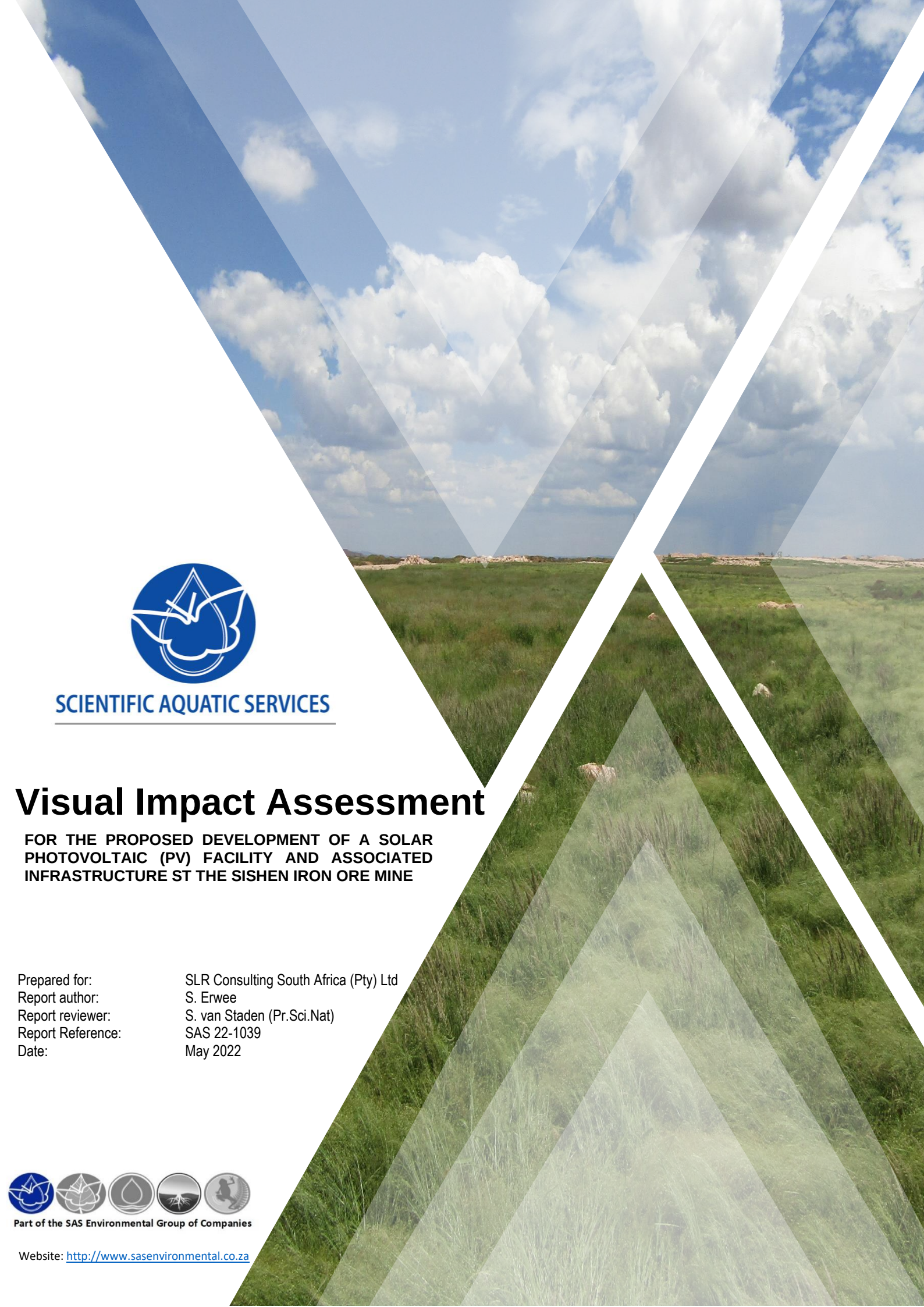

SCIENTIFIC AQUATIC SERVICES

Visual Impact Assessment

FOR THE PROPOSED DEVELOPMENT OF A SOLAR PHOTOVOLTAIC (PV) FACILITY AND ASSOCIATED INFRASTRUCTURE ST THE SISHEN IRON ORE MINE

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Report Reference:	SAS 22-1039
Date:	May 2022

Part of the SAS Environmental Group of Companies

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Basic Assessment (BA) and authorisation process for the proposed Sishen Iron Ore Mine (Sishen Mine) Solar Photovoltaic (PV) Project near Kathu, Northern Cape Province. The Sishen Mine is located within the Gamagara Local Municipality which is an administrative area in the John Taolo Gaetsewe District Municipality.

The Sishen Mine is situated approximately 3,5 km south west of the town of Kathu, 50 km south west of the town of Kuruman and 28 km north east of the town of Olifantshoek. The N14 is situated approximately 3 km west of the Sishen Mine in a north-south direction from Kathu to Olifantshoek, the R325 roadway is located approximately 11 km south of Sishen Mine.

Sishen Mine has been in operation since 1953 and represents one of the largest iron ore reserves in South Africa and in the world, and all surrounding farms are owned by Anglo American: Sishen Iron Ore Company (SIOC), as such mining workers are occupying the majority of the farmsteads in the surrounding area, therefore the sensitive receptors present are accustomed to the mining infrastructure. As such the visual impact on the receiving environment is already present, thus moderately low visual impacts are expected to occur as a result of the development of the proposed solar PV facility during the construction and operational phases.

SIOC, an Anglo-American company, is applying for environmental authorisation for the development of a solar PV facility and associated infrastructure within the mining right area of the Sishen Mine. The proposed solar PV facility will be located on the existing G80 Waste Rock Dump (WRD), hence the landscape within which the study area is, is already significantly altered.

The dominant land use of the municipality is mining and extensive agriculture (livestock Grazing). The arid nature of the climate restricts stocking densities which has led to relatively large farms across the area, resulting in the area being sparsely populated. Farmers and farm workers residing in the area and people at their place of work are sensitive receptors. As noted the sparse farmsteads located in the vicinity of the study area and the residents of the town of Kathu are accustomed to the mining activities in the area therefore the sensitivity of residents may be considered moderate to low. People at their place of work are likely to focus on the activities at hand and not the surrounding environment as such workers are also considered low sensitive receptors.

A visual impact will only occur if there are sensitive receptors present in the area to observe or experience the impact. Based on the desktop and field assessments it is evident that the study area is situated within a sparsely populated area where sensitive receptors are limited and sparse, and all surrounding farms are owned by SIOC, as such mining workers are occupying the majority of the farmsteads in the surrounding area. The proposed solar PV facility will not be built to the edge of the WRD. Due to the steep angle of repose observers in the landscape are unlikely to have a direct line of sight to the proposed solar PV facility. Additionally, the bushveld vegetation limits the view of the observer to their immediate surroundings, not allowing one to see across the vistas.

Glint and glare is only likely to be experienced when the observer is at a higher elevation than the proposed solar PV facility and the degree to which it is tilted. For example the glint and glare from tracking panels with back tracking towards ground-based receptors are most common when the panels are flat in the morning/evening (LOGIS, 2021). This is when the larger incidence angle (angle of incoming light) yields more reflected light. Since the proposed solar PV facility are located on top of a WRD, the ground-based receptors are located lower than the solar PV facility, therefore the sensitive receptors in the area will not experience glint and glare due to the 0° tilt (lying flat) of the panels in the mornings.

In summary and based on the impact assessment, it is evident that the proposed development activities have a low to very low visual impact on the surrounding environment. This is attributed to the fact that the proposed solar PV facility components are to be located on top of a WRD, the sparse sensitive receptors within a 5 km radius as well as the mining setting and the bushveld vegetation limiting the view. Furthermore, with the angle of repose the likelihood of receptors in the area observing the

proposed solar PV facility is low, therefore the level of visual intrusion on the landscape is considered low to negligible. The visual impact will be slightly higher during the construction phase since there will be more movement of vehicles and personnel readying the area for development, once operational the solar PV facility do not require a lot of manpower and movement within the array will be very limited.

It is the opinion of the specialist that the project be considered acceptable from a visual resource management perspective, provided that the mitigatory measures as outlined in the report are implemented and adhered to.

DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 as published in Government Notice 40772 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

NEMA Regulations (2014) - Appendix 6		Relevant section in report
1a	Details of	
	(i) the specialist who prepared the report; and	Appendix L
	(ii) the expertise of that specialist to compile a specialist report including	Appendix L
b	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix L
c	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
cA	an indication of the quality and age of base data used for the specialist report	Section 4
cB	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5
d	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3 and Appendix A to J
f	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan	Section 4
g	an identification of any areas to be avoided, including buffers	Not applicable – findings from ecological assessment may be used to conserve natural visual resources
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;	Not applicable – findings from ecological assessment may be used to conserve natural visual resources
i	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5
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 or activities;	Section 4 and 5
k	any mitigation measures for inclusion in the EMPr	Section 5
l	any conditions for inclusion in the environmental authorisation	Section 5
m	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5
n	a reasoned opinion	
	(i)as to whether the proposed activity, activities or portions thereof should be authorised;	Section 6
	(1A) regarding the acceptability of the proposed activity or activities; and	Section 6
	(ii) if the opinion is that the proposed activity, activities 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;	Section 5 and 6
o	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Consultation with interested and affected parties (I&APs) will be undertaken as part of the project
p	summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Comments and responses that are raised by I&APs will be included in the EIA report compiled by the EAP
q	any other information requested by the competent authority	No information requested at this time

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GLOSSARY OF TERMS

Best Practicable Environmental Option	This is the alternative/option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.
Characterisation	The process of identifying areas of similar landscape character, classifying and mapping them and describing their character.
Characteristics	An element, or combinations of elements, which make a contribution to landscape character.
Development	Any proposal that results in a change to the landscape and/ or visual environment.
Elements	Individual parts, which make up the landscape, for example trees and buildings.
Feature	Particularly prominent or eye-catching elements in the landscape such as tree clumps, church towers or wooded skylines.
Geographic Information System (GIS)	A system that captures, stores, analyses, manages and presents data linked to location. It links spatial information to a digital database.
Impact (Visual)	A description of the effect of an aspect of the development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.
Key characteristics	Those combinations of elements which are particularly important to the current character of the landscape and help to give an area its particularly distinctive sense of place.
Land cover	The surface cover of the land, usually expressed in terms of vegetation cover or the lack of it. Related to but not the same as Land use.
Land use	What land is used for based on broad categories of functional land cover, such as urban and industrial use and the different types of agriculture and forestry.
Landform	The shape and form of the land surface which has resulted from combinations of geology, geomorphology, slope, elevation and physical processes.
Landscape	An area, as perceived by people, the character of which is the result of the action and interaction, of natural and/ or human factors.
Landscape Character Type	These are distinct types of landscape that are relatively homogeneous in character. They are generic in nature in that they may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation and historical land use and settlement pattern, and perceptual and aesthetic attributes.
Landscape integrity	The relative intactness of the existing landscape or townscape, whether natural, rural or urban, and with an absence of intrusions or discordant structures.
Landscape quality	A measure of the physical state of the landscape. It may include the extent to which typical landscape character is represented in individual areas, the intactness of the landscape and the condition of individual elements.
Landscape value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a variety of reasons.
Receptors	Individuals, groups or communities who are subject to the visual influence of a particular project. Also referred to as viewers, or viewer groups.
Sense of place	The unique quality or character of a place, whether natural, rural or urban, allocated to a place or area through cognitive experience by the user. It relates to uniqueness, distinctiveness or strong identity and is sometimes referred to as genius loci meaning 'spirit of the place'.
Sky glow	Brightening of the night sky caused by outdoor lighting and natural atmospheric and celestial factors.
Skylining	Siting of a structure on or near a ridgeline so that it is silhouetted against the sky.

View catchment area	A geographic area, usually defined by the topography, within which a particular project or other feature would generally be visible.
Viewshed	The outer boundary defining a view catchment area, usually along crests and ridgelines.
Visibility	The area from which project components would potentially be visible. Visibility is a function of line of sight and forms the basis of the VIA as only visible structures will influence the visual character of the area. Visibility is determined by conducting a viewshed analysis which calculates the geographical locations from where the proposed project might be visible.
Visual Absorption Capacity	The ability of an area to visually absorb development as a result of screening topography, vegetation or structures in the landscape.
Visual Character	The overall impression of a landscape created by the order of the patterns composing it; the visual elements of these patterns are the form, line, colour and texture of the landscape's components. Their interrelationships are described in terms of dominance, scale, diversity and continuity. This characteristic is also associated with land use.
Visual Exposure	The relative visibility of a project or feature in the landscape. Visual exposure is based on distance from the project to selected viewpoints. Visual exposure or visual impact tends to diminish exponentially with distance.
Visual Intrusion	The nature of intrusion of an object on the visual quality of the environment resulting in its compatibility (absorbed into the landscape elements) or discord (contrasts with the landscape elements) with the landscape and surrounding land uses.
Zone of visual influence	An area subject to the direct visual influence of a particular project.

*Definitions were derived from Oberholzer (2005) and the Institute of Environmental Management and Assessment (2013)

LIST OF ACRONYMS

ARC	Agricultural Research Council
BA	Basic Assessment
BESS	Battery Energy Storage System
BLM	(United States) Bureau of Land Management
BPEO	Best Practicable Environmental Option
DAEARDLR	Department of Agriculture, Environmental Affairs, Rural Development and Land Reform
DEM	Digital Elevation Model
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Minerals Resources and Energy
DTM	Digital Terrain Model
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
GIS	Geographic Information System
GPS	Global Positioning Systems
IAPs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
KOP	Key Observation Points
LI IEMA	Institute of Environmental Management and Assessment
m.a.m.s.l.	Meters above mean sea level
MW	Megawatt
NEMA	National Environmental Management Act (No. 108 of 1997)
NGL	Natural Ground Level
PV	Photovoltaic
RE	Remaining Extent
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SIOC	Sishen Iron Ore Company
UNESCO	United Nations Educational Scientific and Cultural Organization
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management
WHS	World Heritage Site
WRD	Waste Rock Dump

1. INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Basic Assessment (BA) and authorisation process for the proposed Sishen Iron Ore Mine (Sishen Mine) Solar Photovoltaic (PV) Project near Kathu, Northern Cape Province. The Sishen Mine is located within the Gamagara Local Municipality which is an administrative area in the John Taolo Gaetsewe District Municipality.

The Sishen Mine is situated approximately 3,5 km south west of the town of Kathu, 50 km south west of the town of Kuruman and 28 km north east of the town of Olifantshoek. The N14 is situated approximately 3 km west of the Sishen Mine in a north-south direction from Kathu to Olifantshoek, the R325 roadway is located approximately 11 km south of Sishen Mine. The location and extent is indicated in Figures 1 and 2.

The project is associated with a Solar PV Facility (including pedestal mounted solar PV panels, inverter stations, a switchyard, electrical cables to collect generated power at a central substation for distribution and maintenance roads); associated transmission infrastructure (including substations and 132 kV transmission lines); and an access road, hereafter collectively referred to as "**study area**". Refer to Section 1.2 for a detailed project description.

A VIA entails a process of data collection, spatial analysis, visualisation and interpretation to describe the quality of the landscape prior to development taking place and then identifying possible visual impacts after development. Assessing visual impacts are difficult as it is very subjective due to a person's perception being affected by more than only the immediate environmental factors (Oberholzer, 2005). Sishen Mine has been in operation since 1953 and represents one of the largest iron ore reserves in South Africa and in the world, and all surrounding farms are owned by Sishen Iron Ore Company (SIOC), as such mining workers are occupying the majority of the farmsteads in the surrounding area. As such the Sishen Mine forms and important and integral part of the Kathu landscape.

This report, after consideration and description of the visual integrity of the study area and surroundings, must guide the proponent, authorities and Environmental Assessment Practitioner (EAP), by means of recommendations, as to the suitability of the Solar PV Project of the Sishen Mine, from a visual and aesthetic point of view. This report should furthermore serve to inform the planning, design and decision-making process as to the layout and nature of the proposed activities.

1.2 Description of the Proposed Project

SIOC, an Anglo American company, owns the opencast Sishen Mine. The Sishen Mine is located close to the town of Kathu in the Northern Cape Province. SIOC proposes to develop a 150 megawatt (MW) solar photovoltaic (PV) facility and associated infrastructure within the Mining Right area (the Project). The Project will be located on an existing waste rock dump (WRD) on portion 2 and the remaining extent (RE) of the Farm Sacha 468, and Portion 1 of the Farm Sims 462.

