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VISUAL IMPACT ASSESSMENT AS PART OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED HALFGEWONNEN SOLAR PHOTOVOLTAIC (PV) PROJECT, NEAR HENDRINA, MPUMALANGA PROVINCE

Prepared for:

CABANGA environmental

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment (EIA) process for the proposed Halfgewonnen Solar Photovoltaic (PV) Project, near Hendrina, Mpumalanga Province – henceforth referred to as the "**study area**". The project is associated with both linear developments (Main Pipelines and a High-Voltage Powerline), as well as surface infrastructure including the Solar PV Panels, Buildings, the Main Substation and Battery Storage facility.

The study area is located within the Mpumalanga Province and falls in the Gert Sibande District Municipality, and is proposed to be connected to the Ysterkop sub-station which is located within the Nkangala District Municipality. The study area is approximately 4.6 km east of the R35 roadway, 18 km south-west of the N11 national road, and approximately 6.7 km west of the R38 roadway. The town of Hendrina is located 20 km north-east of the study area, the town of Bethal is situated 25 km south, and the town of Davel is approximately 25.8 km south-east of the study area. The Olifants River traverses the central portion of the study area.

The proposed Halfgewonnen Solar PV Project comprises two components:

1. Solar PV 1 will generate approximately 20 MW and will address the electricity requirements for the immediate surrounding and adjacent mines, until they reach the end of their operational lives, thereafter PV1 will connect to the national grid. Construction is expected to take approximately 10 months. The total development footprint will not exceed 30 Hectares (Ha).
2. Solar PV 2 will generate approximately 60 MW, forming part of the Department of Mineral Resources and Energy (DMRE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Construction is expected to take approximately 12 months. The total development footprint is expected to comprise about 60 Ha.

Surface developments will thus include the PV 1 (anticipated 30 Ha) and PV 2 Panels (anticipated 60 Ha), the Main Substation (± 0.3 Ha), additional Buildings (± 0.3 Ha), and the Battery Storage facility (± 3.3 Ha). Linear developments for the project include the Main Pipelines running between the Solar Panels, as well as a High-Voltage Powerline (± 6.2 km) that is recommended to connect the Main Substation to the Ysterkop substation.

A visual impact will only occur if there are sensitive receptors present in the area to observe or experience the visual impact. Based on the desktop and field assessments it is evident that the study area is situated within a relatively remote area where sensitive receptors are very limited and sparse, and is confined to the provincial road D622 traveling along the proposed PV facility area and the farmhouse located directly north of the study area, on Portion 7 of the Farm Dunbar 189IS. Furthermore, the study area is situated adjacent to the active mining areas of the Halfgewonnen Colliery and proposed future mining expansions in the area, and large portions of the study area comprise crop fields. The undulating topography of the surrounding area and the relatively low height of the proposed structures, results in the proposed PV structures not being significantly visually intrusive on the receiving environment.

According to the National Web Based Screening Tool (2021) the overall sensitivity of the Archaeological and Cultural Heritage Combined Sensitivity of the study area is considered high due to the presence of the important Olifants River and the presence of a mountain or ridge. With the environment being classified as high cultural significance, a very high visual impact is deemed possible due to the sensitivity of the landscape. Based on the outcome of the desktop assessment it is evident that only a small portion of the proposed powerline traverses the Olifants River whereas the proposed PV facilities are located approximately 2,3 km north of the Olifants River, rendering no visibility of the proposed PV facilities. As such, the cultural aspect of the area is unlikely to be affected by the proposed PV development.

The moderately undulating terrain is characterised by grassland where cattle grazing and crop cultivation (bean and maize) activities are dominant. There are low hills also present within the landscape, contributing to the overall rural character of the larger region, the existing and ongoing

mining activities lessen the rural character of the immediate surroundings. The Visual Absorption Capacity (VAC) of the area is considered moderate, indicating that the proposed PV structures will be absorbed in the area, resulting in a moderately low visual intrusion.

The sense of place associated within the study area itself can be described as calm, tranquil and peaceful, with limited development and disturbance, with the exception of the agricultural fields and active mining activities in the immediate surroundings. However, taking the broader area into consideration as well as the powerline route, the sense of place is considered busy with the ongoing mining and coal processing taking place at the Halfgewonnen and Overlooked Collieries, and the roads are busy with heavy vehicles and coal tipper trucks. During the construction phase of the proposed Halfgewonnen Solar PV Project, the sense of place will be affected increasing the traffic on the local roads with construction vehicles and the study area itself with some earth moving equipment. Once the PV plant is operational there will be limited operational vehicular movement in and out of the study area, thus reducing the traffic on the local roads.

Based on the outcome of the impact assessment the visual impact associated with the proposed development is considered moderately low. This is mainly attributed to the study area being located within a rural landscape, with undulating terrain characterized by grassland interspersed with mining activities and cultivated fields and limited sensitive receptors. Sensitive receptors within the immediate vicinity (within a 1 km radius) will have the highest visual impact during the construction phase and immediately thereafter, however once the proposed PV facilities are operational the visual impact will be lowered as the PV facilities will form part of the existing industrial structures in the landscape.

Glint and glare may impair the visibility of observers and cause annoyance, discomfort, or loss in visual performance especially for the residents of the farmhouse located north of the study area, on Portion 7 of the Farm Dunbar 189IS. The proposed PV panels have anti-reflective tempered patterned glass in the front and tempered pattern glass at the rear end, therefore limiting the sunlight reflection, in turn lowering the possibility of glint and glare. Possible mitigation measure to further reduce the possibility of glint and glare include: an extra layer of anti-reflective material on the outer surface of the glass on the PV panels; roughen the protective glass surface, reducing specular reflection; and an adjustment in the tilt and orientation angle of PV modules (Sreenath *et. al.*, 2019). These changes can alter the direction of solar reflection and hence the degree of glare impact. The Solar Glare Hazard Analysis Tool (SGHAT) can be used to check the glare potential for the proposed PV system design values. SGHAT has the capability to identify PV configurations that produce no glare and the design with maximum energy production can be selected (Sreenath *et. al.*, 2019).

It can therefore be concluded that with adherence to the mitigation measures as outlined in this report, the proposed development will not have a long term negative visual impact on the surrounding environment, and although it will increase the industrial structures in the landscape, the mining activities have already lowered the overall visual character of the landscape.

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 this 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 K
	(ii) the expertise of that specialist to compile a specialist report including	Appendix K
b	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix K
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 3
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 D to I
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 Figure 8
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 5 and 6
k	any mitigation measures for inclusion in the EMPr	Section 5.5
l	any conditions for inclusion in the environmental authorisation	Section 5.5
m	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5.5
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 5.5 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 application for environmental authorisation, by the appointed EAP
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.
Glint and glare	The two terms 'glint' and 'glare' refer to the unwanted reflection of the sun's rays by the face of a reflective surface. Glint is a momentary flash of light. Glare is a continuous source of excessive brightness.
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.
Specular Reflection	Specular reflection is a type of surface reflectance often described as a mirror-like reflection of light from the surface. In specular reflection, the incident light is reflected into a single outgoing direction.
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 elements 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
BLM	(United States) Bureau of Land Management
BPEO	Best Practicable Environmental Option
DEFF	Department of Environment, Forestry and Fisheries
DEM	Digital Elevation Model
DMRE	Department of Mineral Resources and Energy
DTM	Digital Terrain Model
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
GIS	Geographic Information System
GN	General Notice
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	Mega Watt
NEMA	National Environmental Management Act (No. 107 of 1998)
NFSD	National Framework for Sustainable Development
NGL	Natural Ground Level
NPAES	National Protected Areas Expansion Strategy
PV	Photovoltaic
REEA	Renewable Energy EIA Application
REDZ	Renewable Energy Development Zones
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SACAD	South African Conservation Areas Database
SAPAD	South African Protected Areas Database
SEA	Strategic Environmental Assessment
SGHAT	Solar Glare Hazard Analysis Tool
UNESCO	United Nations Educational Scientific and Cultural Organization
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
VRM	Visual Resource Management

1. INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a Visual Impact Assessment (VIA) as part of the Environmental Impact Assessment (EIA) process for the proposed Halfgewonnen Solar Photovoltaic (PV) Project, near Hendrina, Mpumalanga Province – henceforth referred to as the "**study area**". The project is associated with both linear developments (Main Pipelines and a High-Voltage Powerline), as well as surface infrastructure including the Solar PV Panels, Buildings, the Main Substation and Battery Storage facility. For further detail on the proposed project, refer to Section 1.2.

