, requires ongoing maintenance of current management measures. There are standard measures available for the type of visual impact being assessed and hence the rating does not suggest the existence of a fatal flaw. Furthermore, there are no no-go areas, or buffer zones applicable if the development takes place as envisaged for the purposes of this VIA.

Care should be taken to address any potential visual impacts associated with the proposed development, and where necessary mitigation and management measures should be implemented – as described in Section 6 above.

8 Conclusions

Although the results of the study indicate that the proposed Kloofsig 1 is expected to have a Medium-High visual impact on the surrounding environment. Should mitigation measures, as proposed in Section 6 be correctly implemented, it is expected that these potential visual impacts could be reduced.

Prepared by

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srk consulting
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Ms. A Murray-Rogers
Environmental Scientist

Reviewed by

SRK Consulting - Certified Electronic Signature
srk consulting
486618_48V/42676/Report1
1720-572-3520-ALLK
This signature has been printed digitally. The Author has given permission for its use for this document. The details are stored in the SRK Signature Database

Mr. K Allan (Pr.Sci.Nat)
Senior Scientist

SRK Consulting - Certified Electronic Signature
srk consulting
486618/42676/Report
8073-8448-8722-JORD
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Mr. W Jordaan (Pr.Sci.Nat)
Associate Partner

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendices

Appendix 1: Legal Requirements for Specialist Studies Table

In terms of the NEMA 2014 EIA Regulations, all specialist studies are required to comply with Appendix 6 of the notice. Table A-1 summarises the legal requirement for all specialist studies, as well as an indication of the relevant Section of this report which complies with the requirement.

Table A-1: Legal Requirements for Specialist Studies

Legal Requirement		**Relevant Section in Specialist study**
(1)	A specialist report prepared in terms of these Regulations must contain-	Section 1.3 Appendix 2
(a)	details of-	
	(i) The specialist who prepared the report; and	
	(ii) The expertise of that specialist to compile a specialist report including curriculum vitae.	
(b)	A declaration that the specialist is independent in a form as may be specified by the competent authority.	To be provided
(c)	An indication of the scope of, and the purpose for which, the report was prepared.	Section 1.1 Section 1.2
(d)	The date and season of the site investigation and the relevance of the season to the outcome of the assessment.	Section 1.4
(e)	A description of the methodology adopted in preparing the report or carrying out the specialised process.	Section 1.4
(f)	The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.	Section 4.6
(g)	An identification of any areas to be avoided, including buffers.	Section 7
(h)	A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Figure 4-3 Appendix 3 *(no buffers proposed)*
(i)	A description of any assumptions made and any uncertainties or gaps in knowledge.	Section 1.6
(j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment.	Section 5.2
(k)	Any mitigation measures for inclusion in the EMPR. *Note that an EMPR has three levels of impact management:* • *Impact management action;* • *Impact management outcome; and* • *Impact management objective.*	Section 5.3 Section 6
(l)	Any conditions/aspects for inclusion in the environmental authorisation.	Section 6
(m)	Any monitoring requirements for inclusion in the EMPR or environmental authorisation.	Section 6.1 Section 6.2
(n)	A reasoned opinion[5] (Environmental Impact Statement)-	Section 6 Section 7
	As to whether the proposed activity or portions thereof should be authorised.	
	If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPR, and where applicable, the closure plan.	
(o)	A description of any consultation process that was undertaken during the course of preparing the specialist report.	N/A
(p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto.	N/A
(q)	Any other information requested by the competent authority.	N/A

[5] Also include a summary of the impacts.

Appendix 2: Curriculum Vitae of Project Team

Wouter Jordaan

Associate Partner and Principal Scientist

Profession	Environmental Science, Impact and Risk Assessment
Education	Aspects International Environmental Auditors Course, Associate Auditor, Institute of Environmental Management and Assessment, 2005 BSc (Hons), Geography& Environmental Management, Rand Afrikaans University (RAU), 1999 BSc, Earth Sciences, Geography & Zoology, Rand Afrikaans University (RAU), 1998
Registrations/ Affiliations	Registered Professional Natural Scientist (Pr. Sci. Nat) 400157/09 with the South African Council for Natural Scientific Professions (SACNASP). Member of the International Association for Impact Assessment (IAIA) – South African Chapter

Specialisation

Project management of complex environmental impact assessments for industrial developments and the oil and energy sector; environmental liability assessment, review and due diligence; environmental compliance auditing; Section 30 environmental emergency incident management; closure and rehabilitation planning; geographic information systems (GIS) and remote sensing; visual impact assessment (VIA)

Expertise

Wouter has over 14 years of experience in the fields of Environmental Science and GIS. He specialises in environmental due diligence, review and impact and risk assessment for industrial developments, notably the oil and energy, cement, fertilisers, chemical and acids, and paper manufacturing sectors. He has worked in numerous countries including Democratic Republic of Congo (DRC), Botswana, Namibia, Kenya, Swaziland, Tanzania, Russia and South Africa.

His specific expertise includes:

- environmental liability assessments, reviews and due diligence.
- environmental impact assessments (EIAs) with specialisation in industrial development (cement, fertiliser, paper, chemicals, oil), waste and energy.
- project management and advice on Section 30 NEMA emergency incidents.
- closure cost estimation and rehabilitation planning.
- environmental compliance auditing and monitoring.
- spatial analysis and decision making using geographic information systems (GIS) and remote sensing.
- visual impact assessment report (VIA) report peer review.
- crime prevention through environmental design (CPTED).

Employment

Current Position	SRK Consulting (SA) (Pty) Ltd – Associate Partner, Durban
2013 – 2015	SRK Consulting (SA) (Pty) Ltd - Principal Environmental Scientist
2007 – 2012	SRK Consulting (SA) (Pty) Ltd - Senior Environmental Scientist,
2003 – 2007	SRK Consulting (SA) (Pty) Ltd - Environmental Scientist
2001 – 2003	Knowledge Factory Primedia (Pty) Ltd. - GIS Analyst
2000 – 2001	Hellermann Tyton, Quality Systems (Part-Time)

Languages

English – read, write, speak
Afrikaans – read, write, speak

Wouter Jordaan

Associate Partner and Principal Scientist

Key Experience: Visual Impact Assessment

Location:	Carletonville
Project duration & year:	2 Months, 2015
Client:	Sibanye Gold
Name of Project:	Visual Impact Assessment of the Sibanye Gold Driefontein Mine
Project Description:	Visual Impact Assessment as part of the update to the Driefontein Mine's EMPr
Job Title and Duties:	Project Reviewer, Report review, client meeting
Value of Project:	Undisclosed
Location:	Between Burgersfort and Steelpoort, Limpopo
Project duration & year:	2013-2014
Client:	Anglo American Platinum Rustenburg Platinum Mines Limited (RPM) and African Rainbow Minerals (ARM) Mining Consortium Limited (ARM MC)
Name of Project:	Proposed Modikwa Platinum Mine South 2 Shaft Project, Limpopo Province, South Africa
Project Description:	EIA for a new shaft at the Modikwa Mine
Job Title and Duties:	VIA Specialist
Value of Project:	Undisclosed
Location:	Rustenburg, KwaZulu-Natal
Project duration & year:	2011-2012
Client:	Aquarius Platinum South Africa
Name of Project:	Amendment to the Existing Aquarius Platinum South Africa's Marikana Mine Environmental Management Programme to include the proposed West-West Open Pit Rehabilitation and Tailings Storage Facility Project
Project Description:	Visual Impact Assessment for the Rehabilitation of the Marikana Mine West-West Open Pit and development of an additional surface Tailings Storage Facility (TSF) and associated infrastructure to accommodate re-treated tailings not used in the rehabilitation of the West-West Pit.
Job Title and Duties:	VIA Specialist
Value of Project:	Unknown
Location:	Rustenburg, North-West Province, South Africa
Project duration & year:	2008-2009
Client:	Royal Bafokeng (Pty) Ltd.
Name of Project:	Visual impact assessment for the proposed Styldrift Mine Complex
Project Description:	Visual impact assessment for the proposed Styldrift Mine Complex
Job Title and Duties:	Project manager and reviewer
Value of Project:	Unknown
Location:	Murmansk Region, Northern Russia
Project duration & year:	2008
Client:	Barrick
Name of Project:	Visual Impact Assessment (VIA) for a proposed mining complex, Russia
Project Description:	VIA for a proposed New Mining Complex, Russia
Job Title and Duties:	VIA Specialist, Spatial analysis, viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting
Value of Project:	n/a
Location:	Rustenburg
Project duration & year:	2008
Client:	Aquarius Platinum
Name of Project:	VIA for the proposed construction of an additional shaft (K6 Shaft) at Kroondal Mine, Rustenburg
Project Description:	VIA for the proposed construction of an Additional Shaft (K6 Shaft) at the Kroondal Mine, Rustenburg
Job Title and Duties:	Environmental scientist, Spatial analysis, Viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting
Value of Project:	n/a

Wouter Jordaan

Associate Partner and Principal Scientist

Key Experience: Visual impact assessments

Location:	Rustenburg
Project duration & year:	2007-2008
Client:	Anglo Platinum
Name of Project:	VIA for the proposed Expansion of the Rustenburg Deeps Mine
Project Description:	VIA for the proposed Expansion of the Rustenburg Deeps Mine
Job Title and Duties:	Environmental scientist, Spatial analysis, Viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting
Value of Project:	n/a

Location:	Cato-Ridge, KZN
Project duration & year:	2007-2008
Client:	Assmang
Name of Project:	VIA for the proposed expansion of the Assmang Ferro-Manganese Facility
Project Description:	VIA for the proposed expansion of the Assmang Ferro-Manganese Facility
Job Title and Duties:	Visual Impact Assessment, Report Review
Value of Project:	n/a

Location:	Rust de Winter, Gauteng
Project duration & year:	2007
Client:	South African Police Service (SAPS)
Name of Project:	Construction of a 50m high Triangular Lattice Telecommunication Mast
Project Description:	VIA for a proposed Triangular Lattice Mast for the South African Police Service
Job Title and Duties:	Environmental scientist, Spatial analysis, Viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting
Value of Project:	n/a

Location:	Mondeor, Gauteng
Project duration & year:	2007
Client:	South African Police Service (SAPS)
Name of Project:	Construction of a 30m high Triangular Lattice Communication Mast
Project Description:	VIA for a proposed 30m Triangular Lattice Mast
Job Title and Duties:	Environmental scientist, Spatial analysis, viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting
Value of Project:	n/a