Project motivation

Anglo American is committed to being part of the solution to climate change and aim to play their part in maintaining global temperature rise to below 2°C as called for by the Paris Agreement. South Africa is particularly vulnerable to climate change impacts and have developed a strategic response as set out in the Climate Change Bill (2018). Anglo American has committed to achieve carbon neutrality on Scope 1 and 2 emissions and to reduce their Scope 3 emissions by 50% by 2040, across their operations. One way to achieve this is through FutureSmart Mining™, an Anglo American innovation-led approach to sustainable mining. Integral to FutureSmart Mining™ is their Sustainable Mine Plan, designed to tackle the most pressing environmental, social and governance challenges such as climate change. The Anglo American Green House Gas emission reduction ambitions are built on the following1:

- Scope 1: Deployment of FutureSmart Mining™ is central to reducing energy demand and delivering the step-change innovation required for avoiding emissions, including the capture and use of fugitive methane.
- Scope 2: The procurement and rapid roll-out of renewable power supply, including through embedded generation where necessary.

As part of the Anglo group and in alignment with the Anglo “FutureSmart Mining” and “Carbon Neutrality Energy Strategy”, Kumba has committed to reducing their carbon footprint. The development of the solar PV facility will allow for security of power supply, reduced costs of electricity and reduced carbon emissions. An added benefit to the development of the Project is the repurposing of otherwise unproductive land (WRD), into land which is economically productive again. Kumba sees this strategy as an enhancement to the disturbed area and an alternative vision for the closure of the WRD which will allow for a more constructive end land use.

[1] Anglo American Climate Change Report 2021.

Project components

The Sishen Mine currently receives power from Eskom, through the Ferrum substation. In an effort to reduce their operational carbon emissions, Kumba proposes to develop the 150 MW solar PV facility and associated infrastructure on the G80 WRD. The Project will cover an area of approximately 340 ha and includes the development of the following infrastructure:

- ground mounted solar PV panels;
- trackers or fixed tilt mounting structures;
- inverter stations;
- a switchyard;
- electrical cables;
- substations;
- battery energy storage system (BESS);
- transformer bays;
- transmission lines;
- operation and maintenance buildings;
- water storage and conservancy tanks;
- site camp and laydown area; and
- access and maintenance roads.

An estimated 300 000 PV panels will be ground mounted utilising either tracking or fixed-tilt technology. The height of the panels is not expected to exceed 8 m. Inverter stations will be developed and located within the area of the solar PV facility. Generated power will be transmitted by electrical cables for collection at an onsite substation of up to 190 MVA within the solar PV facility for distribution. The output capacity of the BESS will reach up to 100 MW and the storage capacity will reach 400 MWh (at 4 hours storage). The BESS will be located within the area of the substation with a total area of up to 8.7 ha.

All generated power will be transmitted via transmission lines up to a capacity of 132 kV (either overhead or underground) within a transmission corridor (area of 100 ha, approximately 4 km in length and 255 m wide) to the Pit Substation 2. Water required for the proposed Project will be sourced from the Sishen mining operations. The Project also includes the establishment of water storage and conservancy tanks for storage purposes.

Construction phase

The construction activities include (but is not limited to) the following:

- earthworks (including foundations, trenches, and berms) in accordance with the approved civil/structural engineering drawings;
- establishment of access road; and
- the construction of a solar PV facility and BESS, substation, transmission lines and related support infrastructure (which includes the erection of associated structures such as the operation and maintenance buildings, site camp, fencing, concrete and steel work).

The duration of the construction phase of the Project is anticipated to be approximately 12 - 18 months. A staff complement of approximately 300 individuals would be required for the construction phase, hereby providing skilled and unskilled job opportunities. Procurement opportunities would be sourced locally, as far as possible.

Power for construction activities will be sourced from Eskom through the existing Sishen mining operations and supplemented by diesel generators where required. The construction phase will entail the establishment of ancillary infrastructure including a workshop, storage areas, temporary offices and ablution facilities for construction, permanent ablution facilities and a security hut at the entrance.

An existing access road, located to the north of the G80 rock dump will provide a separate, secure and dedicated access to the solar PV facility separate from the mine's main access. The road of approximately 5 km in length will require upgrading to a width of 50 m for the main access.

Operational phase

Typical activities will include the operation and maintenance of the facility. The duration of the operational phase of the Project is anticipated to be approximately 30 years. During operation, the facility will generate power for the Sishen operations and will create and maintain approximately 30 jobs.

Rehabilitation

Rehabilitation of the Project site will comprise of the following:

- Covering the dump with a layer of competent material e.g., calcrete on top of the clay layer of the WRD.
- On top of the competent layer, another thin layer of either topsoil or a type of gravel.

- Seeding of the entire area or topsoiled, for very light vegetation as it is on top of the WRD. It should be noted that seeding will only take place after the life of the solar PV facility.

The proposed development requires an Environmental Authorisation (EA) from the Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform (DAEARDLR) as the Competent Authority. Given that the Project triggers listed activities and due to the location of the Project on "existing infrastructure" (WRD). The definition of existing infrastructure was defined by the Department of Forestry, Fisheries, and the Environment (DFFE) as attached in Appendix 12.

The project will exceed a generation capacity threshold of more than 20 MW of electricity from a renewable resource as stipulated in Activity 1 of the EIA Regulations Listing Notice 2 of 2014. However, due to the interpretation of existing infrastructure (Appendix 12), the Project is excluded from a full Scoping and EIA process as stipulated in terms of the National Environmental Management Act (No 107 of 1998) (as amended) (NEMA) and Environmental Impact Assessment (EIA) Regulations (GNR 982, as amended) (EIA Regulations, 2014). As such, the environmental assessment will comprise of a Basic Assessment (BA) process as stipulated in terms of the NEMA and the EIA Regulations (2014).

In terms of the National Water Act, 1998 (No. 36 of 1998) and the Regulations Regarding the Procedural Requirements for Water Use Licence (WUL) Applications and Appeals (GNR 267 of March 2017), a General Authorisation process must be followed with the Department of Water and Sanitation (DWS) as the Competent Authority.

1.3 Project Scope

The purpose of this report is:

- To determine the Category of Development and Level of Assessment as outlined by Oberholzer (2005) and with this information undertake an appropriate VIA;
- To describe the receiving environment in terms of regional context, location and environmental and landscape characteristics;
- To describe and characterise the proposed project and the receiving environment in its envisioned future state;
- To identify the main viewsheds through undertaking a viewshed analysis, based on the proposed height of infrastructure components and the Digital Elevation Model (DEM), as a mechanism to identify the locations of potential sensitive receptors sites and the distance of these receptor sites from the study area, if necessary;

- To identify and describe potential sensitive visual receptors residing at or utilising receptor sites;
- To establish receptor sites and identify Key Observation Points (KOPs) from which the proposed project will have a potential visual impact, if necessary;
- To prepare a photographic study and conceptual visual simulation of the proposed project as the basis for the viewshed identification and analysis, if necessary;
- To assess the potential visual impact of the proposed project from selected receptors sites in terms of standard procedures and guidelines; and
- To describe mitigation measures to minimise any potential visual impacts.

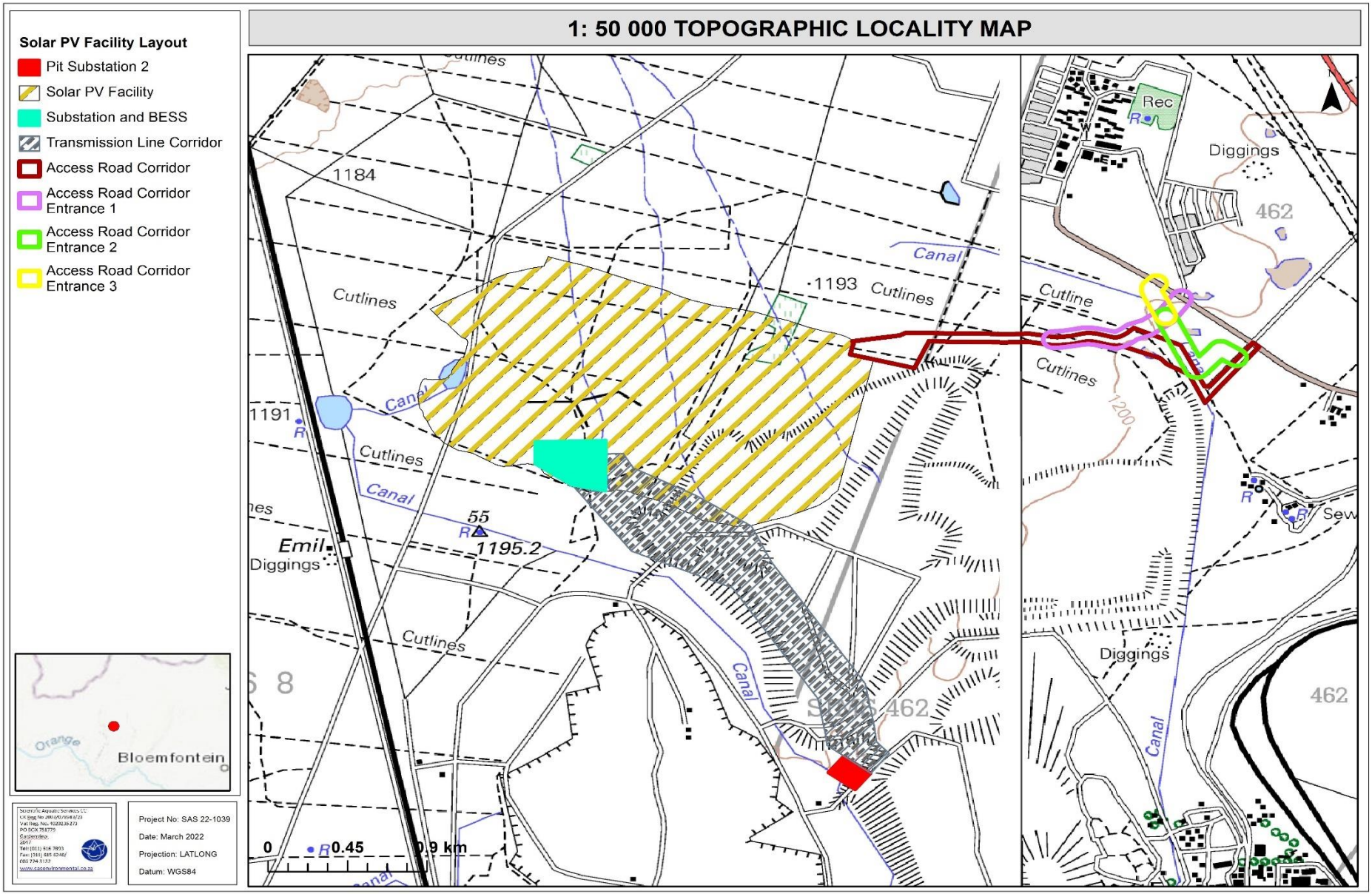


Figure 1: 1:50 000 Topographical map depicting the location of the proposed Solar PV facility and associated infrastructure in relation to the surrounding region.

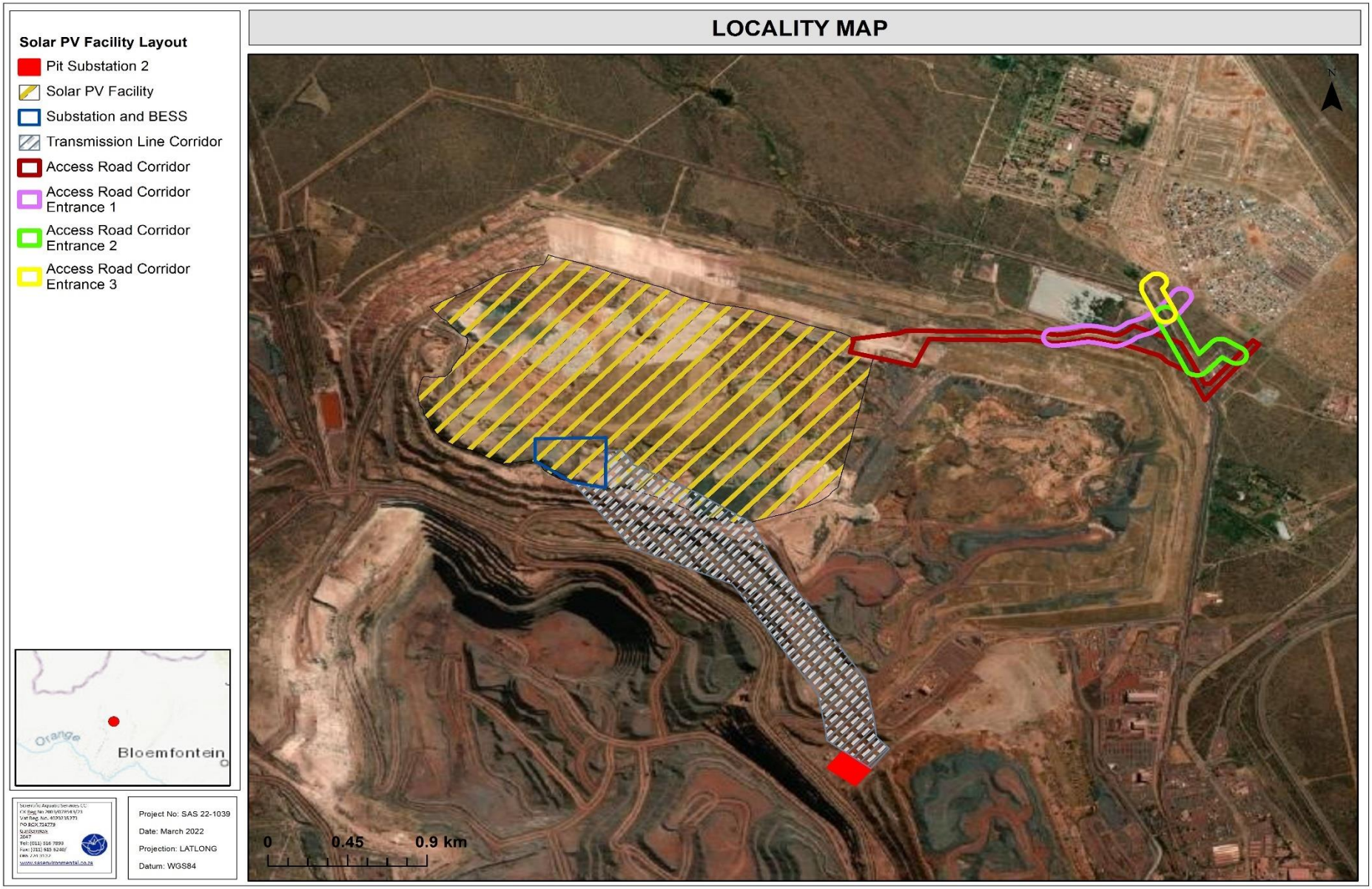


Figure 2: Digital satellite image depicting the location of the proposed Solar PV facility and associated infrastructure in relation to the surrounding region.

1.4 Principles and Concepts of VIAs

Visual resources have value in terms of the regional economy and inhabitants of the region. Furthermore, these resources are often difficult to place a value on as they normally also have cultural or symbolic values. Therefore, VIAs are to be performed in a logical, holistic, transparent and consistent manner. Oberholzer (2005) identifies the following concepts to form an integral part of the VIA process:

- Visual resources include the visual, aesthetic, cultural and spiritual aspects of the environment, which contribute toward and define an area's sense of place;
- Natural and cultural landscapes are inter-connected and must be considered as such;
- All scenic resources, protected areas and sites of special interest within a region need to be identified and considered as part of the VIA;
- All landscape processes such as geology, topography, vegetation and settlement patterns that characterise the landscape must be considered;
- Both quantitative criteria, such as 'visibility' and qualitative criteria, such as aesthetic value or sense of place must be included as part of the assessment;
- VIAs must inform the BA process in terms of visual inputs; and
- Public involvement must form part of the process.

The guideline furthermore recommends that the VIA process identifies the Best Practicable Environmental Option (BPEO) based on the following criteria:

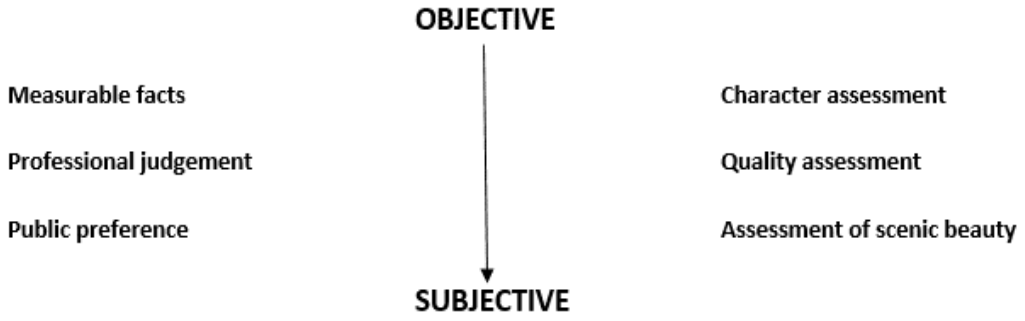
- Long term protection of important scenic resources and heritage sites;
- Minimisation of visual intrusion on scenic resources;
- Retention of wilderness or special areas intact as far as possible; and
- Responsiveness to the area's uniqueness, or sense of place.