The study area is located within the Mpumalanga Province and falls in the Gert Sibande District Municipality, and is proposed to be connected to the Ysterkop sub-station which is located within the Nkangala District Municipality. The study area is approximately 4.6 km east of the R35 roadway, 18 km south-west of the N11 national road, and approximately 6.7 km west of the R38 roadway. The town of Hendrina is located 20 km north-east of the study area, the town of Bethal is situated 25 km south, and the town of Davel is approximately 25.8 km south-east of the study area. The Olifants River traverses the central portion of the study area. For a depiction of the study area, refer to Figures 1 and 2.

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).

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 proposed PV facility, 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

The Applicant (Dreamworks Haven Investments Pty Ltd) proposes to develop the Halfgewonnen Solar Photovoltaic (PV) Facilities which will generate approximately 80 Mega Watts (MW) of power for distribution into the National Grid, specifically for the benefit of mining and farming communities located closer to the proposed development.

The proposed Halfgewonnen Solar PV Project comprises two components:

1. Solar PV 1 will generate approximately 20 MW and will initially address the electricity requirements for the immediate surrounding and adjacent mines, until these mines are decommissioned, after which, if no consumers are identified in the immediate vicinity, PV1 will be connected to the National Grid. Construction is expected to take approximately 10 months. The total development footprint will not exceed 30 Hectares (Ha).
2. Solar PV 2 will generate approximately 60 MW, forming part of the Department of Mineral Resources and Energy (DMRE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Construction is expected to take approximately 12 months. The total development footprint is expected to comprise about 60 Ha.

The solar panels have an approximate height of 1,5m. Surface developments will thus include the PV 1 (anticipated 30 Ha) and PV 2 Panels (anticipated 60 Ha), the Main Substation (± 0.3 Ha), additional Buildings (± 0.3 Ha), and the Battery Storage facility (± 3.3 Ha). Linear developments for the project include the Main Pipelines running between the Solar Panels, as well as a High-Voltage Powerline (± 6.2 km) that is recommended to connect the Main Substation to the Ysterkop substation.

For a depiction of the proposed layout, refer to Figure 3.

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 Visual Impact Assessment;
- 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 in order to minimise any potential visual impacts.

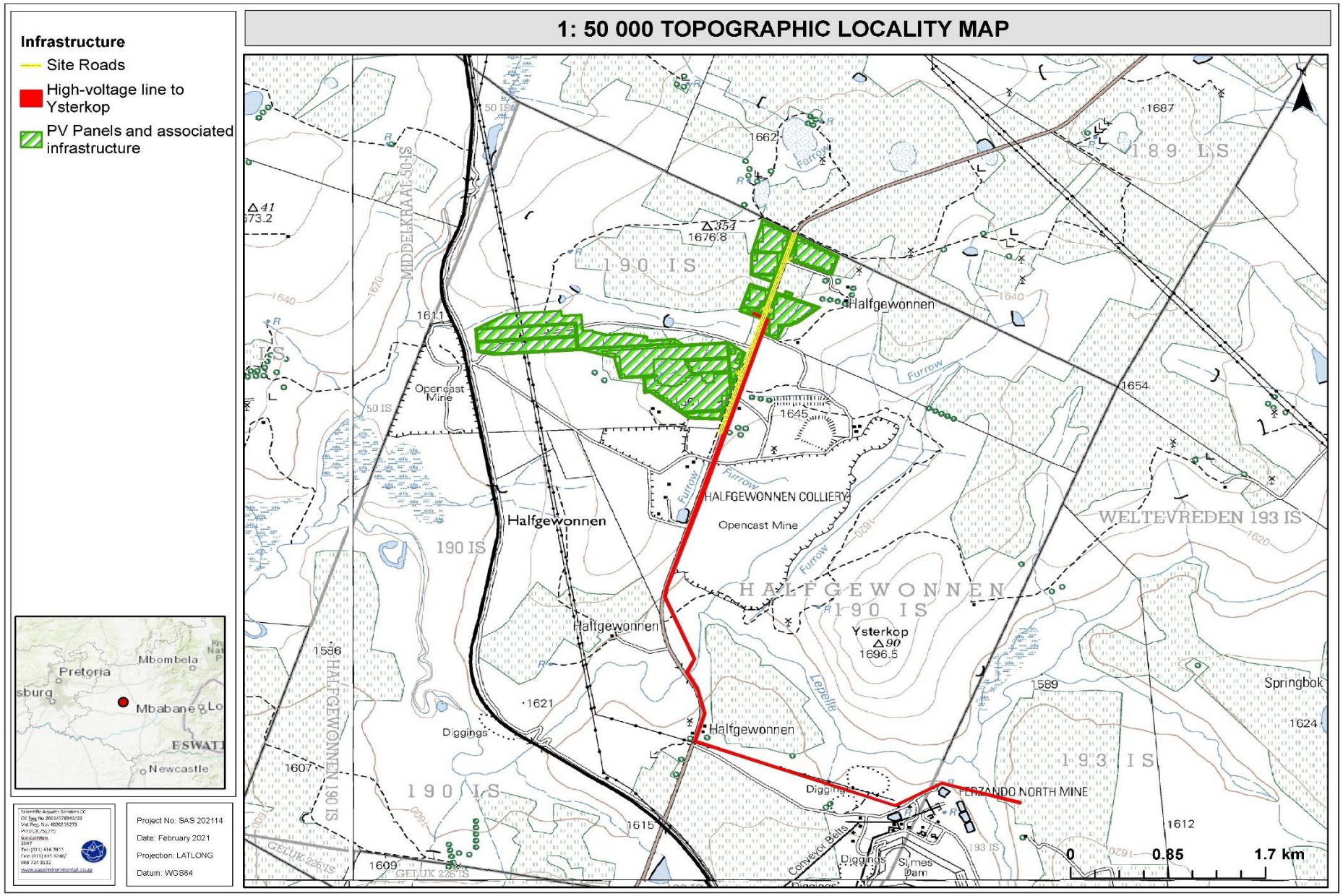


Figure 1: 1:50 000 Topographical map depicting the location of the Halfgewonnen PV Project in relation to the surrounding region.