Location:	Area between uMhlanga Lagoon and Umdloti, KZN
Project duration & year:	2006-2007
Client:	Tongaat Hulett Properties
Name of Project:	VIA for the proposed Sibaya Precinct
Project Description:	VIA for the proposed development of the Sibaya Precinct, KZN
Job Title and Duties:	Environmental scientist, Spatial analysis, viewshed Modelling and analysis, line of sight and 3D-Modelling, Reporting, Presentation at Public Meeting
Value of Project:	n/a

Location:	Lower Drakensberg, KZN
Project duration & year:	2006
Client:	Eskom (SOC) Pty. Ltd
Name of Project:	VIA for the relocation of electrical infrastructure
Project Description:	VIA for the proposed relocation of the existing Cathkin substation and extension of approximately 2.5km of 33KV powerline for Eskoms Cathkin-Mandabeni project, KZN
Job Title and Duties:	Scientist, GIS Modelling, reporting
Value of Project:	n/a

Location:	Richards Bay
Project duration & year:	2006
Client:	RHI
Name of Project:	VIA for RHI Refractories
Project Description:	VIA for proposed Fusion Plant in Richards Bay
Job Title and Duties:	Scientist, GIS Modelling, reporting
Value of Project:	n/a

Wouter Jordaan

Associate Partner and Principal Scientist

In addition to the abovementioned Visual Impact Assessments Wouter has project managed more than 20 other Visual Impact Assessments not listed in the section above. Examples of these include:

- Visual Impact Assessment for the proposed Zuurwater Photovoltaic Project, near Aggeneys, Northern Cape
- Visual Impact Assessment for the proposed capacity upgrades on the National Route 3 Section 2, eThekwini, KwaZulu-Natal
- Visual Impact Assessment for a proposed solar power plant, located near Black Mountain in the Northern Cape for SATO Holdings
- Visual Impact Assessment for the consolidation of the existing EMPr and a proposed expansion to mining activities at the New Clydesdale Mine for Exxaro
- Visual Impact Assessment for the consolidation of the existing EMPr and a proposed expansion to mining activities at the Venetia Mine for De Beers
- Visual Impact Assessment for the proposed opencast coal mining operations near the Kendal Power Station and Kriel, Mpumalanga
- Visual Impact Assessment for the proposed housing estate on the Hilton College School grounds
- Visual Impact Assessment for the proposed opencast coal mining operations on the Vlakfontein Farm, Ogies, Mpumalanga
- Visual Impact Assessment for the Dwaalkop Mining Operation, Limpopo
- Visual Impact Assessment for the proposed solar power generation facility near Victoria East, Northern Cape for Afrom Energy (Pty) Ltd.

Keagan Allan

Senior Scientist

Profession	Senior Scientist & GIS Specialist
Education	BSc Geographical Science – 2003 BSc (Hons) Geographical Science and Environmental Management – 2004 MSc Geographical Science (Cum Laude) – 2007
Registrations/ Affiliations	Registered Professional Natural Scientist (Pr.Sci.Nat), South African Council for Natural Scientific Professions (SACNASP), 400185/13 IAIA South Africa
Awards	Won Best Poster at the 2010 IAIAsa Conference – Poster Applications of GIS in EMF.

Specialisation

Geographical Information Systems and Remote Sensing

Expertise

Keagan Allan has been involved in the field of Geographical Information Systems (GIS) for the past 9 years. His expertise includes:

- Geographical Information Systems (GIS), more specifically data collection and manipulation; modelling of various spatial data for Visual Impact Assessments and Ground Water management and database management.
- Visual Impact Assessment Specialist – using GIS and modelling to conduct Visual Impact Assessments (VIAs) for large scale mining and industrial developments.
- GIS Development – using Visual Basic scripting to develop tools for use within the ESRI ArcMap environment.
- GIS in Environmental Management Frameworks – using Visual Basic in conjunction with GIS techniques to generate information for use in the GIS reporting in an EMF study.
- Remote Sensing (RS) more specifically the use of remotely sensed images in the classification of various land use types.

Employment

Jul 2008 – Present	SRK Consulting, Environmental Scientist, Westville
Feb 2008 – Jun 2008	Haley Sharpe, Assistant Tourism Planner, Southern Africa
Feb 2007 – Aug 2007	UKZN, Cartographic Technician, Pietermaritzburg

Languages

English – read, write, speak

Afrikaans – read, write, speak

Publications

1. ALLAN, K., EMANUAL, P., and MORRIS, J. (2010) Poster Presentation: Applications of GIS in EMF, IAIAsa Conference, Pretoria, August, 2010.
2. ALLAN, K. (2015) Paper Presentation: Environmental Management in the 21st Century: Combining Environmental Processes and GIS Technologies, IAIAsa Conference, KwaZulu-Natal, August 2015.

Keagan Allan

Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	Limpopo Province
Project duration & year:	July 2008 – November 2009
Client:	SRK - JNB
Name of Project:	Olifants Water Reserves
Project Description:	Assessment of the water reserves in the Olifants River Catchment
Job Title and Duties:	GIS Specialist and modelling of groundwater levels
Value of Project:	N/A

Location:	Makhatini, KZN
Project duration & year:	July 2008 - present
Client:	ESKOM
Name of Project:	ESKOM: Makhatini EIA
Project Description:	The development of a new 22 kV power line through the Makhatini Flats area
Job Title and Duties:	GIS Specialist – mapping and modelling
Value of Project:	N/A

Location:	Pinetown, KZN
Project duration & year:	July 2008 - present
Client:	Shell South Africa
Name of Project:	Shell Wavecrest Environmental Impact Assessment (EIA)
Project Description:	EIA for the refurbishment of the Shell Wavecrest Service Station, Sarnia, Pinetown
Job Title and Duties:	Environmental Scientist, Reporting, Public Participation, Field Work.
Value of Project:	N/A

Location:	Alkmaar, Mpumalanga
Project duration & year:	August 2008 – October 2008
Client:	SRK – JNB
Name of Project:	Petroline Visual Impact Assessment
Project Description:	The identification of potential visual impacts the development of a storage depot might have on the surrounding area
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Western Cape
Project duration & year:	August 2008 – November 2008
Client:	SRK – CPT
Name of Project:	ESKOM – Pebble bed Reactor EIA and Risk Assessment
Project Description:	Various EIAs and Risk Assessments for the placement of the proposed Pebble bed Nuclear Reactors.
Job Title and Duties:	GIS Specialist – mapping of the various factors for the project
Value of Project:	N/A

Location:	Durban North, KZN
Project duration & year:	August 2008 – November 2008
Client:	eThekwini Municipality
Name of Project:	Riverhorse as-built floodlines
Project Description:	Flood modeling along a section of the Riverhorse Valley Industrial Park.
Job Title and Duties:	GIS Specialist – mapping and modeling of the terrain
Value of Project:	N/A

Keagan Allan
Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	Rustenburg, North West Province
Project duration & year:	November 2008 – January 2009
Client:	SRK – JNB
Name of Project:	Styldrift Mine – Visual Impact Assessment
Project Description:	Undertaking of a visual impact assessment for the Styldrift Mining Complex
Job Title and Duties:	GIS Specialist – mapping and modelling; reporting.
Value of Project:	N/A

Location:	Pinetown, KZN
Project duration & year:	October 2008 – February 2009
Client:	eThekwini Municipality
Name of Project:	Basic Assessment for the Palmiet River Attenuation
Project Description:	Undertaking a Basic Assessment for the proposed flood attenuation of the Palmiet River Catchment, Pinetown
Job Title and Duties:	Environmental Scientist, Reporting, Public Participation, Field Work.
Value of Project:	N/A

Location:	Lebowakgomo, Limpopo
Project duration & year:	February 2009 – February 2009
Client:	Messina Platinum Mines Ltd.
Name of Project:	Dwaalkop VIA
Project Description:	Visual Impact Assessment for the Dwaalkop Mining Operation, Limpopo
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Mshwati Municipality
Project duration & year:	July 2009 – November 2009
Client:	INR
Name of Project:	Mshwati EMF
Project Description:	Undertaking floodline assessments and service assessment for the Mshwati EMF
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Cape Town
Project duration & year:	August 2009 – September 2013
Client:	City of Cape Town
Name of Project:	City of Cape Town – Stormwater Asset Project
Project Description:	Assessment of stormwater assets in the City of Cape Town Municipality
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Ogies, Mpumalanga
Project duration & year:	October 2009 – November 2009
Client:	SRK – JNB
Name of Project:	Vlakfontein Mine VIA
Project Description:	Visual Impact Assessment for the proposed opencast coal mining operations on the Vlakfontein Farm, Ogies, Mpumalanga
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Keagan Allan

Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	Hilton, KZN
Project duration & year:	November 2009 – January 2010
Client:	Environmental Planning and Design
Name of Project:	Hilton Housing Estate VIA
Project Description:	Visual Impact Assessment for the proposed housing estate on the Hilton College School grounds
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Amajuba Municipality
Project duration & year:	January 2010 – January 2011
Client:	Amajuba District Municipality
Name of Project:	Amajuba District Municipality Disaster Management Plan
Project Description:	Disaster management plan for the district
Job Title and Duties:	Data collection
Value of Project:	N/A

Location:	Pietermaritzburg, KZN
Project duration & year:	July 2008 – May 2010
Client:	Msunduzi Municipality
Name of Project:	Msunduzi EMF
Project Description:	Development of an EMF and SEA for the management of development in the Msunduzi Municipality
Job Title and Duties:	GIS Analyst, Spatial Decision Support Tool Programmer
Value of Project:	N/A

Location:	Kriel Mpumalanga
Project duration & year:	January 2010 – present
Client:	SRK- JNB
Name of Project:	Kriel EMPR Addition Reserves VIA
Project Description:	Visual Impact Assessment for the proposed opencast coal mining operations near the Kendal Power Station and Kriel, Mpumalanga
Job Title and Duties:	GIS Specialist – mapping and modeling; reporting.
Value of Project:	N/A

Location:	Richards Bay
Project duration & year:	April 2010 – December 2010
Client:	Mondi Richards Bay Mill
Name of Project:	MONDI – Phase 1 EIA
Project Description:	EIA for a proposed expansion of the Mondi Richards Bay Mill
Job Title and Duties:	GIS Specialist and Environmental Assessment Practitioner
Value of Project:	N/A