1.5 Assumptions and Limitations

- No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005);
- Distance and terrain plays a critical role when assessing visual impacts of an area. Since the proposed Solar PV facility is located on top of the existing waste rock dump, it was deemed necessary to identify all potential sensitive receptors within a 5 km

radius, on a desktop-level, which would then be verified during the field assessment. The 5 km radius can be considered the visual assessment zone. It should be noted that the visibility of an object decreases exponentially the further away the observer is from the source of impact. The proposed solar PV facility will not be built to the edge of the waste rock dump therefore due to the steep angle of repose any observer on the ground is unlikely to view the proposed solar PV facility. Additionally, the bushveld vegetation limits the view of the observer to their immediate surroundings, not allowing one to see across the vistas. Consequently, it was deemed unnecessary to visit all potentially sensitive receptors within the visual assessment zone, thus focus was placed on visiting sensitive receptors within a 2 km radius to determine the level of visual intrusion on these receptors from the study area. Some sensitive receptors situated further than 3 km were however visited to determine the level of visual intrusion on these receptors from the proposed solar PV facility components;

- Due to a lack of guidelines for specialist visual impact assessments as part of the BA process within the Northern Cape Province, the "Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process" (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning, was used;
- All information relating to the proposed project as referred to in this report is assumed to be the latest available information. Additionally, best practice guidelines were taken into consideration and utilising the maximum expected heights of the infrastructure and the placement thereof in viewshed calculations as a precautionary approach; and
- Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable, as outlined in the diagram below (The Landscape Institute and Institute of Environmental Management and Assessment (LI IEMA, 2002).



2. LEGAL, POLICY AND PLANNING CONTEXT FOR VIAs

Oberholzer (2005) indicates that current South African environmental legislation governing the EIA process, which may include consideration of visual impacts if this is identified as a key issue of concern, is the National Environmental Management Act (NEMA) (Act 107 of 1998). This includes the 2014 NEMA EIA regulations and relevant listing Notices as follows:

- EIA Regulations 2014;
- EIA Regulations Listing Notice 1 of 2014;
- EIA Regulations Listing Notice 2 of 2014; and
- EIA Regulations Listing Notice 3 of 2014.

In addition, the following acts and guidelines are applicable (Oberholzer, 2005):

The National Environmental Management: Protected Areas Act (Act No. 57 of 2003)

This act was developed in 2003 for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes

- Restricted activities involving national and protected parks:
- 48(1) Despite other legislation, no person may conduct commercial prospecting, mining, exploration, production, or related activities–
  (a) in a special nature reserve, national park, or nature reserve
  (b) in a protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs; or
  (c) in a protected area referred to in section 9(b), (c) or (d).

According to the South African Protected Areas Database (SAPAD, 2021)[2], the Kathu Forest Nature Reserve is located approximately 7 km north of the study area and the Sishen Nature Reserve is located approximately 9,5km south of the study area. The South African Conservation Areas Database (SACAD, 2021)[3] and the National Protected Areas Expansion Strategy (NPAES, 2009), indicates no additional protected areas or conservation areas are indicated within 10 km of the study area.

[2] **SAPAD (2021):** The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

[3] **SACAD (2021):** The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

The National Heritage Resources Act (Act No. 25 of 1999)

The purpose of the Act is to protect and promote good management of South Africa's heritage resources, and to encourage and enable communities to nurture and conserve their legacy so it is available to future generations.

The Advertising on Roads and Ribbons Act (Act No. 21 of 1940)

Visual pollution is controlled, to a limited extent, by the Advertising on Roads and Ribbons Act (Act 21 of 1940), which deals mainly with signage on public roads.

Municipal Systems Act (Act 32 of 2000)

In terms of the Municipal Systems Act (Act 32 of 2000), it is compulsory for all municipalities to initiate an Integrated Development Planning (IDP) process in order to prepare a five-year strategic development plan for the area under their control. The IDP process, specifically the spatial component is based in certain areas and provinces on a bioregional planning approach to achieve continuity in the landscape and to maintain important natural areas and ecological processes. The study area is situated within the John Taolo Gaetsewe District Municipality and the Gamagara Local Municipality. The John Taolo Gaetsewe District Municipality IDP for 2017/22 states that solar energy is an alternative form of energy that is looked at for this district.

Renewable Energy Development Zones (REDZ)

A Strategic Environmental Assessment (SEA) was undertaken by the former Department of Environmental Affairs (DEA), which is now known as Department of Forestry, Fisheries and the Environment (DFFE), in order to identify geographical areas most suitable for the rollout of wind and solar PV energy projects and the supporting electricity grid network. These areas are referred to as Renewable Energy Development Zones (REDZs), in which development will be incentivised and streamlined. The study area is currently not located within a REDZ, however it is located within the northern corridor for overhead powerlines, indicating that power projects are taking place within the vicinity.

According to the South African Renewable Energy EIA Application Database (REEA, 2021) the study area is surrounded by several applications for solar facilities which have been approved (Figure 3).

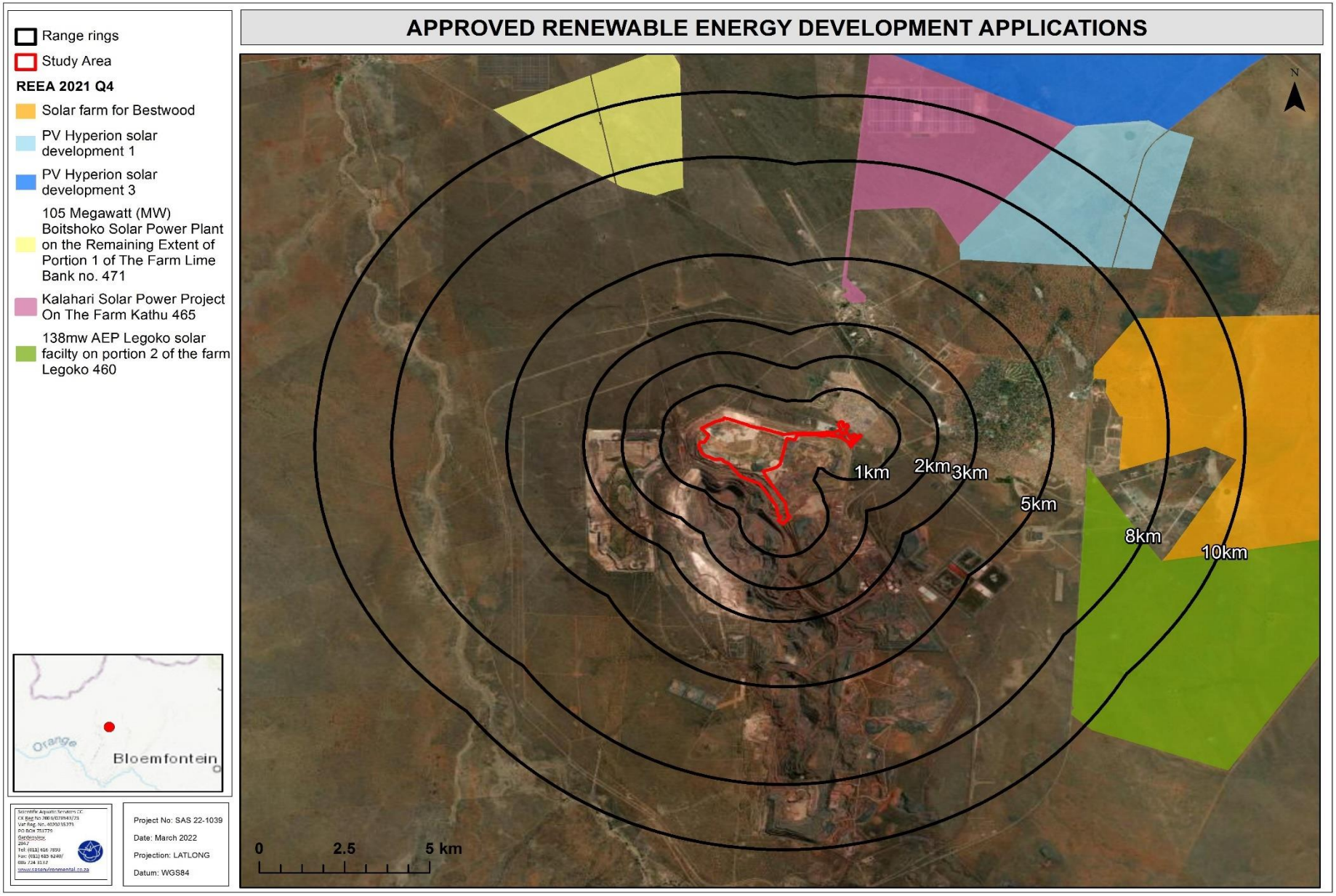


Figure 3: Map indicating approved renewable energy developments located within a 10 km radius of the study area (REEA, 2020).

Other

- According to the Northern Cape Provincial Spatial Development Framework (NCPSDF, 2012) the renewable energy structures form part of the region's economic development;
- Visual and aesthetic resources are also protected by local authorities, where policies and by-laws relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc. have been formulated; and
- Other decision-making authorities such as the Department of Water and Sanitation (DWS) and relevant authorities of the local and district municipality, in terms of their particular legislative frameworks, may also require VIAs to support informed decision-making.

3. METHOD OF ASSESSMENT

3.1 Desktop Assessment

The method of assessment for this report is based on a spatial analysis of the study area and the surrounding areas, using Geographic Information Systems (GIS) such as Planet GIS, ArcGIS, Global Mapper as well as digital satellite imagery, photographs, various databases and all available data on the planned infrastructure. The desktop assessment served to guide the field assessment through identifying preliminary areas of importance in terms of potential visual impacts.

The desktop study included an assessment of the current state of the environment of the area including the climate of the area, topography, land uses and land cover with data obtained from the websites of the South African National Biodiversity Institute (SANBI) and the Agricultural Research Council (ARC). All databases used were published within the last 5 years and contain up to date and relevant information.

During the desktop assessment, which took place prior to and in preparation of the field assessment, the 1:50 000 topographical map, as well as high-definition aerial photographs from Google Earth Pro were used to identify the dominant landforms and landscape patterns. These resources together with digital elevation data were utilised to establish a parameter within which potential sensitive receptors were to be identified via Google Earth Pro. These parameters can henceforth be referred to as the visual assessment zone. Since the proposed solar PV facility will not be built to the edge of the waste rock dump, the angle of repose results in the observer being unlikely to view the proposed solar PV facility. Consequently, the visual

assessment zone encompassed a 5 km radius to determine the level of visual intrusion on these receptors from the study area. The potentially sensitive receptors identified within the visual assessment zone during the desktop assessment will be verified during the field assessment.

Detailed assessment methods used to determine the landscape characteristics of the receiving environment and potential visual impacts of the project are outlined in the relevant sections below as well as in Appendices B – K.

3.2 Field Assessment

A field assessment was undertaken during the autumn season on the 19th of March 2022, which is considered to be a suitable time period during which to conduct the VIA, as the bushveld vegetation associated with the area does not differ considerably between the seasons.

The field assessment included a drive-around and on-foot survey of the study area and in the visual assessment zone (5 km radius) and a drive-around of the surrounds to determine the visual context within which the proposed project is to be developed. The 5 km radius can be considered the visual assessment zone. The visibility of an object decreases exponentially the further away the observer is from the source of impact. The bushveld vegetation limits the view of the observer to their immediate surroundings, not allowing one to see across the vistas. As such the visual assessment zone was reduced to 2 km. Several sensitive receptors situated further than 3 km were however visited to determine the level of visual intrusion on these receptors from the proposed solar PV facility components. Points from where the study area were determined to be visible were recorded (making use of Global Positioning Systems (GPS) to confirm these aesthetically sensitive viewpoints and potential sensitive visual receptors in relation to the proposed project.

4. RESULTS OF INVESTIGATION

4.1 Public Involvement

A public involvement process will be initiated as part of the Environmental Authorisation process, whereby stakeholders are invited to provide input concerning the proposed development. Should any comments be received during this process, the comments will be addressed and the report will be amended.

4.2 Development Category and Level of Impact Assessment

Through application of the VIA methods of assessment as presented in Appendix B, it was determined that the proposed project can be defined as a Category 5 development, which includes renewable energy structure. According to Oberholzer (2005), a high visual impact is therefore possible, with potential intrusion on farmsteads, the town of Kathu and the Kathu Forest Nature Reserve and may potentially lead to a significant changes in the scenic resources and visual character of the area. In line with the above, a Level 4 Assessment is therefore required.

The proposed solar PV facility will be placed on the existing WRD within the existing Sishen Mine, which is situated in a sparsely populated area where sensitive receptors are limited and sparse, and all surrounding farms are owned by SIOC, as such mining workers are occupying the majority of the farmsteads in the surrounding area. It is important to note that visual impacts are only experienced when there are receptors present to experience the impact, in this context there are sparse receptors present, thus there are not likely to be many visual impacts experienced. Furthermore, with the solar PV facility situated on top of the WRD and away from the edge of it, the likelihood of receptors observing the solar PV facility is low. The bushveld vegetation of the surrounding area further limits the view of the observer to the immediate vicinity. A level 2 assessment is therefore undertaken as opposed to a level 4 assessment.

4.3 Description of the Receiving Environment

To holistically describe the receiving environment, this section of the report aims to determine the intrinsic value of the receiving landscape including aspects of the natural, cultural and scenic landscape, taking both tangible and intangible factors into consideration. The table below aims to describe the particular character, uniqueness, intactness, rarity, vulnerability and representability of the study area within its existing context. General views of the landscape associated with the study area and surrounds with respect to the slightly undulating topography, the mountainous backdrop, the bushveld area and the overall character are indicated in the table below.

Table 1: Summary of the visual assessment of the study area and surrounds.

<table>
<tr><td colspan="4">General view of the study and surrounding area, the short continuous vegetative cover, with patches waste rock dump sight, other dumps and mountainous terrain in the distance. The far right photograph is the general view of the proposed access road corridor going up the side of the WRD, indicated by the red line.
    </td></tr>
<tr><td>Climate (Appendix C)</td><td>As a result of climate variations throughout the year, the appearance and perception of the landscape within and surrounding the study area changes with the seasons. The study area and its surrounds appear muted during the winter months, while it appears more vibrant with various colours during the summer months. Atmospheric dust concentration is higher during the dry winter months due to drier soil conditions and lower rainfall, resulting in atmospheric haziness, which will affect the visibility of surrounding landscape. Dust from dumping of waste rock in the vicinity on a windy day could lead to dust suspended in the air for quite some time before it settles again. The figures below are taken at another mine in the Northern Cape just after blasting took place, and the picture on the right was taken half an hour after the blasting event to illustrate this point.
   </td><td>Landscape Character (Appendix E)</td><td>The landscape character associated with the study area’s immediate surroundings can be described as bushveld: relatively flat terrain surrounded by the existing WRD, the opencast pit and open bushveld. Key aesthetic aspects of the landscape associated with the study area and the surrounding region are described in Appendix E. The existing waste rock dumps and stockpiles associated with the various mines in the Gamagara Corridor form part of the skyline. As it is anticipated that the proposed Solar PV facility will not be developed on the edge of the WRD, the visual impact is expected to be low to negligible, as with the angle of repose an observer on the ground will not likely have line of sight of the proposed solar PV facility. The town of Kathu is already accustomed to mining activities, hence the proposed renewable energy activities will not introduce discordant elements into the landscape, thus not having a significant impact on the town of Kathu. The natural landscape is considered simple with the vegetation composition being homogenous within the surrounding area, however with the mining landscape it is considered complex. The proposed solar facility is expected to have a low to negligible impact on the landscape character within the region.</td></tr>
</table>