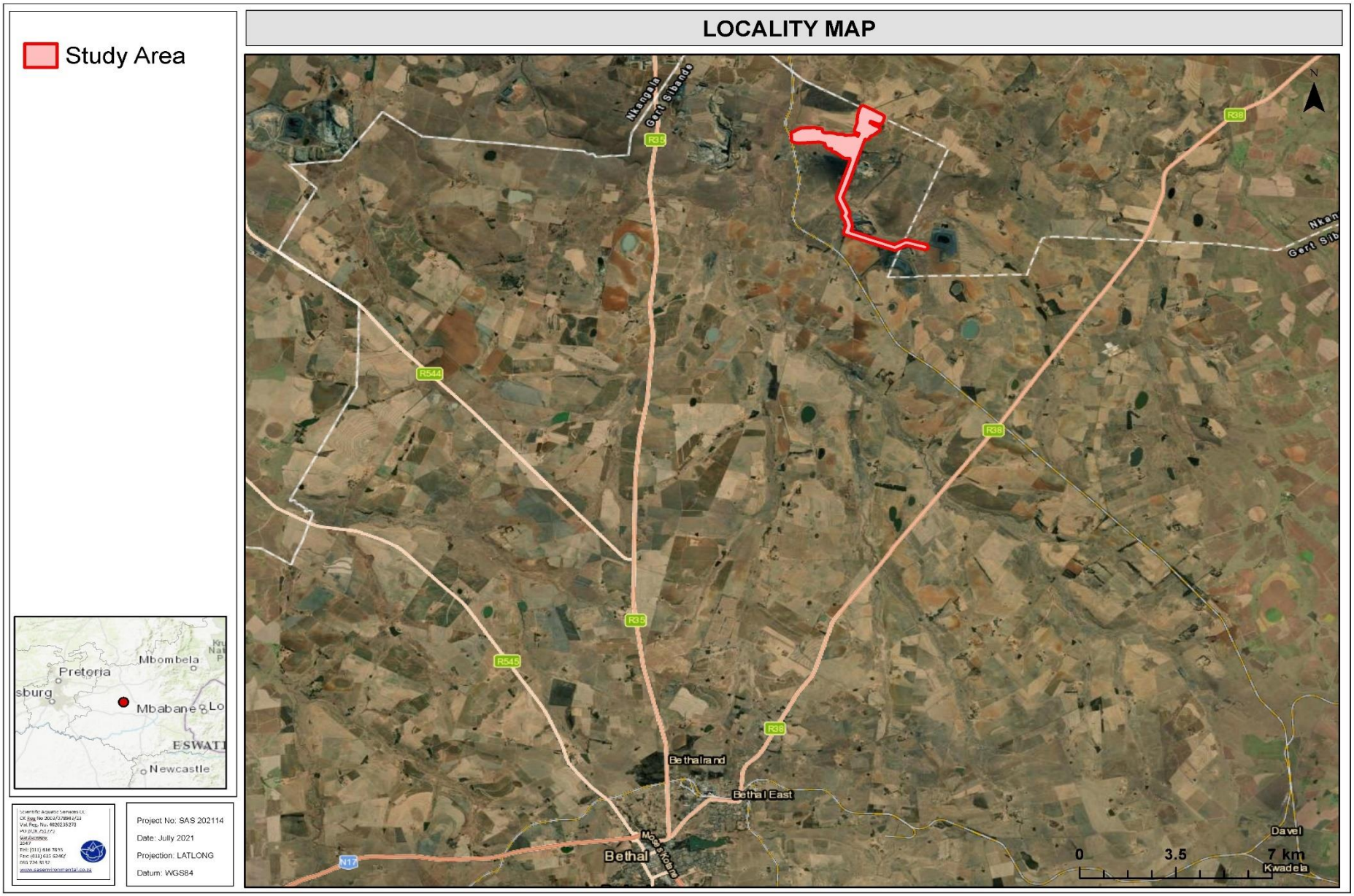


Figure 2: Digital satellite image depicting the location of the Halfgewonnen PV Project in relation to the surrounding region.

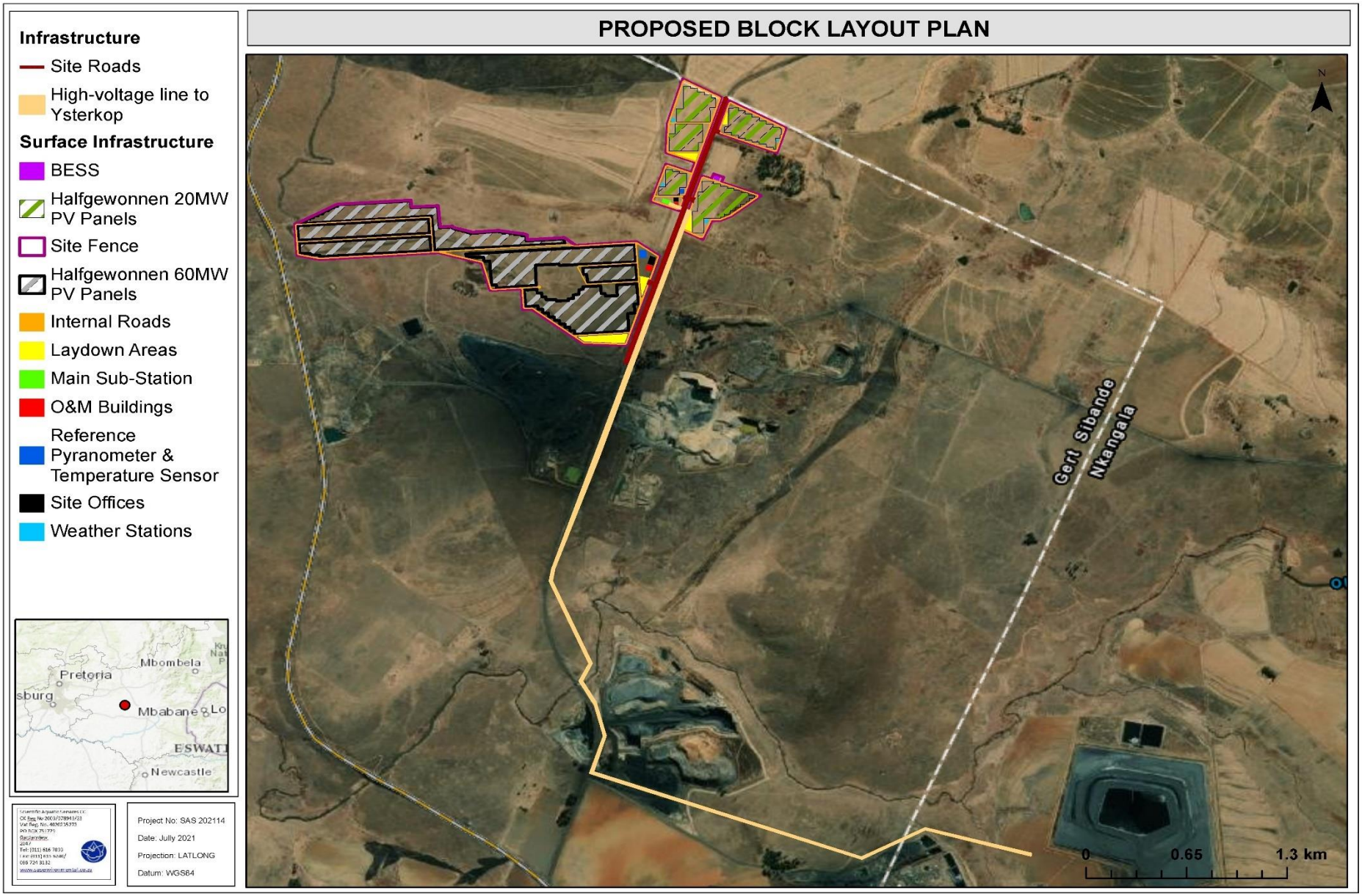


Figure 3: Proposed Layout of the Halfgewonnen PV Project.

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 has to be included as part the assessment;
- VIAs must inform the Environmental Impact Assessment (EIA) 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:

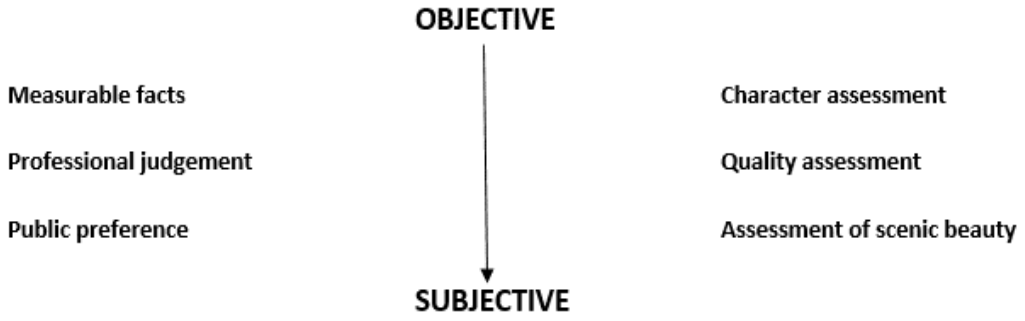
- Long term protection of important scenic resources and heritage sites;
- Minimisation of visual intrusion on scenic resources;
- Retention of wilderness or special areas intact as far as possible; and
- Responsiveness to the area's uniqueness, or sense of place.

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. Due to the undulating terrain of the surroundings and relatively low height of the

proposed PV structures and associated substations, 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. During the field assessment it was established that the undulating terrain, cultivated fields and existing mining infrastructure limits the view of the observer to their immediate surroundings. 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. Several sensitive receptors situated further than 3 km were however visited to determine whether the proposed structures will be visible and the level of visual intrusion on these receptors from the proposed structures;

- Due to a lack of guidelines for specialist visual impact assessments as part of the EIA process within the Mpumalanga 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 No. 107 of 1998). This includes the 2014 NEMA EIA regulations as amended (published in General Notice (GN) No. R 982 as well as R 983 Listing Notice 1, R 984 Listing Notice 2 and R 985 Listing Notice 3).

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:

According to the South African Protected Areas Database (SAPAD, 2020) and the National Protected Areas Expansion Strategy (NPAES, 2009) Dataset, there are no protected areas located within a 10 km radius of the study area, therefore the Protected Areas Act is currently not relevant to the proposed project.

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.

A Phase 1 archaeological and heritage impact assessment has been commissioned as part of the EIA for this project.