Location:	Mpumalanga Province
Project duration & year:	August 2010
Client:	Mpumalanga Department of Agriculture and Land Administration
Name of Project:	EMF for the Msukaligwa and Albert Luthuli Municipalities (includes Mpumalanga Lake District region)
Project Description:	Development of an EMF tool for decision makers in the local municipalities
Job Title and Duties:	Spatial Decision Support Tool Programmer
Value of Project:	N/A

Keagan Allan

Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	KZN
Project duration & year:	January 2010 - present
Client:	Chevron
Name of Project:	Chevron – Water Quality Assessments
Project Description:	Various mapping for a number of Chevron sites around KwaZulu-Natal
Job Title and Duties:	Cartographer
Value of Project:	N/A

Location:	Western Cape Province
Project duration & year:	December 2010 – February 2012
Client:	Cape Winelands District Municipality
Name of Project:	Cape Winelands EMF
Project Description:	Development of an EMF for the district municipality, as well as a GIS tool for assisting decision makers
Job Title and Duties:	GIS Analyst, Spatial Decision Support Tool Programmer
Value of Project:	N/A

Location:	Mpumalanga Province
Project duration & year:	January 2011 – February 2012
Client:	Exxaro
Name of Project:	New Clydesdale Coal - VIA
Project Description:	Visual Impact Assessment for the consolidation of the existing EMPr and a proposed expansion to mining activities at the New Clydesdale Mine
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	Limpopo Province
Project duration & year:	February 2011 – June 2011
Client:	De Beers
Name of Project:	Venetia Mine EMPr Consolidation and VIA
Project Description:	Visual Impact Assessment for the consolidation of the existing EMPr and a proposed expansion to mining activities at the Venetia Mine
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	Black Mountain – Northern Cape
Project duration & year:	June 2011 – February 2012
Client:	SATO Holdings
Name of Project:	SATO Solar Power Plant VIA
Project Description:	Visual Impact Assessment for a proposed solar power plant, located near Black Mountain in the Northern Cape
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	Eastern Cape
Project duration & year:	February 2012 – October 2012
Client:	Afrom Energy (Pty) Ltd.
Name of Project:	Dobbin Solar Power Plant VIA
Project Description:	Visual Impact Assessment for the proposed solar power generation facility near Dobbin, Eastern Cape
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Keagan Allan
Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	Northern Cape
Project duration & year:	February 2012 – October 2012
Client:	Afrom Energy (Pty) Ltd.
Name of Project:	Brakpoort Solar Power Plant VIA
Project Description:	Visual Impact Assessment for the proposed solar power generation facility near Victoria East, Northern Cape
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	KwaZulu-Natal
Project duration & year:	May 2011 – November 2012
Client:	Eskom Holdings SOC Ltd.
Name of Project:	Visual Impact Assessment for the Proposed Candover-Mbazwana-Gezisa 132kV Powerlines and 132/22kV 20MVA Mbazwana and Gezisa Substations, Northern KwaZulu- Natal
Project Description:	Visual Impact Assessment of the proposed new line
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	KwaZulu-Natal
Project duration & year:	February 2012 – May 2012
Client:	Eskom Holdings SOC Ltd.
Name of Project:	Bush clearing specification compiled for the Nondabuya-Ndumo 132kV powerline and the Ndumo 132/22kV substation
Project Description:	Using remote sensing to identify and cost for bush clearing contractors to clear vegetation from the proposed powerline route
Job Title and Duties:	GIS Analyst and Remote Sensing Specialist
Value of Project:	N/A

Location:	KwaZulu-Natal
Project duration & year:	November 2012 – July 2014
Client:	SiVest (Pty) Ltd.
Name of Project:	Rinaldo East Industrial Site Visual Impact Assessment
Project Description:	Visual Impact Assessment for the proposed new industrial site adjacent the N2 freeway in eThekwini
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	KwaZulu natal
Project duration & year:	December 2012
Client:	Primedia (Pty) Ltd
Name of Project:	Visula impact and shadow analysis of the proposed billboard on top of Nedbank House, Durban central business district.
Project Description:	Visual impact assessment and shadow analysis
Job Title and Duties:	GIS Analyst and visual assessment practitioner
Value of Project:	N/A

Location:	Northern Cape
Project duration & year:	February 2013
Client:	Savannah Environmental
Name of Project:	Visual impact assessment for a proposed 500 MW solar power generation facility
Project Description:	Visual impact assessment
Job Title and Duties:	GIS Analyst and visual assessment practitioner
Value of Project:	N/A

Keagan Allan

Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	North West
Project duration & year:	March 2013 – November 2013
Client:	LonMin
Name of Project:	Visual Impact Assessment for Phase 1 and 2 projects of the Styldrift Mining Complex
Project Description:	Visual Impact Assessment for proposed new ventilation shafts and waste rock dumps at the Styldrift Mining Complex, North West Province
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	North West
Project duration & year:	July 2013 – September 2013
Client:	AVD Environmental (LonMin)
Name of Project:	Visual Impact for the proposed new mining complex at the Pandora Mining Complex
Project Description:	Visual Impact Assessment for a proposed new mining complex and powerline at the Pandora Mine, north West Province
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	Eastern Cape
Project duration & year:	December 2013
Client:	Primedia (Pty) Ltd
Name of Project:	Visual Impact of Proposed Billboards along main roads in Port Elizabeth
Project Description:	Visual Impact of Proposed Billboards along main roads in Port Elizabeth
Job Title and Duties:	GIS Analyst and Visual Assessment Practitioner
Value of Project:	N/A

Location:	KwaZulu-Natal Province
Project duration & year:	July 2012 – July 2014
Client:	DWAF
Name of Project:	Groundwater Resource Directed Measures: Mvoti to Umzimkulu Water Management Area
Project Description:	Assessment of the groundwater water reserves in the Mvoti to Umzimkulu Water Management Area
Job Title and Duties:	GIS Specialist and modelling of groundwater levels
Value of Project:	N/A

Location:	KwaZulu-Natal Province
Project duration & year:	August 2013 – present
Client:	Amajuba Municipality
Name of Project:	Emadlangeni Rural Water Supply Desktop Groundwater Assessment
Project Description:	Assessment of borehole distribution and borehole conditions for the supply of water in the Emadlangeni Municipality, KwaZulu-Natal
Job Title and Duties:	GIS Specialist and analyst
Value of Project:	N/A

Keagan Allan
Senior Scientist

Key Experience: GIS / VIA Specialist

Location:	Limpopo Province, South Africa
Project duration & year:	2 months (2015)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed expansions to the existing Blinkwater Tailings Storage Facility and other Associated Infrastructure at the Mogalakwena Mine, Limpopo, South Africa.
Job Title and Duties:	GIS modelling and mapping, photograph simulation of proposed development, site inspection and reporting writing

Location:	Limpopo Province, South Africa
Project duration & year:	2 months (2015)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the Proposed Witrivier Waste Rock Dump at the Mogalakwena Mine, Limpopo, South Africa.
Job Title and Duties:	GIS modelling and mapping, photograph simulation of proposed development, site inspection and reporting writing

Location:	North-West Province, South Africa
Project duration & year:	2 months (2015)
Client:	Shangoni Environmental Consulting
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Tharisa Mine Rail Link, North West Province, South Africa.
Job Title and Duties:	GIS modelling and mapping, site inspection and reporting writing

Location:	Gauteng Province, South Africa
Project duration & year:	2 months (2015)
Client:	Eskom Holdings SOC Limited
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Eskom Kekana and Wonderboom Substations and associated 132kV Powerline.
Job Title and Duties:	GIS modelling and mapping, site inspection and reporting writing

Location:	KwaZulu-Natal Province, South Africa
Project duration & year:	2 months (2015)
Client:	GCS Environmental Consultants
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Rohill Business Estate, KwaZulu-Natal, South Africa.
Job Title and Duties:	GIS modelling and mapping, 3D modelling of proposed mitigation measures, site inspection and reporting writing

Location:	Limpopo Province, South Africa
Project duration & year:	4 months (2014)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the Proposed Modikwa Platinum Mine South 2 Shaft Project, Limpopo Province, South Africa.
Job Title and Duties:	GIS modelling and mapping, and reporting writing

Andrea Murray-Rogers

Environmental Scientist / GIS Specialist

Profession	Environmental Scientist / GIS Specialist
Education	Lakes Environmental AERMOD Air Dispersion Modelling Course, 2014 Aspects International Environmental Auditors Course, IEMA, 2012 BSocSci (Hons), Geography and Environmental Management, University of KwaZulu-Natal, 2009 BSocSci, Geography and Environmental Management, University of KwaZulu-Natal, 2008
Registrations/ Affiliations	International Association for Impact Assessments South Africa, KwaZulu-Natal • 2013/2014: KZN Branch Secretary • 2014/2015: KZN Branch Treasurer • 2015/2016 KZN Branch Treasurer • 2015 & 2016 Conference Committee Treasurer

Specialisation

Visual Impact Assessments, Geographic Information Systems (GIS), Environmental Assessments, Environmental Compliance Auditing, Air Quality Compliance Monitoring, Assessments and Licencing.

Expertise

Andrea Murray-Rogers has been involved in the field of GIS, environmental and air quality related projects for the past 7 years. Her expertise includes:

- Making use of GIS for spatial analysis to aid planning & decision making.
- Undertaking specialist Visual Impact Assessments.
- Environmental Assessments, Management Plans and Implementation Plans.
- Environmental Compliance Auditing.
- Atmospheric Emission Licence and Postponement Applications.
- Air Quality Impact Monitoring and Assessments.
- Water Use License Applications.
- Research & Report writing.