Land Use and visual receptors (Appendix D)	The study area is situated on top of the WRD, which is located in a relatively flat area, adjacent to other existing waste rock dumps and the open cast pit area. There is a mountainous backdrop in the greater region (approximately 20 km east and 28 km west of the study area). The area is dominated by open bushveld with limited disturbance. The dominant land use of the municipality is mining (e.g., Sishen Mine, Kumba Iron Ore Mine; Tshipi Mine, Black Rock Mine) and agriculture. The arid nature of the climate restricts stocking densities which has led to relatively large farms across the area, resulting in the area being sparsely populated. The town of Kathu is the only major town within a 10 km radius (Figure 4). According to the SAPAD (2020), the Sishen Nature Reserve and Brooks Nature Reserve are located within a 10 km radius of the study area. Permanent residents such as farmers and farm workers residing in the area and people at their place of work are sensitive receptors. As noted the sparse farmsteads located in the vicinity of the study area are owned by mining companies, and are accustomed to the mining activities in the area therefore the sensitivity of residents may be considered moderate. Additionally, people residing in the town of Kathu are accustomed to the various mines in the vicinity, thus residents of Kathu are accustomed to a mining setting. People at their place of work are likely to focus on the activities at hand and not the surrounding environment as such workers are considered low sensitive receptors. Since the study area is situated within a remote area, the only main road within the area is the N14 which is predominantly utilised by mine and farm workers and people traveling between Johannesburg and Springbok. Furthermore, the R325 and several farm roads are present in the area, which are utilised infrequently and predominantly by mine workers. Due to their momentary views and experience of the receiving environment motorists are classified as low sensitive receptors.	**Visual Absorption Capacity (VAC) (Appendix F)**	**Medium (Score 8)** According to the calculation the VAC of the area is considered moderate, indicating that the proposed PV panels will be absorbed in the area. Since the proposed PV panels will be placed on top of the WRD, the potential level of visual intrusion on the landscape and is expected to be low to negligible. Furthermore, the bushveld vegetation of the larger region, the sparse receptors and distance thereof, and the existing waste rock dumps and mining infrastructure, will serve to lower the visual intrusion.
		Landscape Quality (Appendix G)	**Low (Score 9)** The landscape associated with the study area and surroundings provide limited topographical variety since the terrain is relatively flat with limited natural distinguishing topographical features. The landscape associated with the study area is not considered scarce as it is representative of the greater region and common in the area. The existing waste rock dumps and stockpiles form part of the skyline and landscape, and since the area is classified as a mining district where renewable energy is sought after, thus the proposed solar facility will not lower the quality of the landscape in a significant manner.
		Landscape Value (Appendix H)	With reference to Appendix I, the study area is situated within the Gamagara Corridor, which is the mining belt of the Northern Cape, thus the study area will not lower the value of the area, it will add to the socio-economic development of the municipality. Since the mine has been in operation since 1953 the receptors are accustomed to the mining infrastructure, as such the proposed PV panels will have a low visual intrusion on the viewer.
		Sense of Place	Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. It is created by the land use, character and quality of a landscape, as well as by the tangible and intangible value assigned thereto. During the field assessment it was evident that even though the study area is situated on top of the WRD and adjacent to the opencast mining activities the study area itself can be described as calm in terms of human movement within the study area, with limited disturbance. The sense of place is however not unique to the study area as it extends to the larger region. The proposed solar PV facility will affect the sense of place of the area, during the construction phase of the proposed development, shifting it from calm and tranquil to busy with vehicular movement in and out of the area. Once the proposed solar facility is operational the sense of place will move back to calm and tranquil. It is also important to note that the proposed development activities will be confined to a localised area.

Topography	The proposed solar facility is situated on top of the WRD as such the topography of the area has been altered significantly. With that said the terrain on top of the WRD is relatively flat. The area is surrounded by mountains in the larger region. Limited distinguishing topographical features in the form of prominent hills or outcrops are present within or around the study area. The existing waste rock dumps of the Sishen Mine form prominent features within the landscape and form part of the skyline of the area. Please refer to Figures 5 and 6 for the elevation and slope models of the area.	**Night Time Lighting (Appendix I)**	The study area in its current state contains no infrastructure and thus no lighting, however the Sishen Mine and the town of Kathu are considered significant sources of night time lighting. The lighting environment of the region is therefore considered suburban with medium district brightness (Zone E3). According to Bortle's Scale the study area falls within a Class 5 area (suburban) where there is encircling light pollution. Furthermore, it is evident that on a cloudy night the lights will be visible in the distance, and is brighter than the sky. Development of the proposed solar PV facility components may potentially be a source of light pollution during the construction and operational phases, due to security lighting on the perimeter fence and at the buildings. The powerlines will however have no source of lighting as such having no effect on night time lighting of the area. Overall, the impact significance of potential night time lighting is expected to be low and will be limited to a local area.
Vegetation Cover (Appendix C)	The study area falls within a single biome and bioregion according to Mucina & Rutherford (2012) namely Savanna Biome and Eastern Kalahari Bushveld Bioregion. The Kathu Bushveld vegetation type characterises the region (Appendix I). The vegetation established on top of the WRD is not representative of the Kathu Bushveld, as the vegetative cover predominantly comprises graminoid species that are not of the same structure and composition as the surrounding natural area. The bushveld vegetation of the area surrounding the mine does however limit the view of the observer to the immediate surroundings, therefore the observer is not able to see across the broad vistas. Furthermore, the farmsteads have clumped and dense trees in the vicinity thus confining their views.		

Viewshed Analysis

From the viewshed analysis, it is evident that the proposed powerline will theoretically be observed from the majority of the town of Kathu, due to the relatively flat terrain. The field assessment indicated that the majority of the town of Kathu will not have such a clear line of sight towards the powerline, due to the powerline situated within the active mining area. Furthermore due to the permeability of the powerlines it will be difficult to discern in the distance and is further screened by the vegetation of the region.

The viewshed analysis of the proposed solar PV facility, indicates any receptors located north, north east, and north west are likely to observe the proposed solar PV facility while receptors to the south, south west and south east will not observe the proposed solar PV facility due to the existing dumps associated with the Sishen Mine. The viewshed analysis further indicates that large portions of Kathu are likely to observe the solar PV facility, however the field assessment indicated that the proposed solar PV facility will not be visible from vantage points within Kathu, mostly due to the solar PV facility not being developed up to the edge of the WRD and the steep slopes of the WRD.

It is however important to note that the viewshed analysis does not take into account the vegetation and existing anthropogenic structures of the area, therefore the field assessment displays a more accurate outcome of the visual intrusion and visibility of the proposed project on the receiving environment. Therefore, taking the VAC (vegetation and topography) of the surrounding environment into consideration, the study area will not be highly visible to sensitive receptors situated further than 1 km. The study area is therefore considered to be in the low visibility zone to any receptors situated further than 1 km, predominantly due to the combined effects of the proposed development situated on top of the WRD and the solar PV facility not being developed to the edge of the WRD. Figures 7 and 8 below indicates the viewshed analysis.

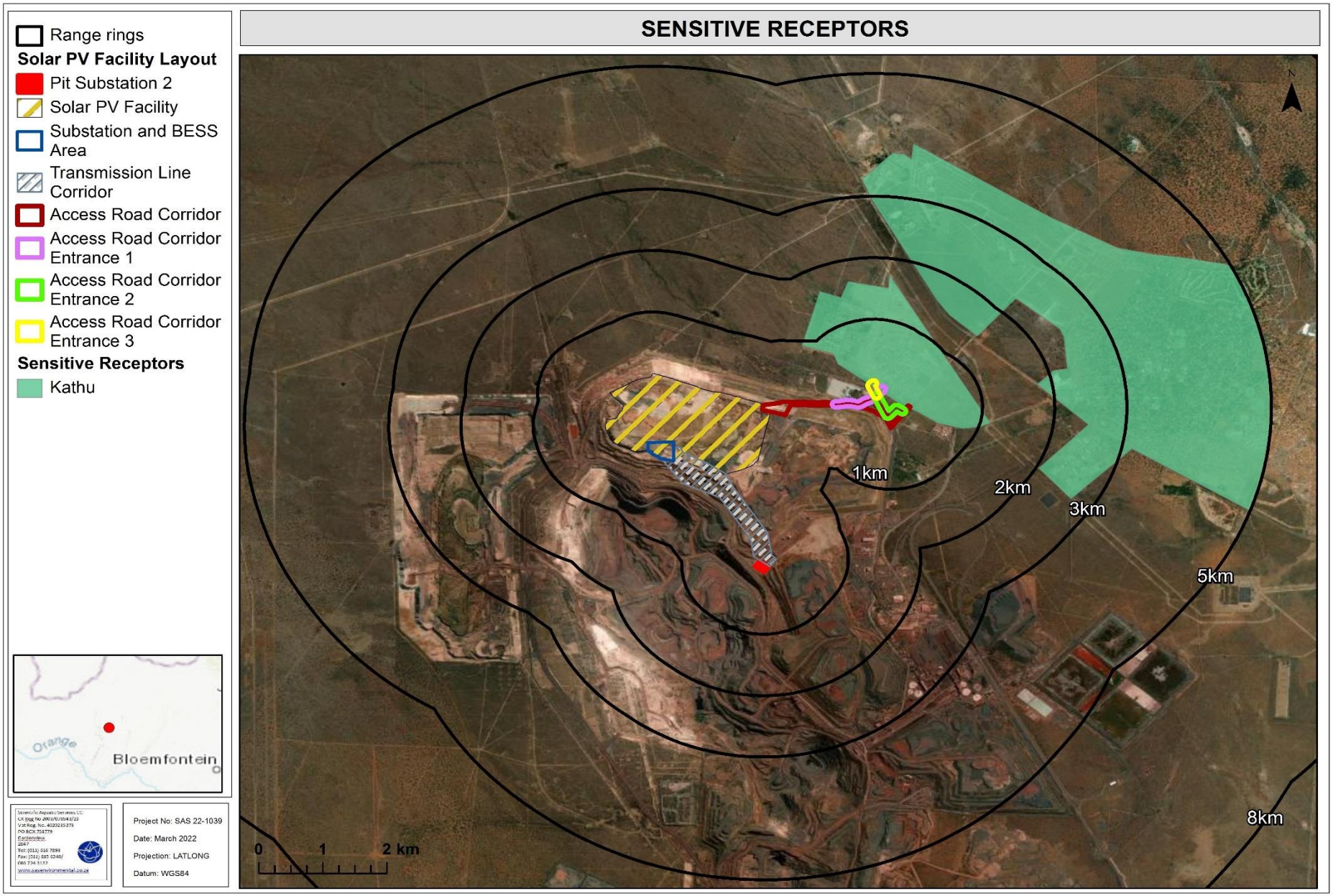


Figure 4: Map indicating the location of sensitive receptors within 5 km of the proposed Solar PV facility and associated infrastructure.

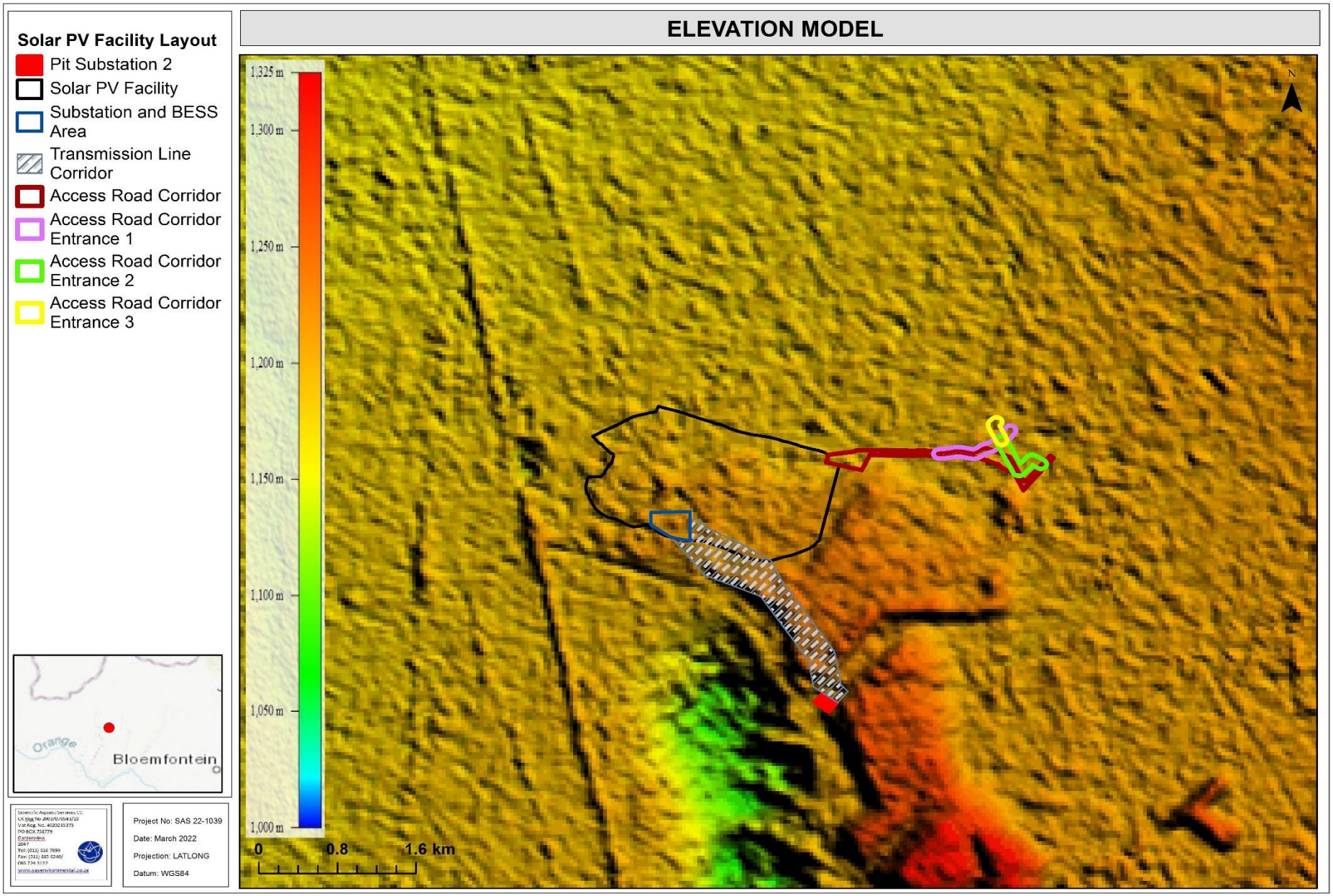


Figure 5: False colour elevation rendering depicting the topographical character of the study area.

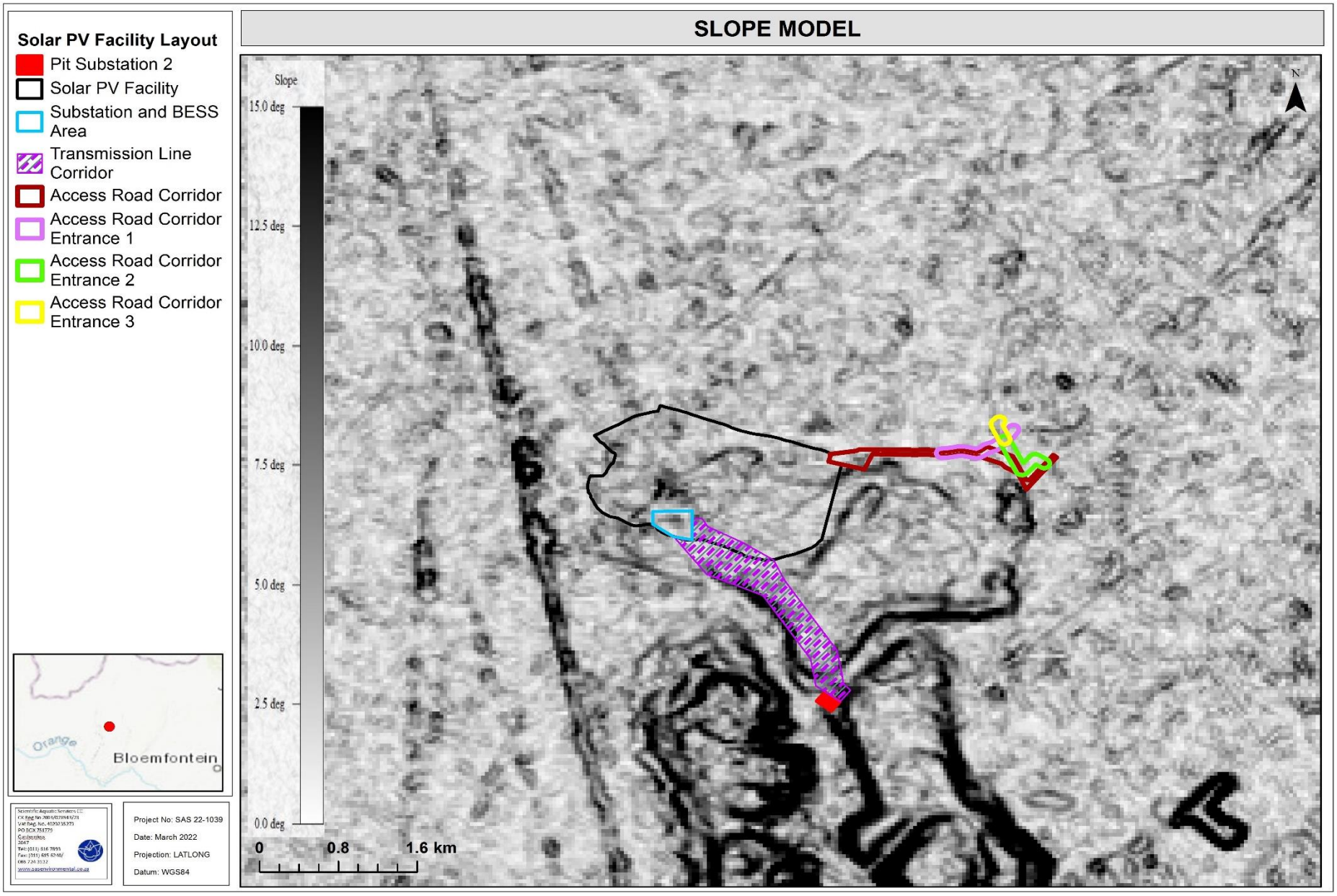


Figure 6: Monochromatic map indicating the general relief associated with the study area.