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 No. 32 of 2000)

In terms of the Municipal Systems Act (Act No. 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 Gert Sibande District Municipality (Govan Mbeki Local Municipality), where the proposed powerline will connect to the Ysterkop sub-station that is situated within the Nkangala District Municipality (Steve Tshwete Local Municipality). According to the Govan Mbeki IDP 2020/2021 the municipality is investing in renewable energy such as solar facilities to diversify and strengthen the Govan Mbeki Municipality, thus reducing the dependence on coal resources. The Steve Tshwete Local Municipality IDP 2020/2021 indicates that the municipality is taking steps to prioritise climate change response actions which includes promoting use of renewable energy. From both municipalities it is envisaged that renewable energy such as solar facilities will provide the platform for economic growth and diversification of the economy.

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 Environment, Forestry and Fisheries (DEFF), 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 any REDZs, however the study area is located approximately 23 km south of the recently promulgated REDZ9 (Emalahleni) published under GN 786 of 17 July 2020. According to GNR 114 of 16 February 2018, where an Application for Environmental Authorisation for large scale wind or solar PV facilities is being made, and these facilities fall outside of the REDZs, these applications will be considered in terms of the requirements of the EIA Regulations of 2014 (as amended).

According to the South African Renewable Energy EIA Application Database (REEA, 2020) the study area is located approximately 1.2 km north of an area that is currently undergoing approval applications for solar facilities namely: The Forzando North Coal Mine photovoltaic facility reference number NEAS: DEA/EIA/0000991/2021, DEA: 14/12/16/3/3/1/452. Furthermore, this application was submitted in terms of the EIA Regulations, 2010, and submitted in 2012.

Other

- According to the Mpumalanga Green Economy Roundtable (2016) South Africa embraced the green economy of a broader sustainable development in the 2008 National Framework for Sustainable Development (NFSD). The Mpumalanga Vision 2030 (Vision 2030) recognises the contribution that green industries can have towards

employment and economic growth. Furthermore, the Mpumalanga Government is a signatory to the Mpumalanga's Climate Change Declaration of 2011, which indicates a commitment to promote low carbon economic growth as part of the green economy.

- 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 most relevant available data on the study area and surroundings. The desktop assessment served to guide the field assessment through identifying preliminary areas of importance in terms of potential sensitive receptors possibly exposed to 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. Based on the undulating terrain of the area, the visual assessment zone encompasses a 5 km radius of the

study area. The potentially sensitive receptors identified within the visual assessment zone during the desktop assessment was 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 A – I.

3.2 Field Assessment

A field assessment was undertaken during the summer season on the 3rd of February 2021. As the study area is located within a relatively remote area adjacent to existing mine dumps and other mining facilities in the surrounding greater area and the area predominantly comprising agriculture, grassland and mining operations the season within which the VIA takes place is irrelevant as the vegetation screening factor will remain similar. Seasonal colour variation will however be evident between winter and summer.

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, in order to determine the visual context within which the proposed project is to be developed. The visibility of an object decreases exponentially the further away the observer is from the source of impact. The undulating terrain 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, if any, on these receptors from the proposed solar facilities. Points from where the proposed solar facilities 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 application 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 A, it was determined that the proposed project can be defined as a Category 5 development, which includes renewable energy structures. According to the National Web Based Screening Tool (2021) the overall sensitivity of the Archaeological and Cultural Heritage Combined Sensitivity of the study area is considered high due to the presence of the important Olifants River and the presence of a hill (Ysterkop). With the environment being classified as high cultural significance, a very high visual impact is deemed possible due to the sensitivity of the landscape.

Based on the outcome of the desktop and field assessments it is evident that only a small portion of the proposed powerline traverses the Olifants River whereas the proposed PV facilities are located approximately 2,3 km north of the Olifants River, rendering no visibility of the proposed PV facilities. As such, the cultural aspect of the area is unlikely to be affected by the proposed PV development. Furthermore, the study area is situated adjacent to the active mining areas of the Overlooked Colliery and Halfgewonnen Colliery and proposed future mining expansions in the area, and large portions of the study area are bean crop fields. The undulating topography of the surrounding area and the relatively low height of the proposed structures, results in the proposed PV structures not being significantly visually intrusive on the receiving environment. As such the proposed PV structures are likely to have a moderate to low visual impact on the receiving environment, and is confined to the provincial road D622 traveling along the proposed PV facility area and the farmhouse located north of the study area, on Portion 7 of the Farm Dunbar 189IS, therefore a Level 2 Assessment was undertaken versus 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 undulating topography, cultivated fields, grassland and mining activities in the area and the overall character are indicated in the figures below.

Figure 4: General view of the study area and surrounding area indicating the agricultural crop fields (top left), active mining activities and grassland (top right), existing overhead powerlines and active mining activities along the proposed powerline route (middle), and grassland and a mine dump in along the proposed powerline route (bottom left and right).

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

Climate (Appendix C)	As a result of climate variations throughout the year, the appearance and perception of the landscape within the surroundings of the study area changes with the seasons in terms of the chroma of the area. The weather conditions at the time of the field assessment was overcast by mid-afternoon, affecting the visibility of existing structures and therefore proposed structures. Since the Mpumalanga Province falls within the region that is characterised by summer rainfall, the visibility of the proposed Halfgewonnen Solar PV Project is likely to be slightly lower during the summer months. Seasonal variation may have some effect on the area from where the proposed Halgewonnen Solar PV Project would potentially be visible, with visibility expected to be slightly higher during the winter months when seasonal screening effects from vegetation is somewhat lowered. Dust storms with wind velocities capable of lifting the soil off the lands that have been prepared for summer crop cultivation is common which in turn affects the visibility in general.	**Landscape Character (Appendix E)**	The study area is located within a rural area interspersed with mining and agricultural activities with limited farmhouses dispersed across the landscape. The moderately undulating terrain is characterised by grassland where cattle are grazing and crop cultivation (bean and maize) are present. There are low hills also present within the landscape, contributing to the rural character of the area. Key aesthetic aspects of the landscape associated with the study area and the surrounding region is described in Appendix E. As the study area is situated within a rural and isolated area with undulating terrain, the landscape within which the study area is located can be defined as enclosed. There are active mining activities and dormant mining facilities within the surrounding landscape, which have negatively affected the landscape. With the study area being situated within a rural area where limited receptors are present, and the relatively low height of the proposed PV structures in comparison to the existing mining structures, it is concluded that the proposed PV facilities are expected to have a moderately low visual impact on the landscape character within the region.
Land Use and visual receptors (Appendix D)	The study area is situated in an area with rainfed agriculture (maize fields) with associated farmsteads, historic and active mining activities, grassland, and cultivation. The study area is furthermore situated in an area with undulating topography, limiting the opportunities for an observer to have a view across the broader landscape. There are no settlements or towns near the study area. There is one farmhouse located directly north of the proposed PV area, which will have a direct visual impact, however the farmhouse has well-established tall trees associated with it, obscuring the view somewhat, and the residents have become accustomed to the existing mining activities adjacent to the study area.	**Visual Absorption Capacity (VAC) (Appendix F)**	**Medium (Score 11)** According to the calculation the VAC of the area is considered moderate, indicating that the proposed PV structures will be absorbed in the area. Due to the nature of the project, its location adjacent to the existing mining activities, the relatively low height of the structures and existing powerlines, the proposed PV structures are likely to be absorbed in the landscape, resulting in a moderately low visual intrusion. The undulating terrain is the main contributing factor to the medium VAC, as the undulating terrain limits the observer from seeing across vast distances, as such confining the line of sight toward the study area to few vantage points in the surrounding environment.