Employment

2010 – Present	SRK Consulting (Pty) Ltd, Environmental Scientist, Durban
2009 – 2010	Terratest (Pty) Ltd, Junior Environmental Scientist
2009	University of KwaZulu-Natal, Graduate Assistant / Demonstrator
2007 – 2008	2G Environmental Consulting, Part-time Junior Environmental Assistant

Languages

English – read, write, speak (Excellent)
Afrikaans – read, write, speak (Fair)
French – read, write, speak (Fair)

Andrea Murray-Rogers

Environmental Scientist / GIS Specialist

Key Experience:	**Geographic Information System & Visual Impact Assessment Experience**
Location:	Mpumalanga Province, South Africa
Project duration & year:	2 months (2016)
Client:	Universal Coal (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the Proposed Extension of the Roodekop Mining Area, on the Farm Diepspriut, Farm No. 41 IS, Mpumalanga Province
Job Title and Duties:	GIS modelling and mapping, photograph simulation of proposed development, site inspection and reporting writing
Location:	Limpopo Province, South Africa
Project duration & year:	2 months (2015)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed expansions to the existing Blinkwater Tailings Storage Facility and other Associated Infrastructure at the Mogalakwena Mine, Limpopo, South Africa.
Job Title and Duties:	GIS modelling and mapping, photograph simulation of proposed development, site inspection and reporting writing
Location:	Limpopo Province, South Africa
Project duration & year:	2 months (2015)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the Proposed Witrivier Waste Rock Dump at the Mogalakwena Mine, Limpopo, South Africa.
Job Title and Duties:	GIS modelling and mapping, photograph simulation of proposed development, site inspection and reporting writing
Location:	North-West Province, South Africa
Project duration & year:	2 months (2015)
Client:	Shangoni Environmental Consulting
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Tharisa Mine Rail Link, North West Province, South Africa.
Job Title and Duties:	GIS modelling and mapping, site inspection and reporting writing
Location:	Gauteng Province, South Africa
Project duration & year:	2 months (2015)
Client:	Eskom Holdings SOC Limited
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Eskom Kekana and Wonderboom Substations and associated 132kV Powerline.
Job Title and Duties:	GIS modelling and mapping, site inspection and reporting writing
Location:	KwaZulu-Natal Province, South Africa
Project duration & year:	2 months (2015)
Client:	GCS Environmental Consultants
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Rohill Business Estate, KwaZulu-Natal, South Africa.
Job Title and Duties:	GIS modelling and mapping, 3D modelling of proposed mitigation measures, site inspection and reporting writing

Andrea Murray-Rogers

Environmental Scientist / GIS Specialist

Key Experience:	**Geographic Information System & Visual Impact Assessment Experience**
Location:	Limpopo Province, South Africa
Project duration & year:	4 months (2014)
Client:	Anglo American Platinum and African Rainbow Minerals
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the Proposed Modikwa Platinum Mine South 2 Shaft Project, Limpopo Province, South Africa.
Job Title and Duties:	GIS modelling and mapping, and reporting writing
Location:	KwaZulu-Natal, South Africa
Project duration & year:	3 months (2014)
Client:	GCS Water and Environmental Consultants
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed Rohill Business Estate, KwaZulu-Natal, South Africa.
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing
Location:	Gauteng Province, South Africa
Project duration & year:	On-going
Client:	Johannesburg Roads Agency
Name of Project:	Floodline Assessments
Project Description:	Various Flooding Assessments and Hazard Analysis within the Gauteng Province, South Africa
Job Title and Duties:	GIS assistance, floodline editing and map creation
Location:	North-West Province, South Africa
Project duration & year:	4 months (2013)
Client:	Alta van Dyk Environmental Consultants cc. on behalf of LonMin (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for the proposed LonMin Mine, near Brits, North-West Province, South Africa
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing
Location:	Limpopo Province, South Africa
Project duration & year:	4 months (2013)
Client:	Rustenburg Platinum Mines Limited
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment Report for the proposed expansions at the Twickenham Platinum Mine, Limpopo Province, South Africa
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing
Location:	Hammarsdale, KwaZulu-Natal, South Africa
Project duration & year:	2 months (2013)
Client:	Terratest (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for the Proposed National Road 3 Capacity Upgrades, Hammarsdale, KwaZulu-Natal
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing

Andrea Murray-Rogers

Environmental Scientist / GIS Specialist

Key Experience: Geographic Information System & Visual Impact Assessment Experience

Location:	Port Elizabeth, South Africa
Project duration & year:	1 month (2013)
Client:	Primedia (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for two proposed billboards, Port Elizabeth, Eastern Cape
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing

Location:	North West Province, South Africa
Project duration & year:	3 months (2014
Client:	Eskom Holdings SOC Limited
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for the proposed Cashan Substation and powerline connecting to the Hekpoort Substation, South Africa
Job Title and Duties:	Site Visit, GIS modelling and mapping, and reporting writing
Value of Project:	R 69 865

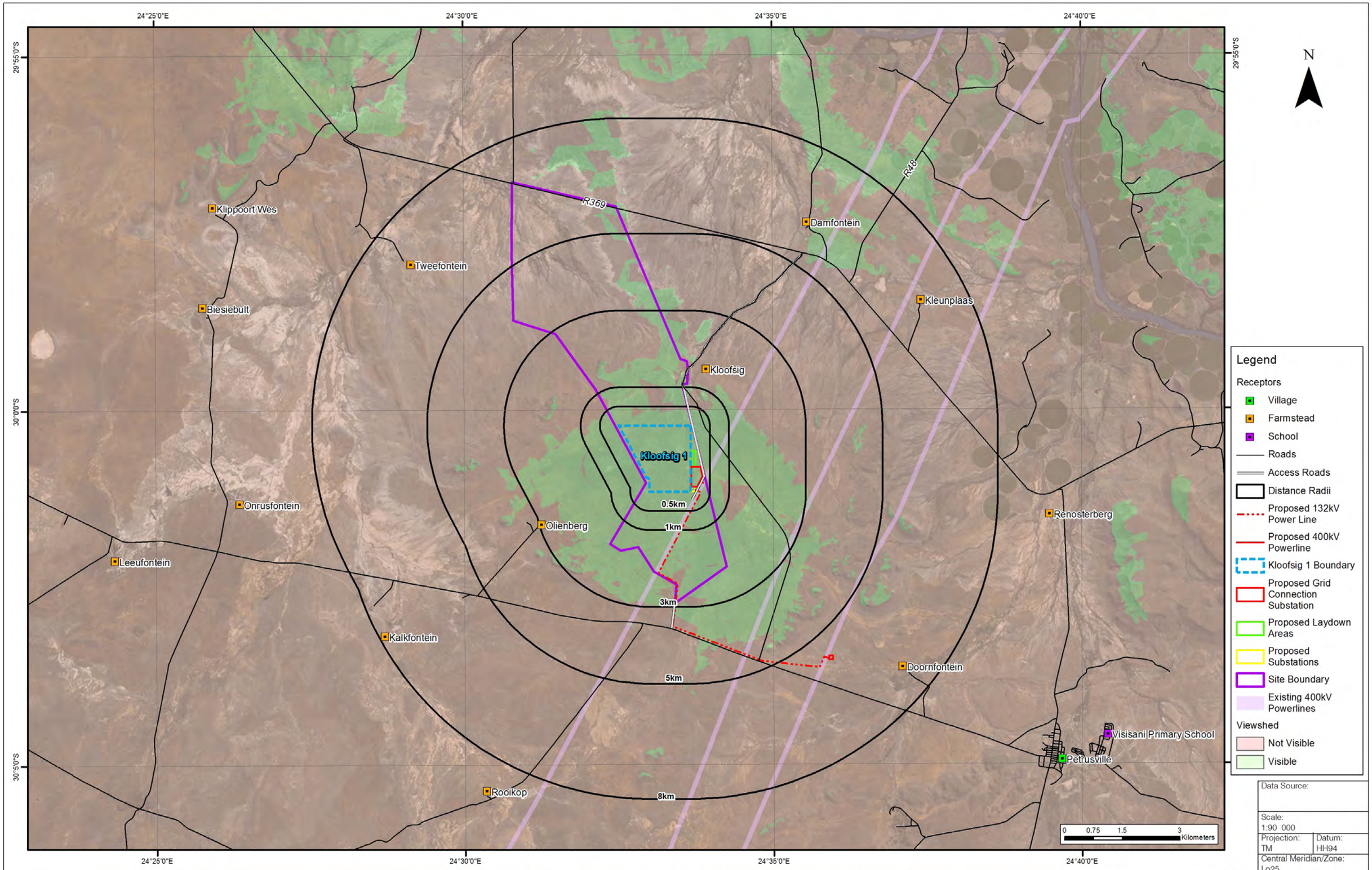
Location:	Durban, KwaZulu-Natal
Project duration & year:	1 month (2012)
Client:	Primedia (Pty) Ltd.
Name of Project:	Visual Impact and Shadow Analysis
Project Description:	Visual Impact and Shadow Analysis of the Proposed Billboard on top of Nedbank House, Durban Central Business District.
Job Title and Duties:	GIS mapping, and reporting writing

Location:	Eastern Cape
Project duration & year:	6 months (2012)
Client:	Afrom Energy (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for the proposed solar power generation facility near Dobbin, Eastern Cape
Job Title and Duties:	GIS mapping and modelling, and report compilation

Location:	Northern Cape
Project duration & year:	6 months (2012)
Client:	Afrom Energy (Pty) Ltd.
Name of Project:	Visual Impact Assessment
Project Description:	Visual Impact Assessment for the proposed solar power generation facility near Victoria East, Northern Cape
Job Title and Duties:	GIS mapping and modelling, and report compilation

Location:	Makhatini Flats, Northern KwaZulu-Natal
Project duration & year:	6 months (2012)
Client:	Eskom Holdings SOC Ltd
Name of Project:	Environmental Implementation Plans
Project Description:	Environmental Implementation plans for the construction of the 132kV powerline and 22kV Ndumo Substation
Job Title and Duties:	GIS mapping and report compilation – Bush clearing specification