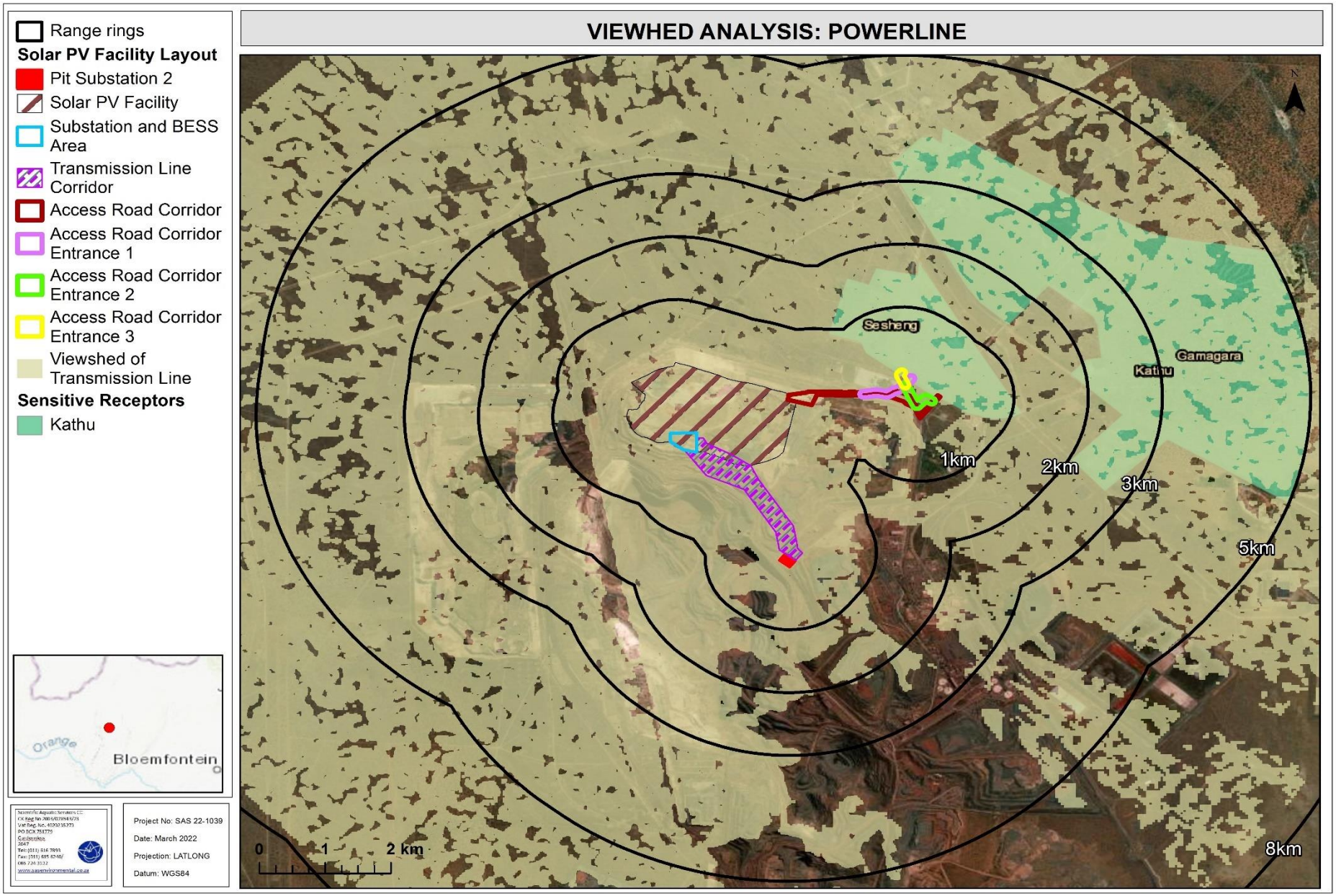


Figure 7: Viewshed analysis of the proposed transmission line associated with the proposed solar facility.

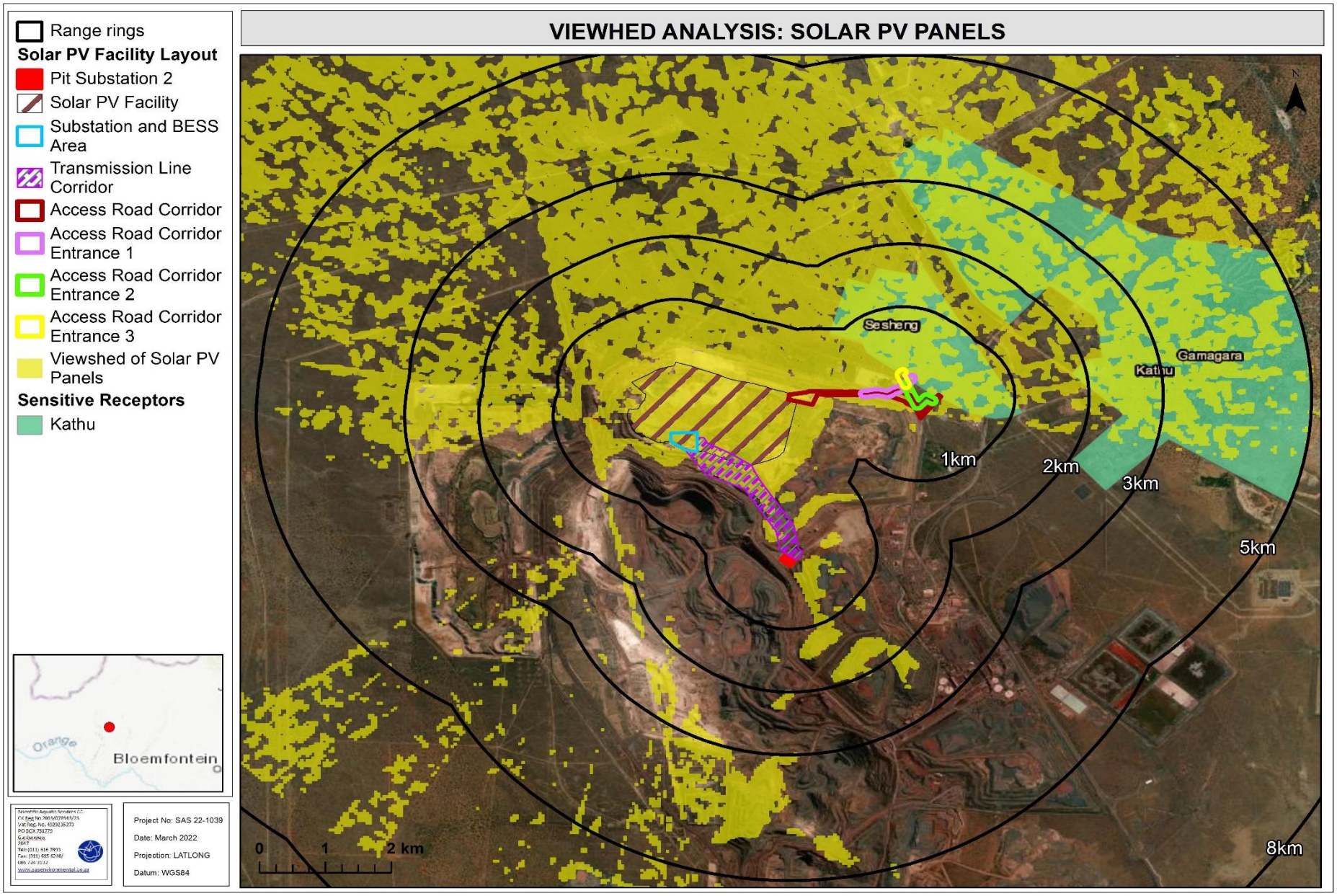


Figure 8: Viewshed analysis of the proposed solar PV panels associated with the proposed solar PV facility.

The figures below indicate the view of the study area from specific viewpoints within the surrounding area. With the limited receptors in the vicinity, the viewpoints are located to the north, east and south of the study area. As these receptors (town of Kathu and N14 road) are in view of the Sishen Mine, they are accustomed to an anthropogenically altered environment, as such the visual impact associated with the proposed solar facility will therefore not be as significant to them. Since the proposed solar PV facility are situated on top of the WRD the likelihood of receptors experiencing possible glint and glare is low to negligible, as it is at a higher elevation and observers have to look up at the WRD.

Figure 9: View from the Sesheng district within Kathu, approximately 1,4 km north east of the study area. The existing WRD is visible in the distance, and considering that the proposed solar PV facility will not be situated on the edge of the WRD, the likelihood of the proposed solar PV facility being visible is low, therefore the visual intrusion is low. The proposed road may be visible however it is an existing dirt road utilised by trucks as such it is not a new impact.

Figure 10:General view from the parking lot at the Sishen Airport, the existing WRD is barely visible from this vantage point, as such the proposed solar PV facility is not likely to be distinguishable at this distance.

Figure 11: View from a farmstead located approximately 11 km north west of the study area. The surrounding bushveld vegetation limits the view of the observer to the immediate vicinity, rendering no possible visibility of the proposed solar PV facility.

Figure 12: View from the edge of Kathu approximately 6 km south east of the study area. Even though the WRD is visible the proposed solar PV facility are located further north on the WRD, hence from this viewpoint the proposed solar PV facility will not be visible.

5. IMPACT ASSESSMENT

The impact assessment was based on the proposed layout as provided by the proponent. As the proposed PV panels are located on top of the WRD associated with and adjacent to the opencast pit of the Sishen Mine, the potential visual impact on the sparse receptors in the vicinity are considered low. Furthermore, the proposed linear developments such as the access roads and transmission line and other associated infrastructure (conservancy tank, substation, and temporary water storage) will have an insignificant visual impact on the receiving environment, as it is located in the active mining area and the proposed road is an existing gravel road that is used by the trucks.

Feedback from international practice has indicated that the installation of solar PV facilities on abandoned / rehabilitated mine dumps is one of the best environmental and economical solutions (Al Heib and Cherkaoui, 2021). When installing the solar PV facility however different environmental, technical, and economic criteria are identified. The ground movement and combustion hazards in the dumps appear to be the main constraints and limitations for the installation of the solar PV facility (Al Heib and Cherkaoui, 2021). Combustion is however not a risk for material of the nature associated with Sishen waste rock.

Since there are limited lighting sources associated with the proposed development, and with the significant light source from the Sishen Mine, the contribution to light pollution and skyglow is negligible. Based on literature review, glint and glare is only likely to be experienced when the observer is at a higher elevation than the proposed solar PV facility and the degree to which it is tilted. For example the glint and glare from tracking panels with back tracking towards ground-based receptors are most common when the panels are flat in the morning/evening (LOGIS, 2021). This is when the larger incidence angle (angle of incoming light) yields more reflected light. Therefore, since the proposed solar PV facility are located on top of a WRD, the ground-based receptors are located lower than the solar PV facility, therefore the sensitive receptors in the area will not experience glint and glare due to the 0° tilt (lying flat) of the panels in the mornings. The observers would theoretically be looking at the base (underside) of the panels. Since the receptors in the area will not experience glint and glare from the proposed development, glint and glare was not taken into consideration during the impact assessment.

The potential activities that may trigger visual impacts during various phases of the proposed development activities are assessed in the tables below. The tables below present an assessment of the significance of the impacts prior to mitigation and management measures being put in place and taking into consideration the available mitigatory measures, assuming that they are fully implemented. Recommendations and mitigation measures have also been

developed which will assist in minimising the proposed project's visual impact throughout the various development phases of the project.

5.1 Impact Discussion

The table below identifies potential activities that might take place during the various phases of the proposed project, which could possibly have a visual impact on the surrounding landscape. It should be noted that the activities listed in the table below were utilised during the impact assessment as pre-mitigated impacts to ascertain the significance of the perceived impacts prior to mitigation measures. The sections below present the results of the findings for each potential impact identified.

Pre-Construction	Construction	Operational	Decommissioning
Planning and placement of PV structures and associated infrastructure up to the edge of the WRD, increasing the potential visual impact	Site clearing, including the removal of topsoil and vegetation within footprint.	Presence of the solar PV facility, in an area where renewable energy structures are present, potentially increasing the cumulative impact	Demolition and removal of infrastructure leading to dust generation, erosion and changes in the visual character of the project area.
Failure to initiate a rehabilitation plan and alien floral species control plan during the pre-construction phase may lead to further impacts on the landscape character during later development phases, especially dust suppression	Excavation for foundations of the substation and panel support structures, leading to increased dust suppression	Potential increased proliferation of alien floral species and further transformation of habitat leading to a change in landscape character	Potential ineffective rehabilitation leading to poor vegetation cover and the bare areas remaining present.
Planning of light placement and overall lighting strategy	Temporary soil stockpiles potentially leading to visual intrusion	Potential ongoing erosion and loss of topsoil leading to high visual contrast	Ongoing proliferation of alien vegetation.
	Construction and placement of PV facility components and substations	A small and periodic increase in human activity and operational vehicles especially during maintenance and cleaning of panels	Stationary and vehicle mounted lighting during the decommissioning phase.
	Construction of general surface infrastructure including access roads.	Exterior lighting around the perimeter of the study area.	
	An increase in dust and vehicular movement due to construction activities	Potential maintenance activities conducted at night.	
	Increased amount of human activity, traffic, construction vehicles, and other equipment such as excavators and cranes.	Potential dust generation leading to increased visual exposure	
	Use of security lighting during the construction phase.		

5.1.1 Impact 1: Overall visual impact on the landscape

With the proposed development located on top of the WRD, the landscape character is already significantly altered and associated with the mining industry, hence the proposed development is not likely to significantly alter the landscape character of the area. The sense of place will also not be significantly affected as the study area is associated with the active Sishen Mine, where there is continuous movement and activity taking place 24 hours a day 7 days a week. Since the visual exposure of the proposed solar PV facility are low, the visual impact thereof is considered low.

Solar Plants and associated powerlines and substations are generally experienced as having a negative impact on landscape aesthetics as it will introduce an industrial aspect to a landscape. This area is however dominated by mining activities and has industrial features present, thus the visual intrusion of the proposed solar PV facility will be moderately low. The visual environment during the construction phase, may lead to moderate levels of visual intrusion, this will however be a temporary impact as the proposed construction activities are estimated to be less than one year. Furthermore, the visual intrusion will only potentially be experienced by receptors within the immediate vicinity as the bushveld vegetation limits the view of the observer to the immediate vicinity.

It is important to note that renewable energy structures are becoming increasingly important features in the South African landscapes and an important source of electricity for the growing population of South Africa.

The significance of the impact is assessed in the table below.