	According to the SAPAD (2020), SACAD (2020) and NPAES (2009) datasets there are no nature reserves or protected areas within a 10 km radius of the study area, rendering the area as a low sensitivity in terms of a protected environment. Permanent residents such as farmers and farm workers residing in the area and people at their place of work are sensitive receptors. As noted there is one farm house located within 2 km of the study area, which will have a view of the study area, due to it being situated directly north of the study area. As mentioned above the farmhouse has well-established tall trees obscuring the view somewhat, however portions of the farm and the farm road will have a clear view of the study area. Additionally, this farmhouse is accustomed to the mining activities in the area therefore the sensitivity thereof may be considered moderate. 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 receptors of low sensitivity. Since the study area is situated within a remote area, the only main roads within the area are the R35 located approximately 6,2 km west of the study area and the R38 located 10 km east of the study area. The provincial road D622 runs adjacent to the study area which is frequently utilised by mine workers. Due to their momentary views and experience of the receiving environment motorists are classified as low sensitive receptors. During the field assessment it was evident that a portion of the tarred road adjacent to the study area was utilised as a truck stop for trucks waiting to be loaded with material from the Overlooked Colliery and Halfgewonnen Colliery, as seen in the figure below. This in turn will detract the motorist's view from the surrounding landscape to the trucks. 	**Landscape Quality (Appendix G)**	**Medium (Score 16)** As emphasised in the National Web Based Screening Tool (2021) the overall cultural sensitivity of the study area is considered high due to the presence of the important Olifants River and the presence of a hill; namely Ysterkop with an elevation of 1696,5 metres above means sea level, located approximately 2,5 km south-east of the study area. Based on the outcome of the desktop and field assessments it is evident that only a small portion of the proposed powerline traverses the Olifants River whereas the proposed PV facilities are located approximately 2,3 km north of the Olifants River. The field assessment further indicated that the undulating terrain of the area renders no visibility of the proposed PV facilities from the bridge crossing of the Olifants River, therefore the cultural aspect of the area is unlikely to be affected by the proposed PV development. There is topographical variety due to the undulating terrain of the area with low hills present as well as existing mine dumps with well-established vegetative cover. The Olifants River and other watercourses within the area also provide increased visual interest. There are watercourses present within the study area and the southern portion of the proposed powerline traverses the Olifants River, however these watercourses are not dominant in the landscape. Due to existing overhead powerlines and other anthropogenic structures such as gravel roads, fences and mining infrastructure, the proposed project will not introduce unacceptable discordant elements into the environment.
		Landscape Value (Appendix H)	With reference to the Appendix H, the study area itself is likely to be most valued by local residents, including the farmers and farm workers. As the landscape is already affected by mining activities as well as agricultural activities the landscape is not undisturbed, however the industrial facilities in the area is limited as such the proposed PV facilities may lower the landscape value of the area through direct loss of agricultural fields and natural grasslands.
Topography	The local topography of the study area consists of slightly undulating plains, with the surrounding environment characterised by moderately undulating plains with low hills and pan depressions. The most prominent features within the landscape are the anthropogenically derived topographical features such as the overburden dumps. As	**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

	previously mentioned, the Olifants River is present and proposed to be traversed by the proposed powerline route and numerous watercourses are present within the study area as well as several small dams within the surrounding area, as such water is somewhat dominant in the landscape. Please refer to Figures 5 and 6 for the elevation and slope models of the area.		thereto. The sense of place associated within the study area itself can be described as calm, tranquil and peaceful, with limited development and disturbance, with the exception of the agricultural fields and active mining activities in the immediate surroundings. However, taking the broader area into consideration as well as the powerline route, the sense of place is considered busy with the ongoing mining and coal processing taking place at the Halfgewonnen and Overlooked Collieries, and the roads are busy with heavy vehicles and coal tipper trucks. During the construction phase of the proposed Halfgewonnen Solar PV Project, the sense of place will be affected increasing the traffic on the local roads with construction vehicles and the study area itself with some earth moving equipment. Once the PV plant is operational there will be limited operational vehicular movement in and out of the study area, thus reducing the traffic on the local roads.
Vegetation Cover (Appendix C)	The study area falls within a single biome and bioregion according to Mucina & Rutherford (2012) namely Grassland Biome and Mesic Highveld Grassland Bioregion. The Eastern Highveld Grassland vegetation type characterises the region (Appendix C). The vegetation within the study area and surrounding environment is short dense grassland dominated by the common highveld grass composition (*Aristida*, *Digitaria*, *Eragrostis*, *Themeda*, *Tristachya*), and the northern portion of the PV 1 Panels are transformed into bean fields to regenerate and fertilize the soil before another season of maize cultivation, which are also short and dense. Since the surrounding area is associated with grassland species with few tree species, the vegetative component of the area provides low screening ability, thus the proposed Halfgewonnen Solar PV Project will not be obscured from sensitive receptors. The main offices of the Halfgewonnen Colliery is situated to the east and within close proximity to the study area also have a dense clump of trees associated with the building, obscuring the view thereof from the study area.	**Night-Time Lighting (Appendix I)**	The study area in its current state contains no infrastructure and thus no lighting, even though the area is considered remote the farmhouse present and mining infrastructure are sources of night-time lighting in the area. Development of the proposed PV facilities may potentially be a source of light pollution during the construction and operational phases, due to security lighting on the perimeter fence and especially 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 moderately low and will be limited to a local area. The lighting associated with the proposed PV facilities may potentially contribute somewhat to the effects of skyglow and artificial lighting in the region.
Viewshed Analysis			
From the viewshed analysis, it is evident that the proposed Halfgewonnen PV Solar facilities will only be visible to observers located less than 1 km away, north and west of the study area. As such, receptors located further than 1 km will not have a clear line of sight toward the study area. It is important to note that there are a limited number of receptors located within a 5 km range of the study area, therefore there is a limited number of observers experiencing the possible visual impact that the proposed Halfgewonnen PV Solar facilities might have. This confined viewshed is mainly attributed to the relatively low height of the solar panels as well as the undulating topography of the area. 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. Taking the VAC (vegetation and topography) of the surrounding environment into consideration, the study area will not be visible to sensitive receptors situated further than 1 km as indicated by the viewshed analysis and confirmed during the field assessment. The proposed Halfgewonnen PV Solar facilities are 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 low height of proposed infrastructure and the undulating terrain of the area. Figure 6 below indicates the viewshed analysis.		

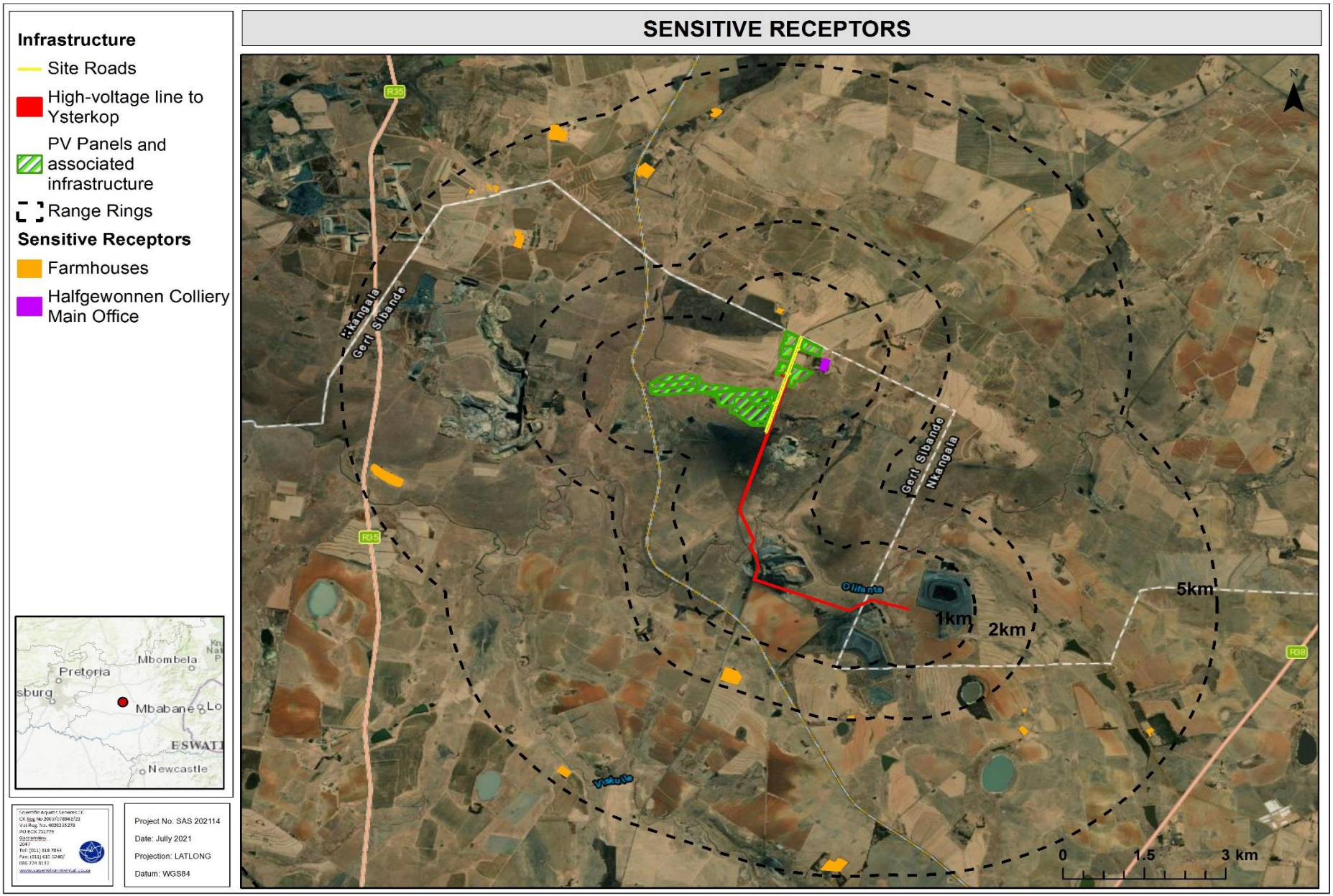


Figure 5: Map indicating the location of sensitive receptors within 5km of the study area.