Appendix 3: Viewsheds



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Scale: 1:90 000

Projection: TM | Datum: HH94

Central Meridian/Zone: Lo25

Date: 02/11/2016 | Compiled by: MURA

Project No: 486618 | Fig No: A1

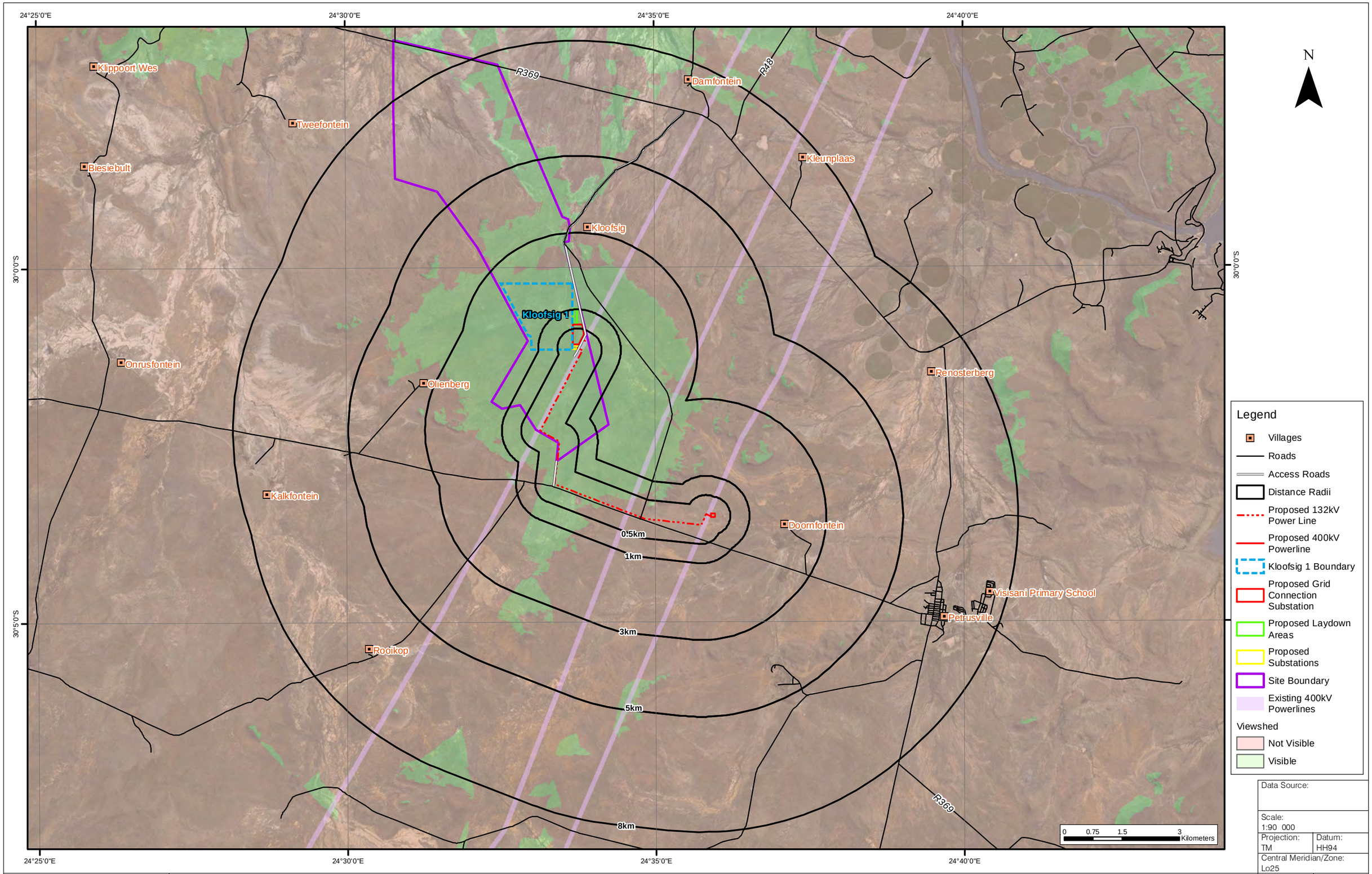
srk consulting

VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

VIEWSHED OF PROPOSED KLOOFSIG 1 SOLAR PANELS

Path: G:\486618_48V_KLOOFSIG_PV_VIA (assisting PE)\8GIS\GISPROJ\MXD\Figures\486618_48V_F_A1_Kloofsig_VIA_Viewshed_Kloofsig1_SP_A3L_C_20161102.mxd

Revision: A Date: 02 11 2016



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Projection: TM	Datum: HH94
Central Meridian/Zone: Lo25	
Date: 02/11/2016	Compiled by: MURA
Project No: 486618	Fig No: A2

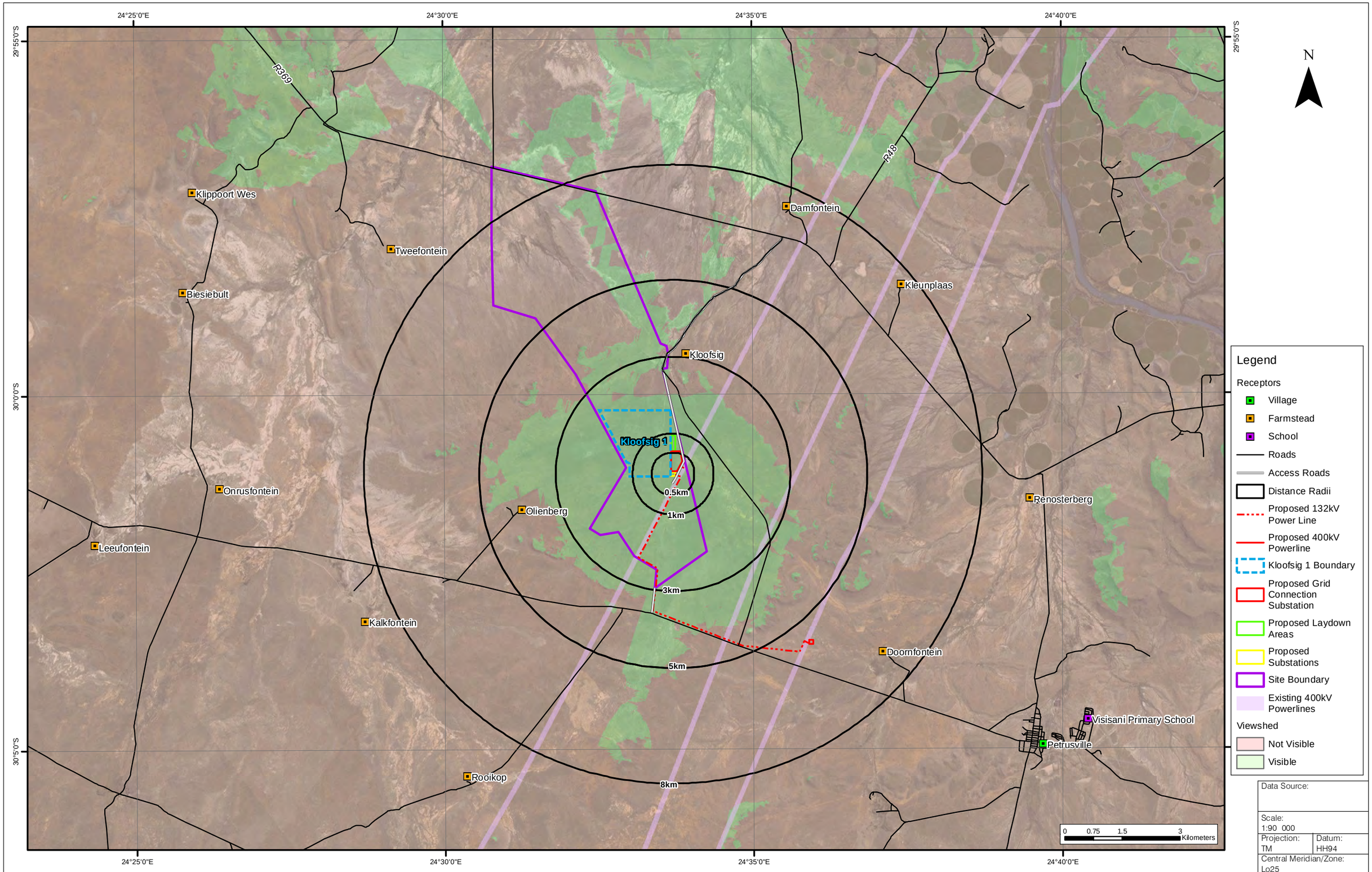
srk consulting

VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

VIEWSHED OF PROPOSED KLOOFSIG 1 POWERLINE

Path: G:\486618_48V_KLOOFSIG_PV_VIA (assisting PE)\8GIS\GISPROJ\MXD\Figures\486618_48V_F_A2_Kloofsig_VIA_Viewshed_Kloofsig1_PL_A3L_C_20161102.mxd

Revision: A Date: 02 11 2016



Data Source:

Scale: 1:90 000

Projection: TM | Datum: HH94

Central Meridian/Zone: Lo25

srk consulting

VISUAL IMPACT ASSESSMENT: KLOOFSIG SOLAR PV ENERGY FACILITY

VIEWSHED OF PROPOSED KLOOFSIG 1 SUBSTATION

Date: 02/11/2016 | Compiled by: MURA

Project No: 486618 | Fig No: A3

Revision: A Date: 02 11 2016

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Appendix 4: Viewpoint Description

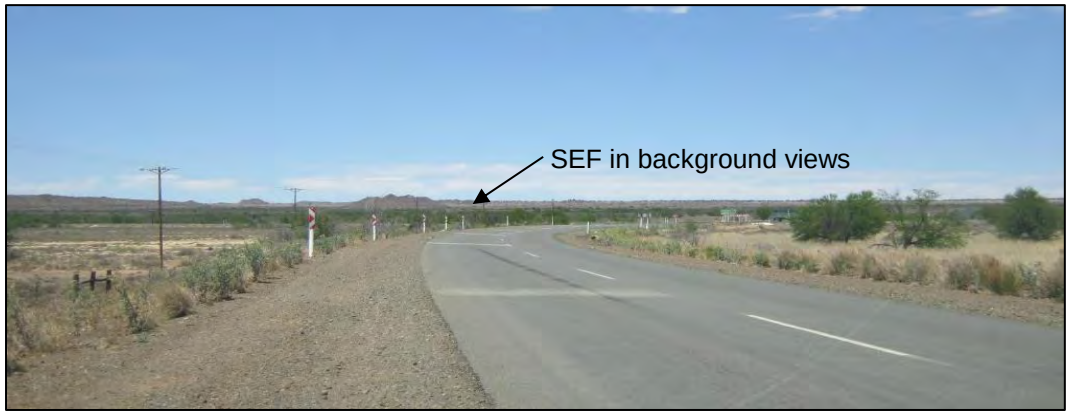
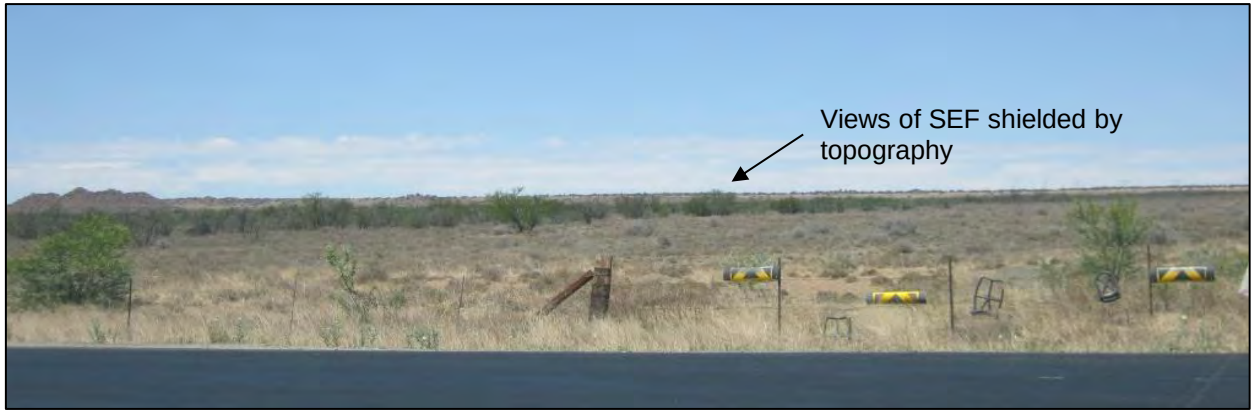
VIEWPOINT DESCRIPTION & VISIBILITY RATING