Table 2: **Assessment of impact for the Construction Phase: Visual Impact on the landscape**

Issue: Impact on landscape character and sense of place		
Phases: Construction Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short Term	Short-term
Extent	Local	Local
Probability	Probable	Probable
Confidence	High	High
Consequence	Low	Low
Significance	**Low (L)**	**Low (L)**

Issue: Impact on landscape character and sense of place	
Degree to which the impact can be mitigated	Very Low. It should be noted that it is very low because the proposed impact is low already thus mitigation measures cannot reduce the visual impact any further.
Degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable	Low. The WRD is an anthropogenic feature in the landscape, hence the landscape is already altered in such a way that the resources are already permanently altered. The proposed development will thus not have an irreplaceable effect on the landscape.
Nature of cumulative impacts	Cumulative visual impacts resulting from the already altered landscape in conjunction with any approved or future renewable energy facilities (wind and/ or solar facilities) in the broader area, must be considered. Renewable energy facilities have the potential to cause large scale visual impacts and the location of several such developments in close proximity to each other could significantly alter the sense of place and visual character in the greater landscape. According to the SA REEA Database, several renewable energy applications have been approved within a 10 km radius of the study area. Powerlines and substations are relatively small developments when compared to renewable energy facilities, however they may still introduce a more industrialised character into the landscape, thus altering the sense of place.
Residual impacts	Certain infrastructure components may remain present once decommissioning has occurred, leading to a permanent alteration of the visual environment. Alien vegetation, which is likely to proliferate as a result of disturbance from development may also remain present after decommissioning, if not mitigated. Revegetation of the WRD and rehabilitation of any impacted areas have the potential to be unsuccessful, which will lead to a long term or permanent visual impact in the area. It is however unlikely that the solar PV facility will be decommissioned as the most likely scenario would be the extension of the lifespan of the solar PV facility by means of replacing individual components with newer more appropriate technology available at that time. The decommissioning phase will include measures for complying with the prevailing regulatory requirements, rehabilitation and managing environmental impacts in order to render the affected area suitable for future desirable use.

Table 3: **Assessment of impact for the Operational Phase: Visual Impact on the landscape**

Issue: Impact on landscape character and sense of place		
Phases: Operational Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short Term	Short-term
Extent	Local	Local
Probability	Possible	Possible
Confidence	High	High
Consequence	Low	Low
Significance	**Low**	**Low**
Degree to which the impact can be mitigated	Very Low. It should be noted that it is very low because the proposed impact is low already thus mitigation measures cannot reduce the visual impact any further.	

Issue: Impact on landscape character and sense of place	
Degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable	Low. The WRD is an anthropogenic feature in the landscape, hence the landscape is already altered in such a way that the resources are already permanently altered. The proposed development will thus not have an irreplaceable effect on the landscape.
Nature of cumulative impacts	Cumulative visual impacts resulting from the already altered landscape in conjunction with any approved or future renewable energy facilities (wind and/ or solar facilities) in the broader area, must be considered. Renewable energy facilities have the potential to cause large scale visual impacts and the location of several such developments in close proximity to each other could significantly alter the sense of place and visual character in the greater landscape. According to the SA REEA Database, several renewable energy applications have been approved within a 10 km radius of the study area. Powerlines and substations are relatively small developments when compared to renewable energy facilities, however they may still introduce a more industrialised character into the landscape, thus altering the sense of place.
Residual impacts	Certain infrastructure components may remain present once decommissioning has occurred, leading to a permanent alteration of the visual environment. Alien vegetation, which is likely to proliferate as a result of disturbance from development may also remain present after decommissioning, if not mitigated. Revegetation of the WRD and rehabilitation of any impacted areas have the potential to be unsuccessful, which will lead to a long term or permanent visual impact in the area. It is however unlikely that the solar PV facility will be decommissioned as the most likely scenario would be the extension of the lifespan of the solar PV facility by means of replacing individual components with newer more appropriate technology available at that time. The decommissioning phase will include measures for complying with the prevailing regulatory requirements, rehabilitation and managing environmental impacts in order to render the affected area suitable for future desirable use.

5.1.2 Impact 2: Impacts due to Night time Lighting

With the study area situated on top of a WRD located directly adjacent to the active opencast pit of the Sishen Mine, the lighting environment of the area is considered suburban with medium district brightness. Due to the nature of the project which would primarily be operational during sunlit (daylight) hours, lighting at night is not a major operational component of such facilities. Possible maintenance activities conducted at night, such as panel washing or replacement might require vehicle-mounted lights, which could contribute to light pollution. Security lights associated with the proposed solar PV facility may potentially contribute somewhat to the effects of skyglow and artificial lighting in the region. This can, however be easily mitigated by installing security lighting no higher than 5 meters above the ground and through appropriate planning of illumination direction. Overall, the impact significance of potential night-time lighting is expected to be low and will be limited to a local area.

Table 4: Assessment of impact for the Construction Phase: Visual Impact due to night time lighting

Issue: Impact on landscape character and sense of place		
Phases: Construction Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Low	Low
Duration	Short Term	Short-term
Extent	Local	Local
Probability	Probable	Probable
Confidence	High	High
Consequence	Low	Low
Significance	**Low**	**Low**
Degree to which the impact can be mitigated	Very Low. It should be noted that it is very low because the proposed impact is low already thus mitigation measures cannot reduce the visual impact any further.	
Degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable	Low. With the Sishen Mine and town of Kathu being two significant sources of lighting, the proposed solar PV facilities will not affect the landscape to an irreplaceable resource.	
Nature of cumulative impacts	With the Sishen Mine and town of Kathu being two significant sources of lighting, the lighting associated with the proposed solar PV facility will not contribute to the cumulative impacts of night time lighting.	
Residual impacts	None	

Table 5: Assessment of impact for the Operational Phase: Visual Impact due to night time lighting

Issue: Impact on landscape character and sense of place		
Phases: Operational Phase		
Criteria	**Without Mitigation**	**With Mitigation**
Intensity	Medium	Low
Duration	Short Term	Short-term
Extent	Local	Local
Probability	Possible	Possible
Confidence	High	High
Consequence	Very Low	Very Low
Significance	**Insignificant**	**Insignificant**
Degree to which the impact can be mitigated	Very Low. It should be noted that it is very low because the proposed impact is low already thus mitigation measures cannot reduce the visual impact any further.	
Degree to which a resource is permanently affected by the	Low. With the Sishen Mine and town of Kathu being two significant sources of lighting, the proposed solar PV facility will not affect the landscape to an irreplaceable resource.	

Issue: Impact on landscape character and sense of place	
activity, i.e. the degree to which a resource is irreplaceable	
Nature of cumulative impacts	With the Sishen Mine and town of Kathu being two significant sources of lighting, the lighting associated with the proposed solar PV facility will not contribute to the cumulative impacts of night time lighting.
Residual impacts	None

5.2 Impact Statement

As it is proposed that the solar PV facility are placed on top of a WRD associated with the Sishen Mine, the landscape is already significantly altered. Furthermore, with the steep angle of repose the likelihood of receptors in the area observing the proposed solar PV facility is low, therefore the level of visual intrusion on the landscape is considered low to negligible. The visual impact will be slightly higher during the construction phase since there will be more movement of vehicles and personnel readying the area for development, once operational the solar PV facility do not require a lot of manpower.

5.3 Mitigation Measures

The sections below indicate the required mitigatory, management and monitoring measures required to minimise potential visual impacts.

General housekeeping

- All construction areas must be kept in a neat and orderly condition at all times;
- Any areas for material storage and other potentially intrusive activities must be screened from view as far as possible, i.e. not on the north eastern boundary of the WRD, facing towards Kathu;
- All operational infrastructure should be actively maintained to avoid degradation.

Development footprint

- The duration of the construction phase should be reduced as far as possible through careful planning;
- The development footprint and disturbed areas associated with the construction phase of the project should be kept as small as possible, with as little vegetation being cleared as possible;
- As far as possible, existing roads are to be utilised for construction and maintenance purpose, to limit cumulative impacts from roads and traffic, as well as to limit the extent of the vegetation cleared for the purpose of the project;
- Site offices and temporary structures should be limited to single storey and situated at such a location so as to reduce visual intrusion; and

- The height of any temporary structures such as soil stockpiles should be kept as low as possible.

Infrastructure placement

- The proposed solar PV facility should not be placed on the edge of the WRD, so as to reduce the potential of visual exposure.

Infrastructure appearance

- The use of permanent signage and project construction signs should be in accordance with the requirements of the project and construction regulations, and where possible be minimised and visually unobtrusive;
- A transparent fence, such a ClearVU fence for example, should be muted in colour and located as close as possible around the PV facilities, to avoid impeding visibility and ensure that it is visually pleasing to observers;
- The use of highly reflective material for storage and security facilities should be avoided. Lighter tones attract an observer while darker shades recede from the viewer, therefore pure whites and bright colours should be avoided;
- It should be noted that for non-mobile PV facilities, the immobile nature of the panels presents the same geometry to viewers at a given location. The array will therefore almost always appear mostly black when viewed from the south, because the panels are facing north to maximise the solar radiation exposure, thus entailing that the undersides would generally be in shadow (Royal Haskoning DHV, 2015).

Dust

- The soil in WRD may contain a non-negligible amount of small particles. Dust deposition on the solar PV facility on windy days can affect the efficiency of the PV system and may result in increased visual exposure, therefore a dust management programme must be designed to reduce dust suppression. Dust management may include regular watering of the WRD surface, however just enough to not result in undue runoff, or ensuring that as much vegetation as possible is retained within the project footprint area, i.e. under the solar PV facility if possible and feasible.

Lighting

- As far as possible, construction activities should be restricted to daylight hours, in order to limit the need for bright floodlighting and the potential for skyglow and to avoid the use of additional night-time lighting for security purposes;
- Night lighting of construction sites and camps should be minimised as far as possible, taking into consideration that due to safety requirements a certain level of lighting may be necessary;

- Where security lighting is used during the construction phase and operational phase at the Project Site, the following management measures should be implemented
  - Making use of motion detectors on security lighting, at the substations, ensures that the site will remain in relative darkness, until lighting is required for security and maintenance purposes. This will ensure that there is no permanent light source at night, only if and when required;
  - Placement of lights should consider the location of surrounding receptors and as far as possible be screened from view;
  - The use of high light masts and high pole top security lighting should be avoided. Any high lighting masts should be covered to reduce glow;
  - Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surroundings of the infrastructure, thereby minimising the light spill and trespass;
  - Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum;
  - Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose;
  - The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent should be considered to reduce skyglow (BLM, 2013).

Rehabilitation

- Upon completion of construction, the project area should be left in a condition that protects the soil surface against erosion and instability;
- Indigenous and locally occurring plant species selected for use in re-vegetation should be selected taking quick growth rates into consideration in order to cover bare areas and prevent soil erosion;
- Upon decommissioning, if it will take place, it is important that vegetation be reinstated to blend with the natural environment.

6. CONCLUSION

The dominant land use of the municipality is mining and extensive agriculture (livestock Grazing). The arid nature of the climate restricts stocking densities which has led to relatively

large farms across the area, resulting in the area being sparsely populated. Farmers and farm workers residing in the area and people at their place of work are sensitive receptors. As noted the sparse farmsteads located in the vicinity of the study area and the residents of the town of Kathu are accustomed to the mining activities in the area therefore the sensitivity of residents may be considered moderate to low. People at their place of work are likely to focus on the activities at hand and not the surrounding environment as such workers are also considered low sensitive receptors.

A visual impact will only occur if there are sensitive receptors present in the area to observe or experience the impact. Based on the desktop and field assessments it is evident that the study area is situated within a sparsely populated area where sensitive receptors are limited and sparse, and all surrounding farms are owned by SIOC, as such mining workers are occupying the majority of the farmsteads in the surrounding area. The proposed solar PV facility will not be built to the edge of the WRD. Due to the steep angle of repose observers in the landscape are unlikely to have a direct line of sight to the proposed solar PV facility. Additionally, the bushveld vegetation limits the view of the observer to their immediate surroundings, not allowing one to see across the vistas.

Glint and glare is only likely to be experienced when the observer is at a higher elevation than the proposed solar PV facility and the degree to which it is tilted. For example the glint and glare from tracking panels with back tracking towards ground-based receptors are most common when the panels are flat in the morning/evening (LOGIS, 2021). This is when the larger incidence angle (angle of incoming light) yields more reflected light. Therefore, since the proposed solar PV facility are located on top of a WRD, the ground-based receptors are located lower than the solar PV facility, therefore the sensitive receptors in the area will not experience glint and glare due to the 0° tilt (lying flat) of the panels in the mornings.

In summary and based on the impact assessment, it is evident that the proposed development activities have a low to very low visual impact on the surrounding environment. This is attributed to the fact that the proposed solar PV facility components are to be located on top of a WRD, the sparse sensitive receptors within a 5 km radius as well as the mining setting and the bushveld vegetation limiting the view. Furthermore, with the angle of repose the likelihood of receptors in the area observing the proposed solar PV facility is low, therefore the level of visual intrusion on the landscape is considered low to negligible. The visual impact will be slightly higher during the construction phase since there will be more movement of vehicles and personnel readying the area for development, once operational the solar PV facility do not require a lot of manpower and movement within the array will be very limited.

It is the opinion of the specialist that the project be considered acceptable from a visual resource management perspective, provided that the mitigatory measures as outlined in the report are implemented and adhered to.

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APPENDIX A – METHOD OF ASSESSMENT

Level of Assessment

The following methods of assessment for determining the level of detail of the assessment was utilised in this report (Oberholzer, 2005):

Table B1: Categories of development and impact severity.

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

The following key provides an explanation to the categories of development:

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

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

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

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

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

The following box explains the nature of the impacts:

Very high visual impact expected:
Potentially significant effect on wilderness quality or scenic resources;
Fundamental change in the visual character of the area;
Establishes a major precedent for development in the area.

High visual impact expected:
Potential intrusion on protected landscapes or scenic resources;
Noticeable change in visual character of the area;
Establishes a new precedent for development in the area.

Moderate visual impact expected:
Potentially some effect on protected landscapes or scenic resources;
Some change in the visual character of the area;
Introduces new development or adds to existing development in the area.

Minimal visual impact expected:
Potentially low level of intrusion on landscapes or scenic resources;
Limited change in the visual character of the area;
Low-key development, similar in nature to existing development.

Little or no visual impact expected:
Potentially little influence on scenic resources or visual character of the area;
Generally compatible with existing development in the area;
Possible scope for enhancement of the area.

From the above, the severity of the impact determines the level of the assessment:

Table B2: Impact assessment level of input determination.

Approach	Little or no visual impact expected	Minimal visual impact expected	Moderate visual impact expected	High visual impact expected	Very high visual impact expected
Level of visual input recommended	Level 1	Level 2	Level 3	Level 4	

The following box explains the inputs required at each level of assessment. As indicated in Section 5.2, a Level 4 assessment is required for the proposed project (Oberholzer, 2005).

Level 1 input:
Identification of issues, and site visit;
Brief comment on visual influence of the project and an indication of the expected impacts / benefits.

Level 2 input:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area and receptors;
Brief indication of potential visual impacts, and possible mitigation measures.

Level 3 assessment:
Identification of issues raised in scoping phase, and site visit;
Description of the receiving environment and the proposed project;
Establishment of Receptor Site area, view corridors, viewpoints and receptors;
Indication of potential visual impacts using established criteria;
Inclusion of potential lighting impacts at night;
Description of alternatives, mitigation measures and monitoring programmes.
Review by independent, experienced visual specialist (if required).

Level 4 assessment:
As per Level 3 assessment, plus complete 3D modelling and simulations, with and without mitigation.
Review by independent, experienced visual specialist (if required).

APPENDIX B – IMPACT ASSESSMENT METHODOLOGY (SLR METHODOLOGY)

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the project; views and concerns of I&APs; social and political norms, and general public interest.

Identification and Description of Impacts

Identified impacts will be described in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change (before and after mitigation). Mitigation measures may be existing measures or additional measures that were identified through the impact assessment and associated specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation.

Introduction

In assigning significance ratings to potential impacts before and after mitigation the approach presented below is to be followed.

Determine the impact consequence rating: This is a function of the “intensity”, “duration” and “extent” of the impact.

Determine impact significance rating: The significance of an impact is a function of the consequence of the impact occurring and the probability of occurrence.

Modify significance rating (if necessary): Significance ratings are based on largely professional judgement and transparent defined criteria. In some instances, therefore, whilst the significance rating of potential impacts might be “low”, the importance of these impacts to local communities or individuals might be extremely high. The importance/value which interested and affected parties attach to impacts will be highlighted, and recommendations should be made as to ways of avoiding or minimising these perceived negative impacts through project design, selection of appropriate alternatives and / or management.

Determine degree of confidence of the significance assessment: Once the significance of the impact has been determined, the degree of confidence in the assessment will be qualified. Confidence in the prediction is associated with any uncertainties, for example, where information is insufficient to assess the impact.

Criteria for Impact Assessment
The criteria for the impact assessment is provided in below.