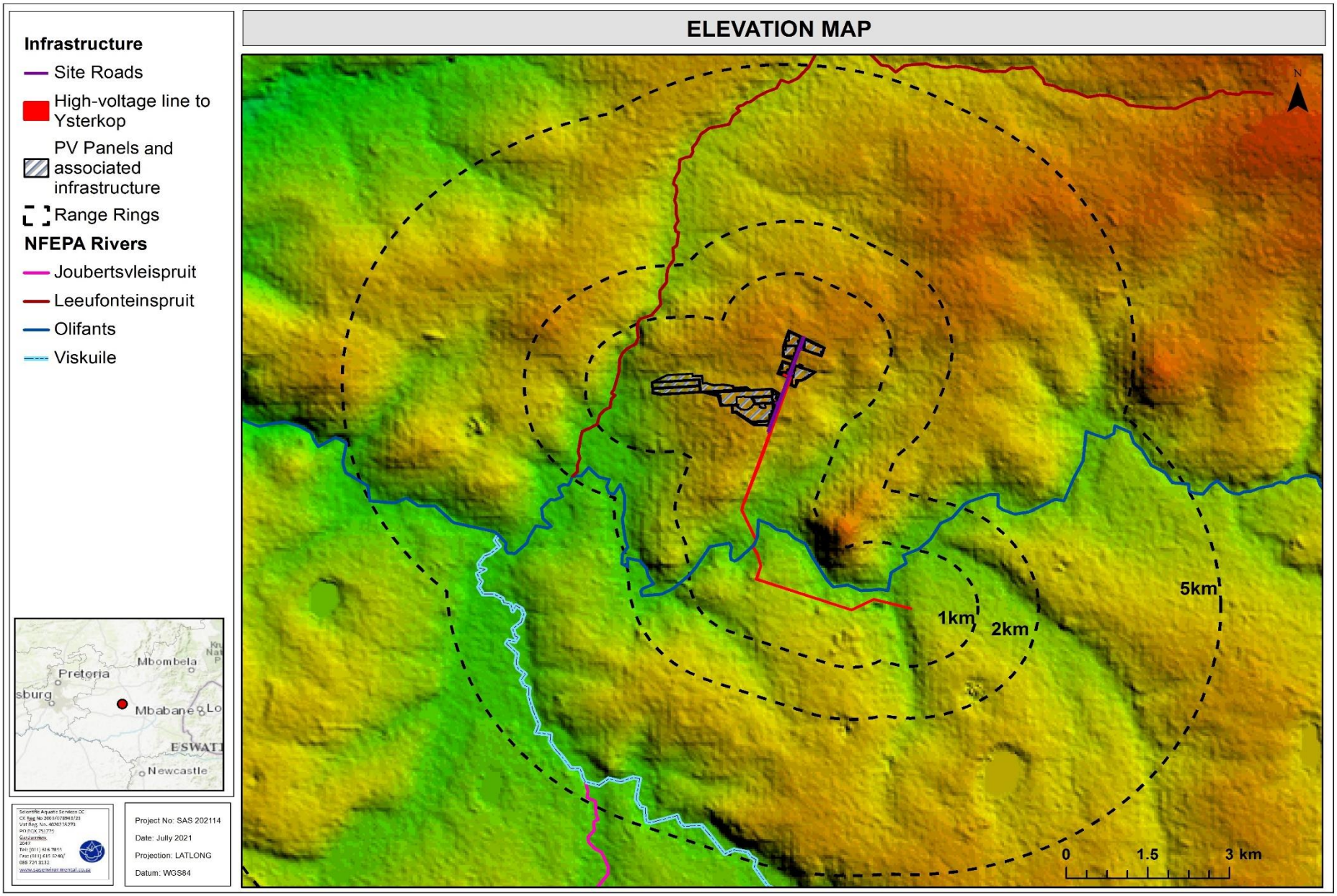


Figure 6: False colour elevation rendering depicting the topographical character of the study area.

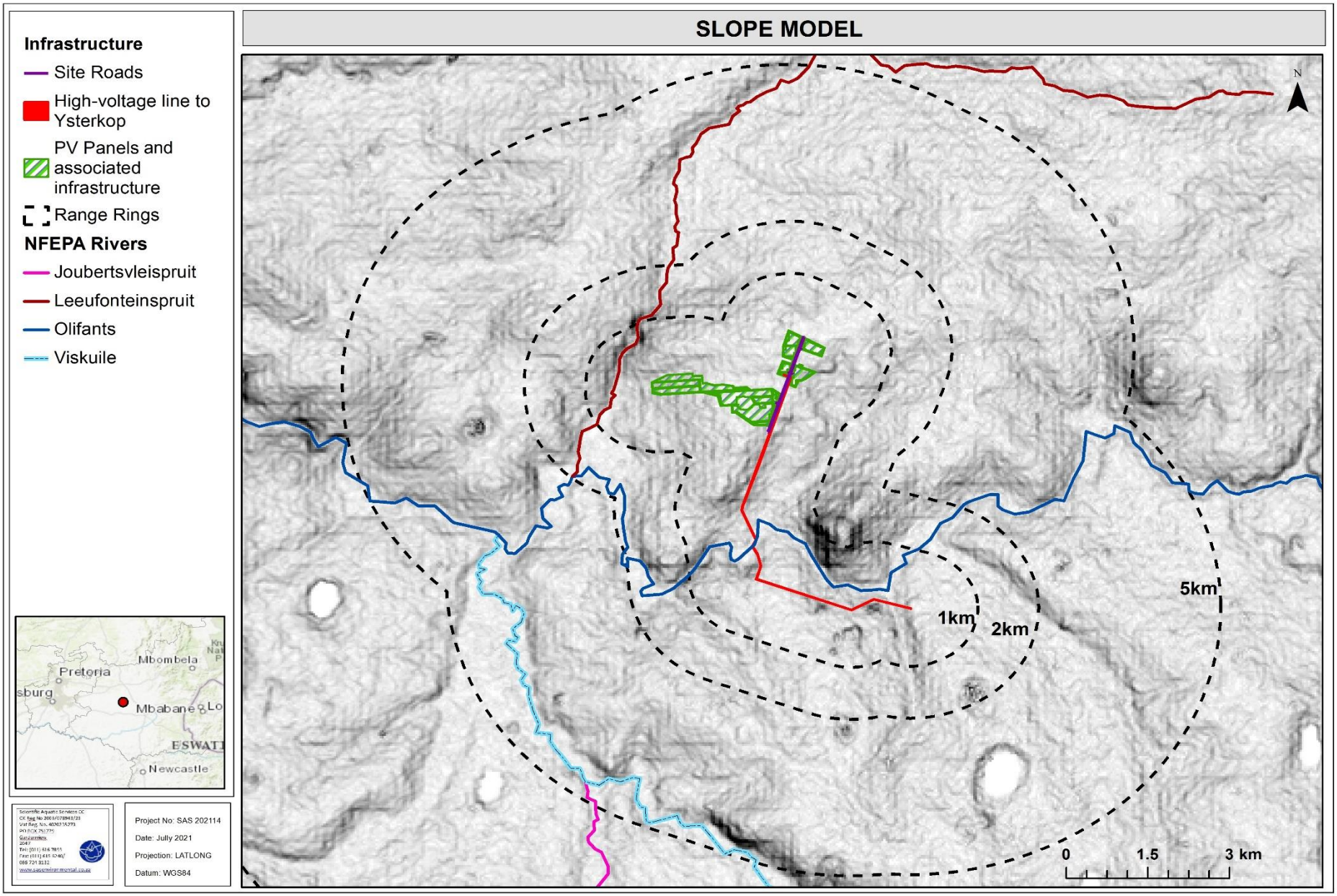


Figure 7: Monochromatic map indicating the general relief associated with the study area.