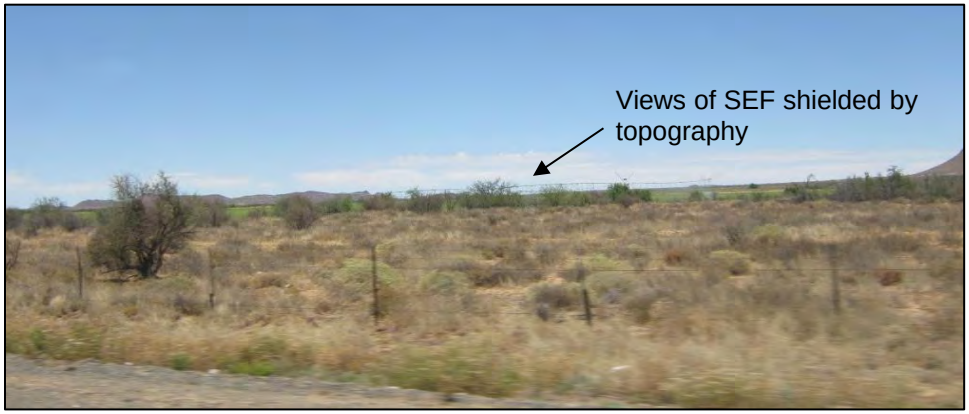
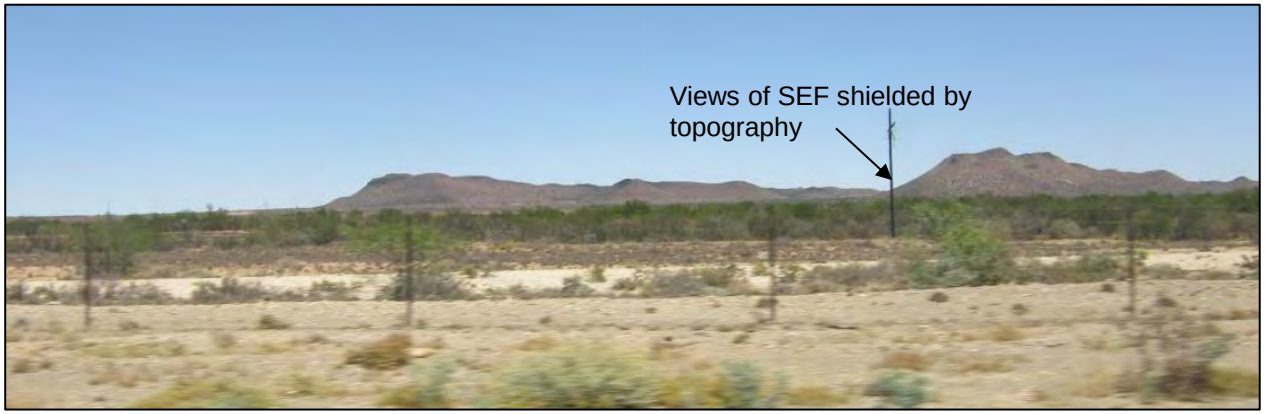
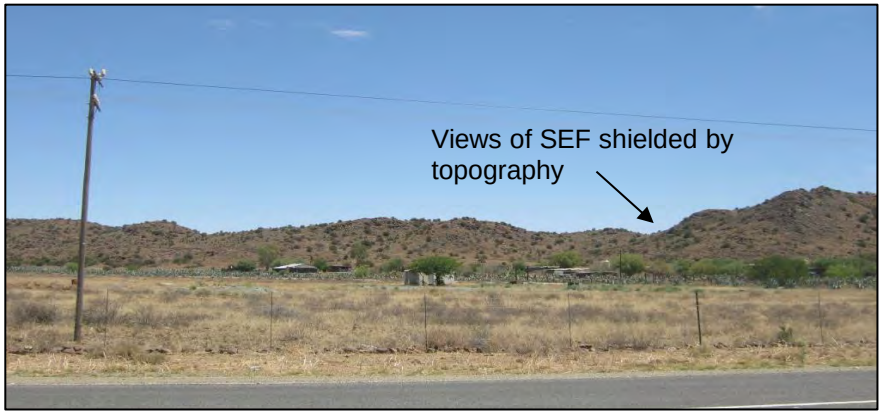
		KLOOFSIG 1		
VP	**Location and Viewing Direction**	**Solar Panels**	**Powerlines**	**Substation**
VP1	VP1 is located at the intersection of the R369 and the R48, north-east of the proposed development.	2	2	1
VP2	VP2 is located along the R48 towards Petrusville, north-east of the proposed solar facility.	1	1	1
VP3	VP3 is located along the R48 towards Petrusville, east of the proposed solar facility.	1	1	1
VP4	This viewpoint is located along the R48, south-east of the proposed development.	1	2	1
VP5	This viewpoint is located along the R48, south-east of the proposed development.	1	1	1
VP6	VP6 is located along the R48 at the intersection between Koffiefontein and Vanderkloof.	1	1	1
VP7	VP7 is located along the R48, east-north-east of the proposed solar facility.	1	1	1
VP8	VP8 is located along the R48, north-east of the proposed solar facility.	2	2	1
VP9	This viewpoint is located at the entrance to the proposed project area off the R369.	2	2	1
VP10	VP10 is located along a secondary road towards the proposed development.	2	2	2
VP11	VP11 is located approximately 3.5km north of the proposed development, along a secondary road.	4	2	2
VP12	VP12 is located approximately 2.5km north of the proposed development, along a secondary road.	4	2	2
VP13	VP13 is located is located near the town of Orania along the R369, north-west of the proposed development.	1	1	1
VP14	VP14 is located along the R387, north-west of the proposed solar facility.	1	1	1
VP15	VP15 is located at the intersection of the R387 and R369 (Kraankuil Orania / Petrusville Intersection)	1	1	1
VP16	VP16 is located along the R369, approximately 15km north-west of the proposed development.	2	1	1
VP17	VP17 is located along the R369, approximately 12km north-west of the proposed development.	2	1	1
VP18	VP18 is located along the R369, approximately 10km north-west of the proposed development.	2	1	1
VP19	VP19 is located along the R369, approximately 8.5km north-west of the proposed development.	1	1	1
VP20	VP20 is located along the R369, approximately 7km north-west of the proposed development.	1	1	1
VP21	VP21 is located along the R369, approximately 5km west-north-west of the proposed development.	2	1	2
VP22	VP22 is located along the R369, approximately 5km north of the proposed development.	2	1	2
VP23	VP22 is located along the R369, approximately 4.5km north of the proposed development.	2	2	2
VP24	This viewpoint is located near the entrance to the proposed project area off the R369.	2	2	2
VP25	VP25 is located along the R369, before the intersection to Koffiefontein, north-east of the proposed solar facility.	4	2	2
VP26	VP26 is located near to the intersection of the R369 and the R48, north of the proposed development.	4	2	2
		2.6	***1.9***	***1.8***

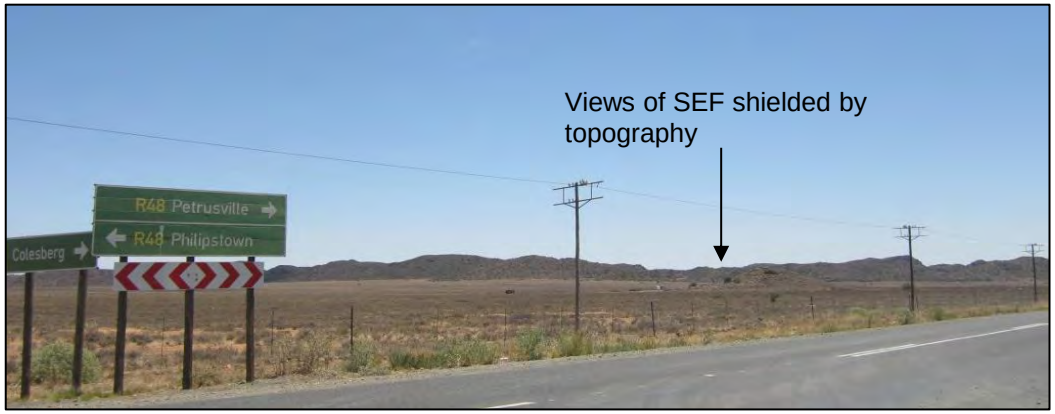
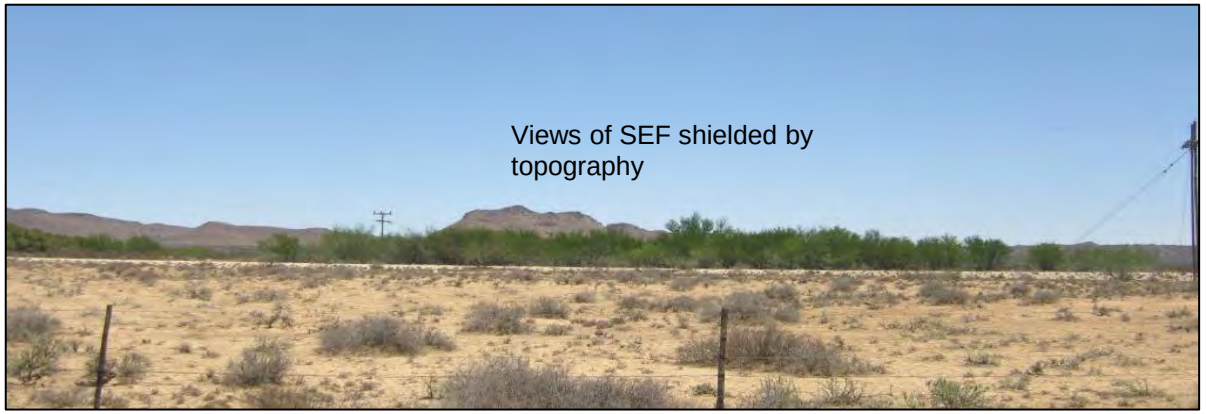
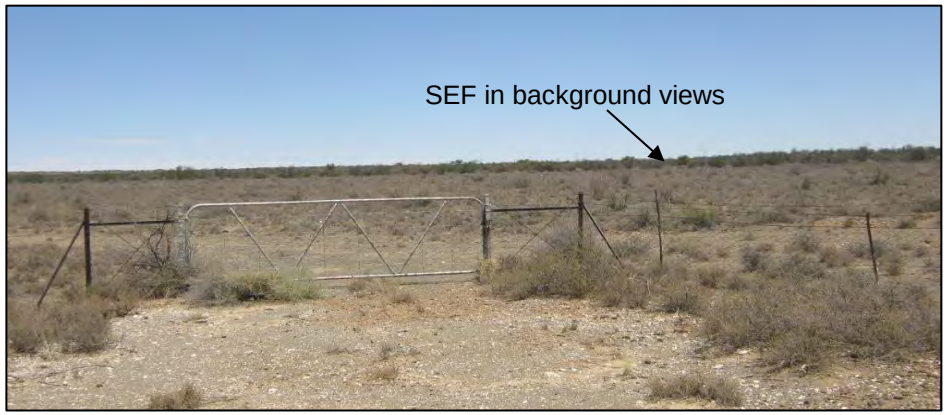
Visibility Ranking – after Site Visit Verification			
Not Visible	Marginally Visible	Visible	Highly visible
Final Visibility Criteria (Exposure Rating)			
1	2	4	5