Table B1: Impact Assessment Criteria

Criteria	Rating	Description
Criteria for ranking of the INTENSITY (SEVERITY) of environmental impacts	**ZERO TO VERY LOW**	Negligible change, disturbance, or nuisance. The impact affects the environment in such a way that natural functions and processes are not affected. People / communities are able to adapt with relative ease and maintain pre-impact livelihoods.
	LOW	Minor (slight) change, disturbance, or nuisance. The impact on the environment is not detectable or there is no perceptible change to people's livelihood.
	MEDIUM	Moderate change, disturbance, or discomfort. Where the affected environment is altered, but natural functions and processes continue, albeit in a modified way. People/communities are able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support.
	HIGH	Prominent change, disturbance, or degradation. Where natural functions or processes are altered to the extent that they will temporarily or permanently cease. Affected people/communities will not be able to adapt to changes or continue to maintain-pre impact livelihoods.
Criteria for ranking the DURATION of impacts	**SHORT TERM**	< 5 years.
	MEDIUM TERM	5 to < 15 years.
	LONG TERM	> 15 years, but where the impact will eventually cease either because of natural processes or by human intervention.
	PERMANENT	Where mitigation either by natural processes or by human intervention will not occur in such a way or in such time span that the impact can be considered transient.
Criteria for ranking the EXTENT / SPATIAL SCALE of impacts	**LOCAL**	Impact is confined to project or study area or part thereof, e.g. limited to the area of interest and its immediate surroundings.
	REGIONAL	Impact is confined to the region, e.g. coast, basin, catchment, municipal region, etc.
	NATIONAL	Impact is confined to the country as a whole, e.g. South Africa, etc.
	INTERNATIONAL	Impact extends beyond the national scale.
Criteria for determining the PROBABILITY of impacts	**IMPROBABLE**	Where the possibility of the impact to materialise is very low either because of design or historic experience, i.e. ≤ 30% chance of occurring.
	POSSIBLE	Where there is a distinct possibility that the impact would occur, i.e. > 30 to ≤ 60% chance of occurring.
	PROBABLE	Where it is most likely that the impact would occur, i.e. > 60 to ≤ 80% chance of occurring.
	DEFINITE	Where the impact would occur regardless of any prevention measures, i.e. > 80% chance of occurring.

Criteria	Rating	Description
Criteria for determining the DEGREE OF CONFIDENCE of the assessment	LOW	≤ 35% sure of impact prediction.
	MEDIUM	> 35% and ≤ 70% sure of impact prediction.
	HIGH	> 70% sure of impact prediction.
Criteria for the DEGREE TO WHICH IMPACT CAN BE MITIGATED - the degree to which an impact can be reduced / enhanced	NONE	No change in impact after mitigation.
	VERY LOW	Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact.
	LOW	Where the significance rating drops by one level, after mitigation.
	MEDIUM	Where the significance rating drops by two to three levels, after mitigation.
	HIGH	Where the significance rating drops by more than three levels, after mitigation.
Criteria for LOSS OF RESOURCES - the degree to which a resource is permanently affected by the activity, i.e. the degree to which a resource is irreplaceable	LOW	Where the activity results in a loss of a particular resource but where the natural, cultural, and social functions and processes are not affected.
	MEDIUM	Where the loss of a resource occurs, but natural, cultural, and social functions and processes continue, albeit in a modified way.
	HIGH	Where the activity results in an irreplaceable loss of a resource.

Determining Consequences

Consequence attempts to evaluate the importance of a particular impact, and in doing so incorporate extent, duration, and intensity. The ratings and description for determining consequence are provided below.

Rating	Description
VERY HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***long term***; OR of ***high intensity*** at a ***national level*** in the ***medium term***; OR of ***medium intensity*** at a ***national level*** in the ***long term.***
HIGH	Impacts could be EITHER: of ***high intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***high intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***national level*** in the ***long term***; OR of ***high intensity*** at a ***local level*** in the ***long term***; OR of ***medium intensity*** at a ***regional level*** in the ***long term.***
MEDIUM	Impacts could be EITHER: of ***high intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***medium intensity*** at a ***regional level*** in the ***medium term***; OR of ***high intensity*** at a ***regional level*** in the ***short term***; OR of ***medium intensity*** at a ***national level*** in the ***short term***; OR of ***medium intensity*** at a ***local level*** in the ***long term***; OR of ***low intensity*** at a ***national level*** in the ***medium term;*** OR of ***low intensity*** at a ***regional level*** in the ***long term.***

LOW	Impacts could be EITHER of ***low intensity*** at a ***regional level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***national level*** in the ***short term***; OR of ***high intensity*** at a ***local level*** and endure in the ***short term***; OR of ***medium intensity*** at a ***regional level*** in the ***short term***; OR of ***low intensity*** at a ***local level*** in the ***long term***; OR of ***medium intensity*** at a ***local level*** and endure in the ***medium term.***
VERY LOW	Impacts could be EITHER of ***low intensity*** at a ***local level*** and endure in the ***medium term***; OR of ***low intensity*** at a ***regional level*** and endure in the ***short term***; OR of ***low to medium intensity*** at a ***local level*** and endure in the ***short term.*** OR **Zero to very low intensity** with any combination of extent and duration.

Determining Significance

The consequence rating is considered together with the probability of occurrence in order to determine the overall significance using the table below.

		PROBABILITY			
		IMPROBABLE	POSSIBLE	PROBABLE	DEFINITE
CONSEQUENCE	VERY LOW	INSIGNIFICANT	INSIGNIFICANT	VERY LOW	VERY LOW
	LOW	VERY LOW	VERY LOW	LOW	LOW
	MEDIUM	LOW	LOW	MEDIUM	MEDIUM
	HIGH	MEDIUM	MEDIUM	HIGH	HIGH
	VERY HIGH	HIGH	HIGH	VERY HIGH	VERY HIGH

In certain cases, it may not be possible to determine the significance of in impact. In these instances, the significance is unknown.

Mitigation measure development

According to the DEA *et al.,* (2013) "Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands".

According to the DEA *et al.,* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The

importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act), and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.,* 2013).

The primary environmental objective of the Mineral and Petroleum Resources Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations".
Pressures on biodiversity are numerous and increasing. According to the DEA *et al.,* (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including[4]:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.,* 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *et al.,* 2013):

[4] Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate impact** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
  - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
  - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the study area supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use; and
  - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.[5]

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[6] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.

[5] Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

[6] Mitigation measures should address both positive and negative impacts

- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

APPENDIX C – VEGETATION TYPE

Table C1: Kathu Bushveld Vegetation type associated with the proposed project area (Mucina & Rutherford, 2012)

Climate	Summer and autumn rainfall, very dry winters
Altitude (m)	960 – 1300
MAP* (mm)	300
MAT* (°C)	18.5
MFD* (Days)	27
MAPE* (mm)	2883
MASMS* (%)	85
Distribution	Northern Cape Province
Geology & Soils	Aeolian red sand and surface calcrete, deep (>1.2m) sandy soils of Hutton and Clovelly soil forms.
Conservation	Least Threatened. Target 16%. None statutorily conserved.
Vegetation & landscape features	Medium-tall tree layer with *Acacia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. Shrub layer generally most important with, for example, *A, mellifera, Diospyros lycioides* and *Lycium hirsutum.* Grass layer is variable in cover.

Dominant floral taxa		
Grass Species	**Herb Species**	**Tree/ Shrub Species**
Aristida meridionalis (d), *Brachiaria nigropedata* (d), *Centropodia glauca* (d), *Eragrostis lehmanniana* (d), *Schmidtia pappophoroides* (d), *Stipagrostis ciliata* (d), *Aristida congesta*, *Eragrostis biflora*, *E. chloromelas*, *E. heteromera*, *E. pallens*, *Melinis repens*, *Schmidtia kalahariensis*, *Stipagrostis uniplumis*, *Tragus berteronianus*.	*Acrotome inflata*, *Erlangea misera*, *Gisekia africana*, *Heliotropium ciliatum*, *Hermbstaedtia fleckii*, *H. odorata*, *Limeum fenestratum*, *L. viscosum*, *Lotononis platycarpa*, *Senna italica* subsp. *arachoides*, *Tribulus terrestris*.	**Tall Tree** *Acacia erioloba* (d) **Small Trees** *Acacia mellifera subsp. detinens (d),* *Boscia albitrunca (d),* *Terminalia sericea.* **Tall Shrubs** *Diospyros lycioides subsp. lycioides (d),* *Dichrostachys cinerea,* *Grewia flava,* *Gymnosporia buxifolia,* *Rhigozum brevispinosum.* **Low Shrubs** *Aptosimum decumbens,* *Grewia retinervis,* *Nolletia arenosa,* *Sida cordifolia,* *Tragia dioica.*

APPENDIX D – VISUAL RECEPTORS

The number of observers and their perception of the proposed project will have an impact on the VIA and also on the perceived sensitivity of the landscape. The perception of viewers is difficult to determine as there are many variables to consider, such as cultural background, state of mind, reason for the sighting and how often the project is viewed within a set period. It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the project. It is also necessary to generalise the viewer sensitivity to the proposed project to some degree (Oberholzer, 2005).

The IEMA (2002) identifies a number of potential sensitive receptors that may be affected by a proposed development, namely:

- Users of recreational landscapes/ public footpaths and bridleways, including tourists and visitors;
- Residents;
- Users of public sports grounds and amenity open space;
- Users of public roads and railways;
- Workers; and
- Views of or from within valued landscapes.

The sensitivity of visual receptors and views will depend on:

- The location and context of the viewpoint;
- The expectation and occupation or activity of the receptor; and
- The importance of the view.

The most sensitive receptors may include:

- Users of outdoor recreational facilities, including public rights of way, whose attention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; and
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscape of acknowledges importance or value);
- People travelling through or past the affected landscape in cars on trains or other transport routes;
- People at their place of work.

APPENDIX E – LANDSCAPE CHARACTER

Landscape character, from an aesthetic perspective, is mainly defined by natural determinants, such as vegetation, geology and topography, as well as cultural factors including land use, settlement patterns and the manner in which humans have transformed their natural surroundings. According to Swanwick (2002), landscape character may be defined as a distinct, recognisable and consistent pattern of elements in the landscape that makes it unique and provides it with a particular sense of place. Individual "landscape elements" that contribute to landscape character include hills, rolling plains, valleys, woods, trees, water bodies, as well as buildings and roads. "Landscape features" are those elements that are prominent or eye-catching.

Landscapes may be divided into landscape character types, which are defined as distinct types of landscape that are relatively homogeneous in character. Such landscape character types are generic in nature and may occur in different areas in different parts of the country, but wherever they occur, they share broadly similar combinations of geology, topography, drainage patterns, vegetation, land use and settlement patterns (Swanwick, 2002).

Key aesthetic aspects of the landscape are described in the table below, according to the method prescribed by Swanwick (2002).

Table E1: Aesthetic and perceptual aspects of landscape character.

Aspect	Characteristics				Motivation
Scale	Intimate	Small	Large	Vast	The scale of the landscape is considered to be **large** due to the significant distance one can see across the terrain. The mountainous terrain of the greater area does however obscure views. Furthermore, the adjacent waste rock dumps with its significant heights form part of the skyline.
Enclosure	Tight	Enclosed	Open	Exposed	The landscape is considered **open,** with limited distinguishing topographical features in the surrounds that would result in it being enclosed, the existing waste rock dumps do however form prominent features in the area and are seen from distances further than 8 km.
Diversity	Uniform	Simple	Diverse	Complex	The landscape is considered **simple** with the vegetative cover being homogenous with the surrounding area
Texture	Smooth	Textured	Rough	Very rough	The texture associated with the landscape is **textured** due to the dominant woody and grass layer throughout the greater area.
Form	Vertical	Sloping	Rolling	Horizontal	Taking only the study area and immediate surrounds into consideration, the landscape is relatively flat (**horizontal**). The dominant form of the landscape of the greater region is **rolling**, due to the mountainous terrain of the larger surrounding region.
Line	Straight	Angular	Curved	Sinuous	The line landscape element is **straight** to slightly **curved** with limited linear anthropogenic elements present. The existing adjacent waste rock dumps and mountains in the greater region prevents the landscape from appearing completely straight.
Colour	Monochrome	Muted	Colourful	Garish	The colours associated with the landscape are **muted**, with limited vegetation colour variation.
Balance	Harmonious	Balanced	Discordant	Chaotic	The landscape is considered to be **balanced** in terms of the relationship between the vertical and horizontal landscape elements.
Pattern	Random	Organised	Regular	Formal	The landscape is considered **regular,** with elements being even spaced and well-balanced.

Aspect	Characteristics				Motivation
Movement	Dead	Still	Calm	Busy	The level of movement within the study area is **still**, with the exception of occasional mine workers, there is little movement in the study area.

In addition to the above, other aspects of landscape perception, such as perception of beauty and scenic attractiveness also play a role in defining landscape character. These aspects are more subjective and responses thereto are personal and based on the experience and preference of the observer. Factors simultaneously perceived by senses other than sight, such as noisiness, tranquillity, exposure to the elements and sense of safety, further influence landscape character.

APPENDIX F – VISUAL ABSORPTION CAPACITY

Visual Absorption Capacity (VAC) refers to the inherent ability of a landscape to accommodate change without degeneration of the visual quality and without resulting in an overall change of the identified landscape character type. A high VAC rating implies a high ability to absorb visual impacts and manmade structures and the ability of natural features such as trees or higher-lying areas to screen or hide an object where it would have visible otherwise (Oberholzer, 2005), while a low VAC rating implies a low ability to absorb or conceal visual impacts.

The factors that have been considered during the VAC analysis are listed and explained in the table below, according to the methodology prescribed by the United States Bureau of Land Management (BLM, 2004) and as adapted to the South African context (Table D1). Five factors have been considered, namely vegetation, soil contrast, visual variety, topographical diversity and recovery time.

Table F1: VAC Factors and Rating table.

Factors	Rating Criteria and Score		
Vegetation	Low, uniform vegetation or sparse vegetative cover, typically less than 1m in height, lacking in variety, uniform colour, minimal screening capability, typically low scrub or grass type vegetation. **Score: 1**	Vegetation of moderate height (1 – 2m), some species variety (2 to 3 types), some variation in colour, mostly continuous vegetative cover, effectively screens low-profile projects such as low-profile surface disturbance, scrub/grass, and intermingled shrubs. **Score: 2**	Higher vegetation (>2m height), lush, continuous vegetative cover; some variety of vegetative types is typical but not mandatory, provides significant screening capability of projects up to 4 – 6m in height, woodlands. **Score: 3**
Soil contrast	Surface disturbance would expose a high degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 1**	Surface disturbance would expose a medium degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 2**	Surface disturbance would expose only a low degree of contrast in colour with surrounding soil, rock and vegetation. **Score: 3**
Visual variety	Rating unit exhibits a low degree of visual variety in terms of the landscape character elements of form, line and texture and may also exhibit minimal variety in landforms, vegetation, or colour. **Score: 1**	Rating unit exhibits a medium degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit medium variety in landforms, vegetation, or colour. **Score: 2**	Rating unit exhibits a high degree of visual variety in terms of the landscape character elements of form, line, and texture and may also exhibit high degree of variety in landforms, vegetation, or colour. **Score: 3**
Topographical diversity	Landform has low amount of topographic diversity and variety. **Score: 1**	Landform has moderate amount of topographic diversity and variety. **Score: 2**	Landform has high amount of topographic diversity and variety. **Score: 3**
Recovery time	Long-term recovery time (greater than 5 years) **Score: 1**	Medium recovery time (3 to 5 years) **Score: 2**	High (rapid) recovery time (1 to 2 years) **Score: 3**

Scores, when added, amounting to between 5 and 7 are categorised as Low, scores between 8 and 11 as Medium and between 12 and 15 as High.

VAC is further closely related to visual intrusion, which refers to the physical characteristics and nature of the contrast created by a project on the visual aspects of the receiving environment. It is also, as with VAC, a measure of the compatibility or conflict of a project with the existing landscape and surrounding land use. The visual intrusion ratings are listed in the table below.

Table F2: Visual intrusion ratings.

Rating	Explanation
High visual intrusion	Results in a noticeable change or is discordant with the surroundings.
Moderate visual intrusion	Partially fits into the surroundings, but clearly noticeable.
Low visual intrusion	Minimal change or blends in well with the surroundings.

Through applying the scoring categories as outlined above, the following scores have been calculated for the proposed project area, which have similar landscape characteristics:

Table F3: VAC Scores achieved.

Factor	Score obtained	Motivation
Vegetation	**2**	Vegetation is of moderate (grass) height and mostly continuous with good cover, however bare ground is present, especially in the area where the rehabilitation of the WRD is still taking place.
Soil contrast	**2**	Surface disturbance would result in a medium degree of contrast in colour with the surrounding area due to the brown colour of the waste rock dumps and vegetation and bare ground present in the vicinity of the study area.
Visual variety	**1**	There is a low degree of visual variety due to the homogenous nature of the vegetation, the relatively flat terrain and limited natural distinguishing topographical features in the area. The existing waste rock dumps and stockpiles does however form prominent features in the landscape, and the proposed expansion activities will increase the bulk appearance thereof.
Topographical diversity	**1**	The topography of the study area is relatively flat, with limited topographical features, which results in low topographical variety within the area.
Recovery time	**2**	Due to the dominant vegetation within the study area comprising grass, recovery time is expected to be moderate.
Total	**8**	**Medium**

APPENDIX G – LANDSCAPE QUALITY

Landscape visual quality, integrity or 'scenery beauty' relates primarily to human impact on a landscape and the physical state of the landscape in terms of intactness from visual, functional and ecological perspectives (Swanwick, 2002). It also serves as an indication of the condition of landscape elements and features (as outlined in Section 5.3.5), which in turn depends largely on an observer's visual perception through either increasing or reducing the visual quality of a landscape. Visual quality is thus a factor of an observer's emotional response to physical landscape characteristics and therefore assigning values to visual resources is a subjective process.