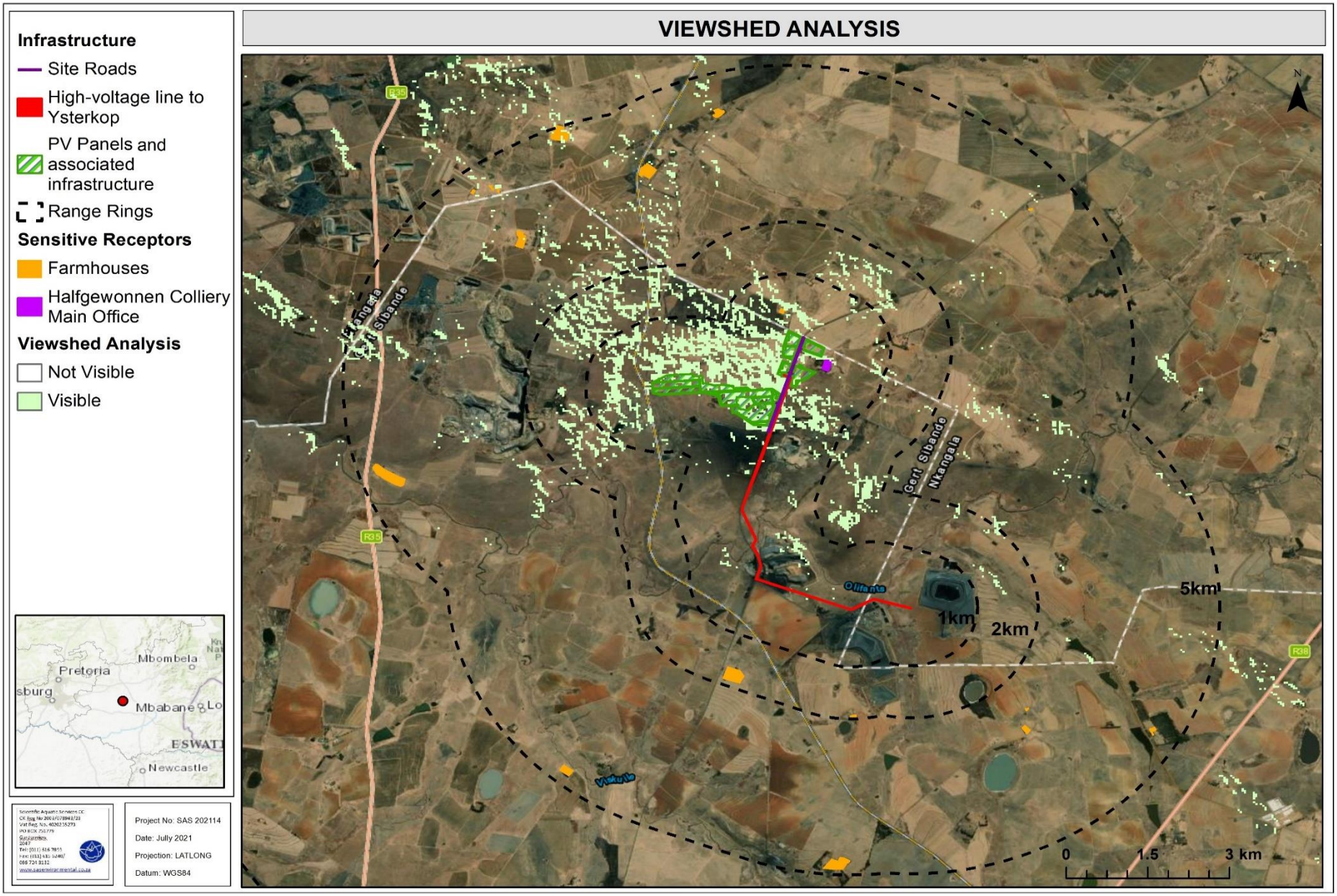


Figure 8: Viewshed analysis of the PV panels and associated infrastructure of the Halfgewonnen PV Solar Facility.

The figures below indicate the view of the proposed Halfgewonnen PV Solar facilities from specific viewpoints within the surrounding area. It should be noted that the one farmhouse located within 2 km of the study area has grown accustomed to the existing mining facilities and activities present, as such the visual impact of the proposed Solar PV facilities will not be as significant as in an area where no previous disturbance has occurred. From the figures below it is evident that the undulating topography and existing mining and industrial structures, screen the view of the study area from the limited sensitive receptors within 3 km.

Figure 9: View from the provincial road D622, approximately 4,8 km south of the proposed Halfgewonnen Solar PV facilities. The proposed Halfgewonnen Solar PV facilities (red arrow) are in the far distance and will not be clearly noticeable from this vantage point due to the existing mining infrastructure, trees and relatively low height of the proposed solar panels. Due to the distance, the visual intrusion of the proposed solar panels are marginal to negligible.

Figure 10: View from the provincial road D622, approximately 600 m south of the study area. The existing infrastructure associated with the Halfgewonnen Colliery and trucks awaiting to be loaded and the undulating terrain screens the view towards the proposed Solar panels, thus not having a visual impact at this vantage point.

Figure 11: Conceptual rendering of the view from the farmstead's road situated directly adjacent to and north of the study area. The proposed solar panels will be clearly visible from here (red line), however as indicated in the bottom figure the farmhouse has a dense clump of trees surrounding it, thus screening the view partially toward the study area.

Figure 12: Conceptual rendering of the view from provincial road D622 situated approximately 3,4 km north east of the study area. The undulating terrain limits the view of the observer, rendering no visibility of the study area (dashed red arrow).

5. IMPACT ASSESSMENT

Potential impacts on the visual environment in the region as a result of the proposed PV facilities and based on available information, are discussed in the sections below, according to the method outlined in Appendix B. This section presents 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.

The project life cycle for a new Solar PV facilities includes the following primary activities:

Feasibility phase: This phase includes confirming the feasibility of the Project by evaluating and addressing the following ➢ Solar resource assessment; ➢ Site selection; ➢ Project land allocation; ➢ Project yield assessment; ➢ Permitting and licensing; ➢ Legal agreements; ➢ Socio economic development; ➢ Industrialisation and localisation; ➢ Project cost determination; ➢ Project financing; and ➢ Risk analysis.	**Design phase** ➢ Confirming key design features such as the type of PV module to be used, tilting angle, mounting and tracking systems, inverters, and module arrangement; ➢ Confirming specifications for the components of the Solar PV facilities ; ➢ Preparing detailed designs (layout, civil, electrical); ➢ Preparing construction plans; ➢ Preparing the Project schedule; and ➢ Preparing the commissioning plans.
Construction phase ➢ Establishing access roads; ➢ Preparing the site (fencing, clearing, levelling and grading, etc.); ➢ Establishing the site office; ➢ Establishing laydown areas and storage facilities; ➢ Transporting equipment to site; ➢ Undertaking civil, mechanical and electrical work; and	**Operational phase** Once the PV facilities are up and running the facility will be largely self-sufficient. Operational activities associated with the maintenance and control of the Solar PV facility will include the following ➢ Testing and commissioning the facility's components; ➢ Cleaning of PV modules; ➢ Controlling vegetation;

➢ Reinstating and rehabilitating working areas outside of permanent development footprint.	➢ Managing stormwater and waste; ➢ Conducting preventative and corrective maintenance; and ➢ Monitoring of the facility's performance.
Decommissioning Solar PV facilities are likely to have an operational lifetime of 20 to 25 years or more. The most likely scenario would be extension of the lifespan of the solar facilities 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.	

After consideration of the findings of these assessments, recommendations and mitigation measures have been developed which will assist in minimising the proposed project's visual impact throughout the various development phases of the project. The mitigation measures outlined would serve to minimise the potential visual impacts identified to lower significance levels.