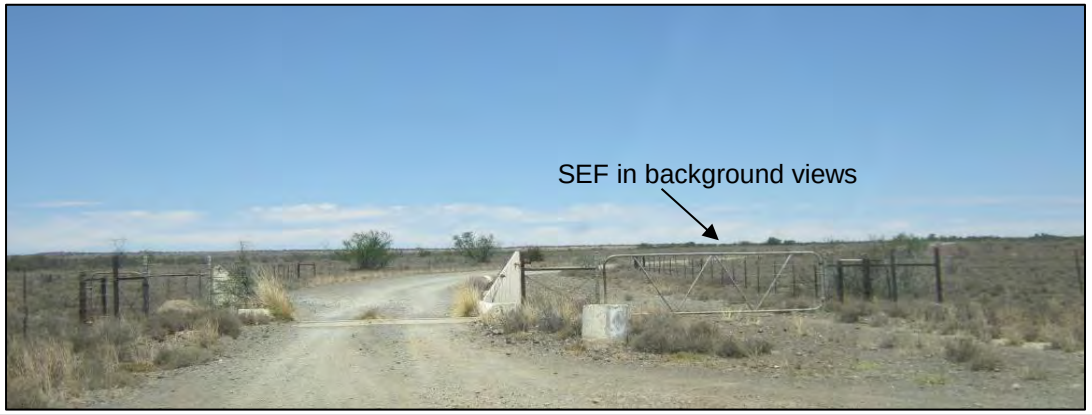
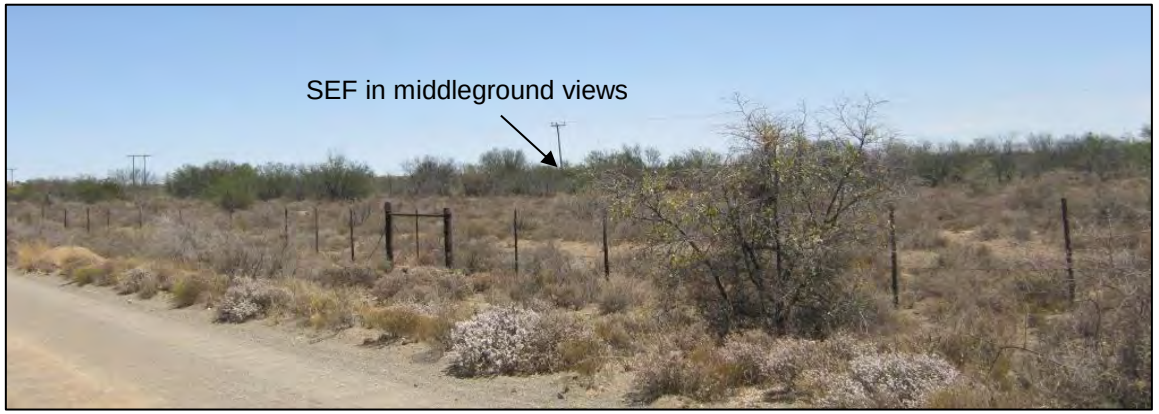
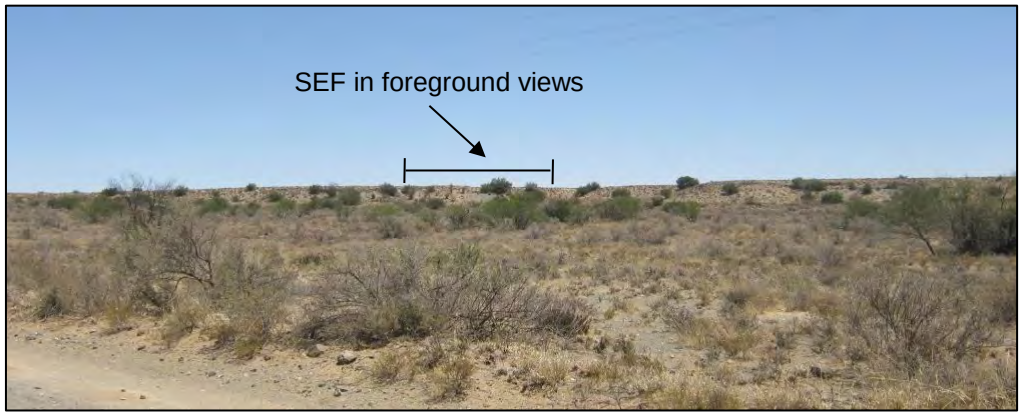
Appendix 5: Photographs of the Viewpoints taken

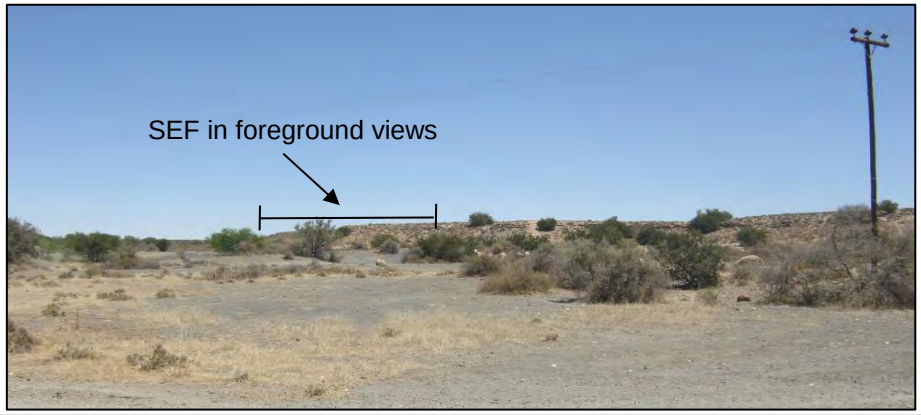
VIEWPOINT PHOTOGRAPHS

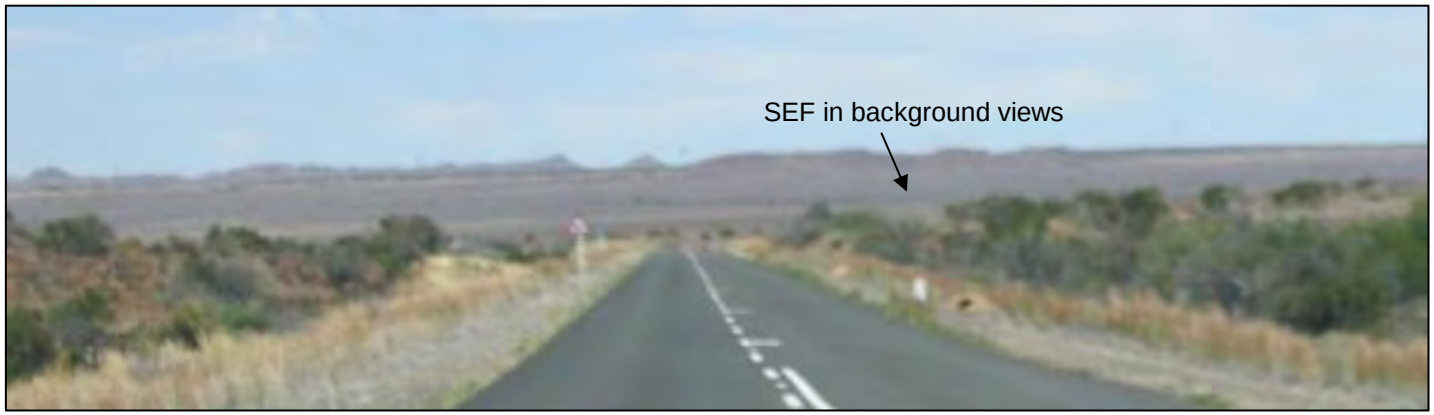
VP	Description	Photographs
VP1	VP1 is located at the intersection of the R369 and the R48, north-east of the proposed development.	
VP2	VP2 is located along the R48 towards Petrusville, north-east of the proposed solar facility.	