According to the BLM Visual Resource Management (VRM) system (1984), a system specifically developed for minimising the visual impacts of surface-disturbing activities and maintaining scenic values for the future, landscape, visual and scenic quality evaluation may be determined based on seven key factors, as outlined in the tables below and adapted to the South African environment. It is important to note that there may be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area, however within the context of the proposed project, this method of assessment is deemed suitable as an indication of landscape quality.

Table G1: Landscape Quality - Explanation of Rating Criteria.

Factor	Definition
Landform	Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental or they may be exceedingly artistic and subtle.
Vegetation	Give primary consideration to the variety of patterns, forms, and textures created by plant life. Consider short-lived displays when they are known to be recurring or spectacular. Consider also smaller scale vegetation features, which add striking and intriguing detail elements to the landscape.
Water	That ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.
Colour	Consider the overall colour(s) of the basic components of the landscape (e.g., soil, rock, vegetation, etc.) as they appear during seasons or periods of high use. Key factors to use when rating "colour" are variety, contrast, and harmony.
Adjacent Scenery	Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0-8 kilometres, depending upon the characteristics of the topography, the vegetative cover, and other such factors. This factor is generally applied to units that would normally rate very low in score, but the influence of the adjacent unit would enhance the visual quality and raise the score.
Scarcity	This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs.
Cultural Modifications	Cultural modifications in the landform/water, vegetation, and addition of structures should be considered and may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. Rate accordingly.

Table G2: Scenic Quality - Rating Criteria and scoring system.

Factor	Rating Criteria and Score		
Landform	High vertical relief as expressed in prominent cliffs, spires, massive rock outcrops, areas of severe surface variation, highly eroded formations, dune systems or detail features that are dominant and exceptionally striking and intriguing. **Score: 5**	Steep canyons, mesas, buttes, interesting erosional patterns, landforms of variety in size and shape or detail features, which are interesting though not dominant or exceptional. **Score 3**	Low rolling hills, foothills, or flat valley bottoms or few or no interesting landscape features. **Score: 1**
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. **Score: 5**	Some variety of vegetation, but only one or two major types. **Score: 3**	Little or no variety or contrast in vegetation. **Score: 1**
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **Score: 5**	Flowing, or still, but not dominant in the landscape. **Score: 3**	Absent, or present, but not noticeable. **Score: 0**
Colour	Rich colour combinations, variety or vivid colour; or pleasing contrasts in the soil, rock, vegetation, water or snowfields. **Score: 5**	Some intensity or variety in colours and contrast of the soil, rock and vegetation, but not a dominant scenic element. **Score: 3**	Subtle colour variations, contrast, or interest; generally mute tones. **Score: 1**
Adjacent Scenery	Adjacent scenery greatly enhances visual quality **Score: 5**	Adjacent scenery moderately enhances overall visual quality. **Score: 3**	Adjacent scenery has little or no influence on overall visual quality. **Score: 0**
Scarcity	One of a kind, unusually memorable or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. **Score: 5**	Distinctive, though somewhat similar to others within the region. **Score: 3**	Interesting within its setting, but fairly common within the region. **Score; 1**
Cultural Modifications	Modifications add favourably to visual variety while promoting visual harmony. **Score: 2**	Modifications add little or no visual variety to the area, and introduce no discordant elements **Score: 0**	Modifications add variety but are very discordant and promote strong disharmony. **Score: -4**

Scores, when added, amounting to less than 11, are categorised as Low, scores between 12 and 18 as Medium and scores more than 19 as High.

Through applying the scoring categories as outlined above, the following scores have been calculated for the proposed project area:

Table G3: Scenic Quality – Results and motivation.

Factor	Score obtained	Motivation
Landform	**1**	The landscape associated with the study area and surroundings provide limited topographical variety since the terrain is relatively flat with limited distinguishing natural topographical features.
Vegetation	**1**	The vegetation composition within the study area and surrounds are homogenous, resulting in little variety vegetation in the area.
Water	**0**	Surface water is absent within the landscape, as the Gamagara River has been dry for several years.
Colour	**3**	There is some colour variation however limited to the colour palette of greens and browns.
Adjacent Scenery	**3**	Adjacent scenery, contributes to the greater landscape viewing experience, moderately enhancing the overall visual quality of the area.
Scarcity	**1**	The landscape character type is interesting, however it is relatively common within the region as it is similar to the surrounds
Cultural Modifications	**0**	Since the study area is situated on top of a WRD and adjacent to existing waste rock dumps, the proposed solar PV facility will add little or no visual variety to the area, and introduce no discordant elements
Total	**9**	Low

Scores, when added, amounting to less than 11, are categorised as Low, scores between 12 and 18 as Medium and scores more than 19 as High.

APPENDIX H – LANDSCAPE VALUE

Landscape value is concerned with the relative value that is attached to different landscapes. Landscape values are described as the environmental or cultural benefits, including services and functions that are derived from various landscape attributes (Department of the Environment and Local Government, Ireland (DoE, 2000). A landscape may be valued by different communities for many different reasons without any formal designation, recognising, for example, perceptual aspects such as scenic beauty, tranquillity or wildness, special cultural associations, the influence and presence of other conservation interests, or the existence of a consensus about importance, either nationally or locally (DoE, 2000). These attributes include the components and image of the landscape as already established in the assessment of landscape character, including aesthetic and ecological components, but also includes historical and socio-cultural associations, as well as religious and mythological dimensions.

In determining landscape value, the people or groups of people who could be affected by the proposed development should be considered, due to landscapes being valuable to people in different ways. In this regard, consideration is given to:

- People who live and work in an area may have a different perception of the landscape to that held by visitors because of their more regular contact with the landscape and the ongoing changes within it;
- Special interest, for example the ecological, cultural or historic value of the landscape, as knowledge of these issues can often affect people's perception and appreciation of a landscape; and
- Landscapes valued by a public wider than the local population, because they have a strong image or are well known and valued nationally and internationally.

APPENDIX I – NIGHT TIME LIGHTING

To understand the potential visual impacts from night lighting, it is important to understand the existing lighting levels. The Institute of Lighting Engineers (ILP) (2011) identifies five environmental zones for exterior lighting control and with which to describe the existing lighting conditions within the landscape (Table I1). These environmental zones are supported by design guidance for the reduction of light pollution, which can then inform proposed mitigation measures and techniques. Where an area to be lit lies on the boundary of two zones the obtrusive light limitation values used should be those applicable to the most rigorous zone.

Table I1: Environmental zones for night-time lighting.

Environmental Zone	Surrounding	Lighting Environment	Examples
E0	Protected	Dark	UNESCO Starlight Reserves, IDA Dark Sky Parks
E1	Natural	Intrinsically Dark	National Parks, Areas of Outstanding Natural Beauty etc.
E2	Rural	Low District Brightness	Village or relatively dark outer suburban locations
E3	Suburban	Medium District Brightness	Small town centres or suburban locations
E4	Urban	High District Brightness	Town/city centres with high levels of night-time activity

Stationary lights facing upward are significant contributors to light pollution and causes sky glow and glare, while light facing in a horizontal direction can be visible for long distances, lead to light trespass (light falling outside the desired area of illumination) and be disturbing to viewers and vehicles. Sky glow refers to the night-time brightening of skies, caused by the scattering and redirecting of light in the atmosphere, by water droplets and dust in the air, back towards the ground. Such stray light mostly comes from poorly designed and improperly aimed light, and from light reflected from over-lit areas (ASSA, 2012). Lighting from vehicles within rural areas will generally be more intrusive than in urban settings and, therefore, will have a potentially greater impact due the general lack of existing ambient light within areas further away from the proposed incline shaft areas.

The ILP (2011) recommends that, to maintain the night-time setting, lighting within the identified zone should have minimal illumination into the sky as well as to adjacent viewpoints.

Bortle Dark Sky Scale

The Bortle Dark Sky Scale was developed by John Bortle "based on nearly 50 years of observing experience," to describe the amount of light pollution in a night sky. It was first published in a 2001 Sky & Telescope article. The results are documented on this map below. To facilitate learning and using the scale, Bortle's indicators of sky brightness have been adapted as a table (below), including the colour codes used in available light pollution chart.

Number Code	Map Color Code	Label	Sky Mag.	Naked Eye Limit Mag.	320mm Limit Mag.	Triangulum Galaxy visible?	Andromeda Galaxy visible?	Central Galaxy visible?	Zodiacal light visible?	Light Pollution	Clouds	Ground Objects
1		excellent dark sky	22.00–21.99	≥ 7.5	> 17	obvious	.	casts shadows	striking	airglow apparent	.	visible only as silhouettes
2		average dark sky	21.99–21.89	7.0–7.49	16.5	easy with direct vision	.	appears highly structured	bright, faint yellow color	airglow faint	dark everywhere	large near objects vague
3		rural sky	21.89–21.69	6.5–6.99	16.0	easy with averted vision	.	complex structure	obvious	LP on horizon	dark overhead	large distant objects vague
4		rural/suburban transition	21.69–20.49	6.0–6.49	15.5	difficult with averted vision	obvious	only large structures	halfway to zenith	low LP	lit in distance	distant large objects distinct
5		suburban	20.49–19.50	5.5–5.99	14.5–15.0	.	easy with direct vision	washed out	faint	encircling LP	brighter than sky	
6		bright suburban	19.50–18.94	5.0–5.49	14.0–14.5	.	easy with averted vision	visible only near zenith	.	LP to 35°	fairly bright	small close objects distinct
7		suburban/urban transition	18.94–18.38	4.5–4.99	14.0	.	difficult with averted vision	invisible	.	LP to zenith	brilliantly lit	.
8		city sky	< 18.38	4.0–4.49	13	.	.	.	.	bright to 35°	.	headlines legible
9		inner city sky	.	≤ 4.0		.	.	.	.	bright at zenith	.	.

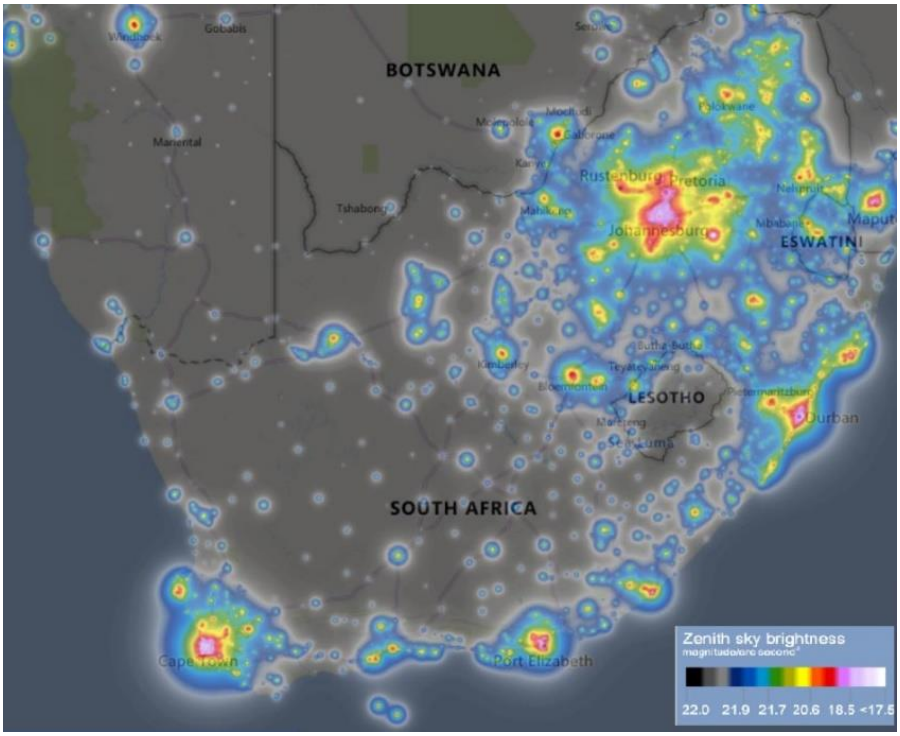

Figure I1: Light pollution map of South Africa (The World Atlas of the Artificial Night Sky Brightness).

APPENDIX J – VISUAL EXPOSURE AND VISIBILITY

Visual exposure refers to the geographic area from which the proposed project will be visible and is defined by the degree of visibility of a proposed project from various receptors sites. Visibility, in turn, is determined by distance between the components of a proposed project and the viewer.

Visual exposure is determined by the zone of visual influence or the "viewshed". A viewshed is the topographically defined area that includes all the major observation sites from where a proposed development will be visible. The boundary of the viewshed tends to connect high points in the landscape through following ridgelines and demarcates the zone of visual influence. The zone of visual influence usually fades out beyond 5km distance and the further away from an observer the project is, the less visible it would be. It is also important to note that the actual zone of visual influence of the proposed project may be smaller than indicated because of screening by existing vegetation and infrastructure, which may partially or totally obscure a view.

General visibility classes, as applicable to the proposed infrastructure are indicated in the table below.

Table J1: Visibility classes (IEMA, 2002).

Class	Description
Highly visible	Clearly noticeable within the observer's view frame within 1km
Moderately visible	Recognisable feature within observer's view frame further than 1km
Marginally visible	Not particularly noticeable within observer's view frame further than 2km
Hardly visible	Practically not visible unless pointed out to observer beyond further than 3km

Three distance zones have been identified (BLM, 1984) based on visibility from travel routes and observation points. These have been determined and confirmed through field verification.

- Foreground – includes local and sub-regional areas visible from main roads, farm houses, residential areas such as towns and villages, industrial/commercial areas and gravel farm roads, and any other viewing locations which are up to 1 kilometre away.
- Middle ground – includes local and sub-regional areas visible from main roads, residential areas such as towns and villages, isolated houses, industrial/commercial areas, accommodation at nature reserves and gravel farm roads, or other viewing locations which are up to 3 kilometres away.
- Background – includes sub-regional areas barely visible further than 3 kilometres away.

Viewshed Analysis

The viewshed analysis calculates the geographical locations from where the proposed project might be visible. This potential visual exposure of the project has been modelled by creating a Digital Terrain Model (DTM) from 1m contour data, and applying a viewshed analysis using GIS software, whereby all areas with a line of sight towards the proposed project is indicated. It must be noted that the heights of existing infrastructure and vegetation are not included in the calculation of the viewshed and it is, therefore, important to bear in mind that the proposed development will not be visible from all points within the viewshed, as views may be obstructed by visual elements, whereby such intervening objects will modify the viewshed at ground level.

APPENDIX K – INDEMNITY AND TERMS OF USE OF THIS REPORT

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations, at their discretion, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Although SAS CC exercises due care and diligence in rendering services and preparing documents, SAS CC accepts no liability and the client, by receiving this document, indemnifies SAS CC and its directors, managers, agents and employees against all actions, claims, demands, losses, liabilities, costs, damages and expensed arising from or in connection with services rendered, directly or indirectly by SAS CC and by the use of the information contained in this document.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

APPENDIX L – SPECIALIST INFORMATION

Details of the specialist who prepared the report

Stephen van Staden	MSc Environmental Management (University of Johannesburg)
Sanja Erwee	BSc Zoology (University of Pretoria)

The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	082 442 7637
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

Specialist Declaration

I, Stephen van Staden, declare that -

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

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource discipline lead, Managing member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000
Tools for wetland assessment short course Rhodes University	2016
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2013

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

SELECTED PROJECT EXAMPLES OUT OF OVER 2000 PROJECTS WORKED ON

1 Mining: Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)
6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions.

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION CURRICULUM VITAE OF SANJA ERWEE

PERSONAL DETAILS

Position in Company	GIS Technician and Visual Specialist
Joined SAS Environmental Group of Companies	2014

EDUCATION

Qualifications

BSC Zoology (University of Pretoria)	2013

Short Courses

Global Mapper	2015
SANBI BGIS Course	2017
Global Mapper Lidar Course	2017
ESRI MOOC ARCGIS Cartography	2018

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Western Cape Free State

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Plant species and Landscape Plan

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

GIS

- Mapping and GIS for various sectors and various disciplines (biodiversity, freshwater, aquatic, soil and land capability).