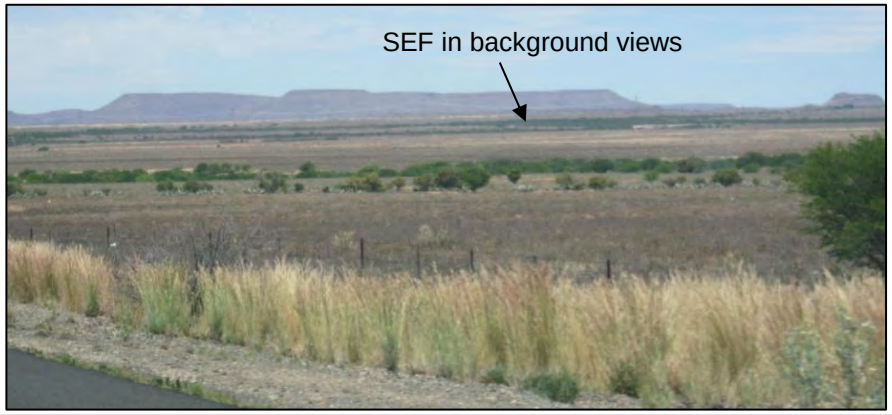
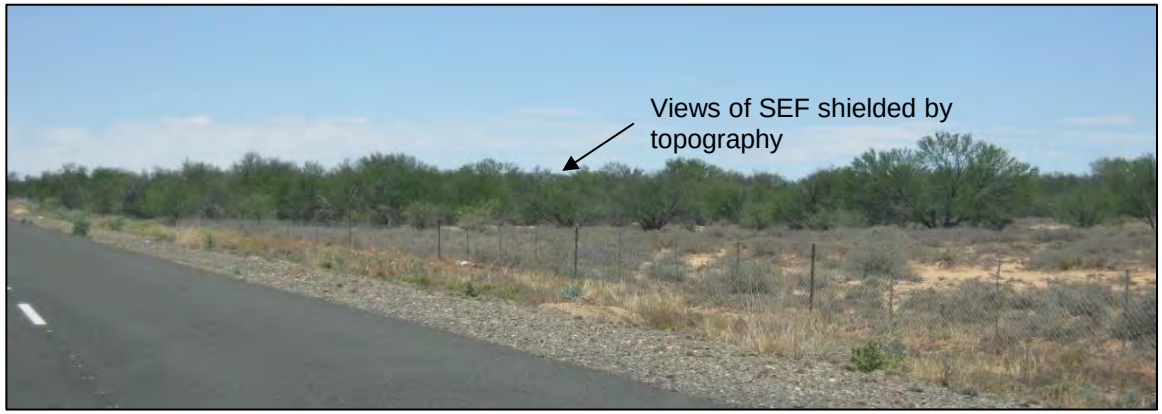
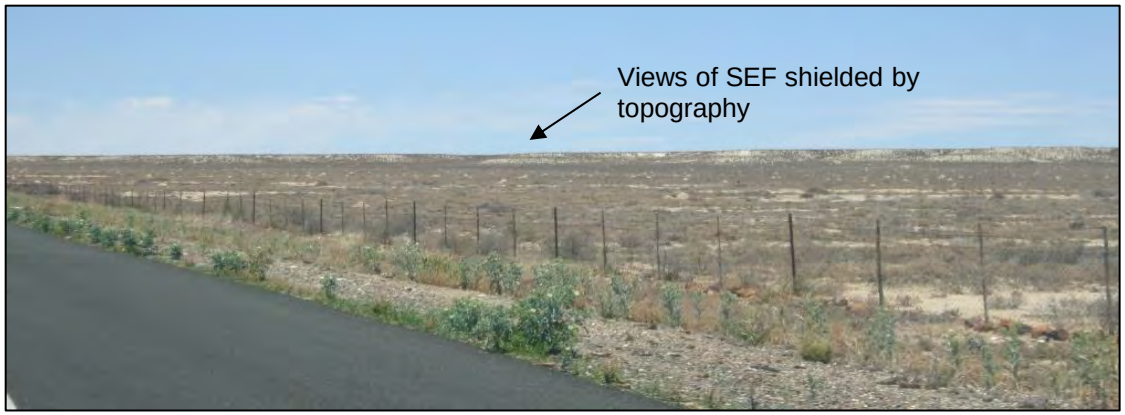
VP	Description	Photographs
VP3	VP3 is located along the R48 towards Petrusville, east of the proposed solar facility.	
VP4	This viewpoint is located along the R48, south-east of the proposed development.	
VP5	This viewpoint is located along the R48, south-east of the proposed development.	

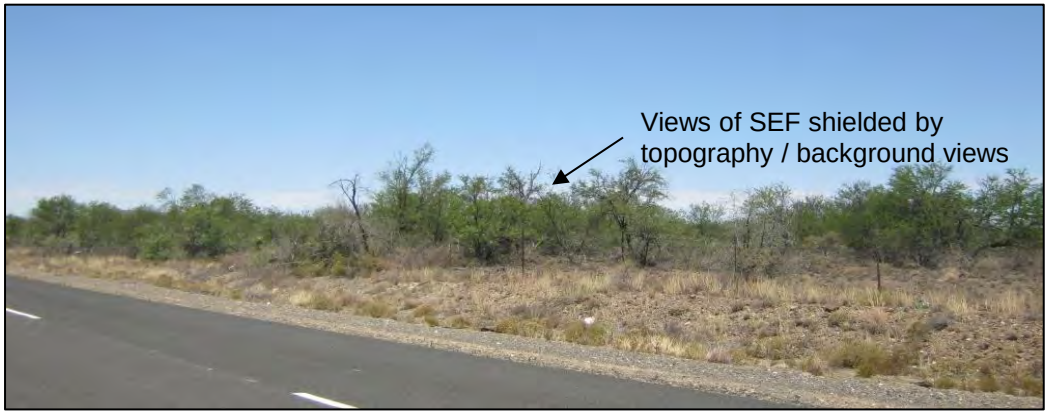
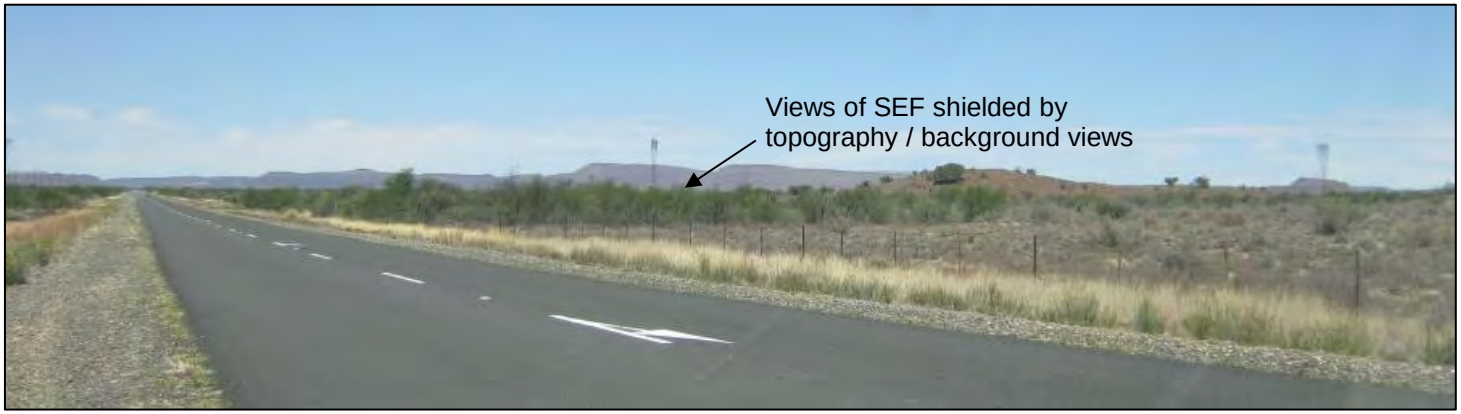
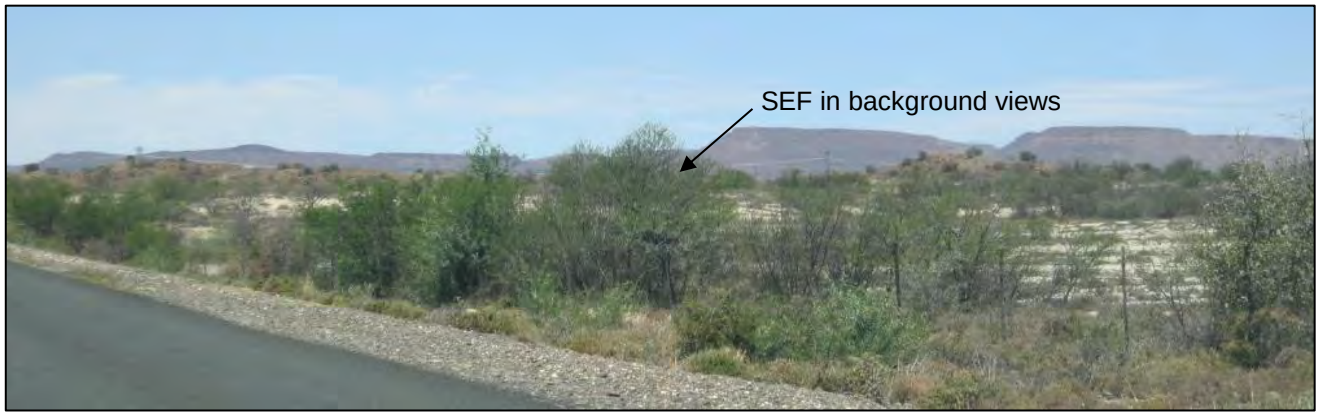
VP	Description	Photographs
VP6	VP6 is located along the R48 at the intersection between Koffiefontein and Vanderkloof.	
VP7	VP7 is located along the R48, east-north-east of the proposed solar facility.	
VP8	VP8 is located along the R48, north-east of the proposed solar facility.	

VP	Description	Photographs
VP9	This viewpoint is located at the entrance to the proposed project area off the R369.	
VP10	VP10 is located along a secondary road towards the proposed development.	
VP11	VP11 is located approximately 3.5km north of the proposed development, along a secondary road.	

VP	Description	Photographs
VP12	VP12 is located approximately 2.5km north of the proposed development, along a secondary road.	
VP13	VP13 is located is located near the town of Orania along the R369, north-west of the proposed development.	
VP14	VP14 is located along the R387, north-west of the proposed solar facility.	

VP	Description	Photographs
VP15	VP15 is located at the intersection of the R387 and R369 (Kraankuil Orania / Petrusville Intersection)	
VP16	VP16 is located along the R369, approximately 15km north-west of the proposed development.	
VP17	VP17 is located along the R369, approximately 12km north-west of the proposed development.	

VP	Description	Photographs
VP18	VP18 is located along the R369, approximately 10km north-west of the proposed development.	
VP19	VP19 is located along the R369, approximately 8.5km north-west of the proposed development.	
VP20	VP20 is located along the R369, approximately 7km north-west of the proposed development.	

VP	Description	Photographs
VP21	VP21 is located along the R369, approximately 5km west-north-west of the proposed development.	
VP22	VP22 is located along the R369, approximately 5km north of the proposed development.	
VP23	VP22 is located along the R369, approximately 4.5km north of the proposed development.	

VP	Description	Photographs
VP24	This viewpoint is located near the entrance to the proposed project area off the R369.	
VP25	VP25 is located along the R369, before the intersection to Koffiefontein, north-east of the proposed solar facility.	
VP26	VP26 is located near to the intersection of the R369 and the R48, north of the proposed development.	

SRK Report Distribution Record

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