Based on literature review, glint and glare from the proposed PV structures are geometrically possible towards some sensitive receptors, thus glint and glare was considered during the impact assessment both pre-mitigation and with the implementation of mitigation measures. These reflections will however not have a significant impact on the receiving sensitive receptors due to vegetation, topography and other anthropogenic structures obscuring the view. In the event that glint and glare is visible, the reflection experienced would be similar to other reflections produced from surfaces in the ambient environment, such as reflection of windows, streets signs and still water (PagerPower, 2014). Glint and glare may impair the visibility of observers and cause annoyance, discomfort, or loss in visual performance especially for the residents of the farmhouse located north of the study area.

The proposed PV panels have anti-reflective tempered patterned glass in the front and tempered pattern glass at the rear end, therefore it limits the sunlight reflection resulting in lowering the possibility of glint and glare, also increasing the absorption of sunlight.

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 in close proximity to sensitive receptors (especially the farmhouse north of the study area).	Site clearing, including the removal of topsoil and vegetation within footprint.	Presence of the PV facilities within an area where no renewable energy structure have been introduced in the area.	Demolition and removal of infrastructure leading to dust generation, erosion and changes in the visual character of the project area.
Placement of PV facilities in such a way that it leads to loss of natural visual resources such as watercourses and rocky ridges.	Excavation of foundations for substation infrastructure and foundations of panel support structures, potential loss of watercourses during excavation activities.	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.
Failure to initiate a concurrent 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.	Temporary soil stockpiles leading to visual intrusion.	Potential ongoing erosion and loss of topsoil leading to high visual contrast, and potential loss of watercourses.	Ongoing proliferation of alien vegetation.
Planning of light placement and overall lighting strategy.	Construction and placement of PV facilities and substations.	Potential of sunlight reflecting off the PV arrays creating glint and glare impacts.	Stationary and vehicle mounted lighting during the decommissioning phase.
	Construction of general surface infrastructure including access roads.	A small and periodic increase in human activity and operational vehicles especially during maintenance and cleaning of panels.	
	An increase in dust and vehicular movement due to construction activities	Exterior lighting around the perimeter of the study area.	
	Potential erosion and loss of topsoil leading to high visual contrast.	Potential lighting at night from operational vehicles.	
	Increased amount of human activity, traffic, construction vehicles, and other equipment such as excavators and cranes.	Security and other lighting around and on support structures could also contribute to light pollution.	
	Use of security lighting during the construction phase.	Potential maintenance activities conducted at night.	

5.1.1 Impact 1: Impact on Landscape Character and Sense of Place

The proposed project may impact on the existing landscape and visual character of the region and Sense of Place associated with the study area and its immediate surroundings. The character of the landscape in the region of the study area is characterised by undulating terrain with low hills and existing overburden dumps, dominated by grassland and interspersed with watercourses such as the Olifants River, cultivated fields, isolated tree clumps mostly

associated with farmhouses or offices, and mining activities. With the study area being situated within a rural area with limited receptors present within 2 km, and the relatively low height of the proposed PV structures in comparison to the existing mining structures, the proposed PV facilities are expected to have a moderately low visual impact on the landscape character within the region. The significance of the impact is assessed in the table below.

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	4	3	3	7	10	70 (Medium Low)
Operational phase	4	3	4	3	3	7	10	70 (Medium-Low)
Decommissioning	3	3	3	3	3	6	9	54 (Medium-Low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	3	3	3	3	3	6	9	54 (Medium Low)
Operational phase	2	3	3	2	4	5	9	45 (Low)
Decommissioning	2	3	2	2	2	5	6	30 (Low)

The landscape character and sense of place of the study area is considered of moderate visual sensitivity and importance. From the above table, it was found that prior to mitigation, the expected impact on the overall visual character and sense of place of the area as a result of the proposed PV facilities area considered to be Medium Low during all the phases. A temporary change in landscape character and sense of place is likely to occur as the proposed construction and operational activities will alter the land use. During the construction phase of the proposed Halfgewonnen Solar PV Project, the sense of place will be affected, shifting the mood from calm and tranquil to busy with construction vehicles and potential need for some earth moving equipment, however once the panels are operational there will be limited vehicular movement in and out of the area, thus returning the area to a calm and tranquil landscape. Post mitigation, should management measures be effectively implemented, the overall impact significance may be decreased to Medium Low and Low significance levels.

5.1.2 Impact 2: Visual Intrusion and VAC impacts

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 does however have industrial features present as well as mining landscapes, thus the visual intrusion of the proposed PV facilities will be moderately low. The altered visual environment during the construction phase, may lead to moderate levels of

visual intrusion and lead to increased visual contrast, 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 be experienced by receptors within the immediate vicinity as the undulating topography screens the view and reduces the viewshed extent significantly . Once the proposed PV facilities are operational the vegetation cover below the panels will be partially restored reducing the contrast in the landscape to some degree. It is expected that although the VAC of the study area will temporarily be negatively impacted on by the proposed PV facilities, this impact, as well as visual intrusion may be mitigated through the implementation of suitable mitigation measures.

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

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	4	3	3	7	10	70 (Medium Low)
Operational phase	4	3	4	3	3	7	10	70 (Medium Low)
Decommissioning	3	3	2	3	3	6	8	48 (Low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	3	3	3	3	3	6	9	54 (Medium Low)
Operational phase	2	3	3	2	4	5	9	5 (Low)
Decommissioning	2	3	2	2	2	5	6	30 (Low)

The expected level of visual intrusion as a result of the proposed project is considered Medium Low during the construction and operational phases and Low during the decommissioning phase, due to the clearing of vegetation and alteration of landforms. The VAC of the study area and surrounds is however determined to be medium, which illustrates the ability of the surrounding area to absorb or conceal some visual impacts. Due to the relatively low height of the proposed structures, the undulating terrain and the limited sensitive receptors in the area, the proposed PV facilities are not expected to lead to a significant level of visual intrusion on the surrounding landscape. The perceived significance ratings may be lowered to Medium Low and Low significance levels through the implementation of mitigation measures such as progressive revegetation of impacted areas take place and that clearing of vegetation remain limited.

5.1.3 Impact 3: Visual Exposure and Visibility Impacts

This impact relates directly to the perception of sensitive visual receptors towards the proposed project. As determined during the field assessment there are few receptors within a 2 km radius and the only receptors that will be affected by the proposed project is the farmhouse situated directly north of the study area, on Portion 7 of the Farm Dunbar 189IS and the provincial road D622 that travels along the study area and proposed powerline. Direct visual exposure will take place as a result of infrastructure construction and operations and associated lighting, glaring, an increased amount of human activity within the study area and indirectly through fugitive dust generated by construction related activities. In addition to physical infrastructure, impacts from clearing of vegetation during construction, potential erosion as a result of bare soils, maintenance activities and the alteration of local topography will also create contrast in the landscape and may be visible to receptors. It is however 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, and particularly for the Mpumalanga Province. In general more and more people are accepting PV facilities as essential sources of energy and are being accustomed to their presence and appearance within the landscape across the country.

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

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	4	3	4	3	3	7	10	70 (Medium Low)
Operational phase	3	3	4	3	4	6	11	66 (Medium Low)
Decommissioning	3	3	3	3	3	6	9	54 (Medium Low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	3	3	3	2	3	6	8	48 (Low)
Operational phase	2	3	3	2	4	5	9	45 (Low)
Decommissioning	2	3	2	2	2	5	6	30 (Low)

The proposed development activities are expected to visually impact two visual receptors in the region, road users on the provincial road D622 traveling along the study area and powerline, however this road is mostly utilised by mine and farm workers and the farmhouse directly north of the study area, on Portion 7 of the Farm Dunbar 189IS. The significance of the visual impact is considered to be of Medium Low significance during all the phases of the

development prior to mitigation. Should mitigation measures be implemented, this impact is still likely to occur, with a Low impact significance expected during the various development phases.

5.1.4 Impact 4: Impacts due to Night time Lighting

Since the study area is located within a rural area there are limited sources of night-time lighting; the farmhouse located north of the study area, and the mining activities adjacent to the study area. The lighting environment of the region is therefore considered rural and of low district brightness. Due to the nature of a PV facilities 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 PV facilities 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.

Unmanaged	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	3	3	6	8	48 (Low)
Operational phase	3	3	3	3	4	6	10	60 (Medium Low)
Decommissioning	2	3	2	3	3	6	8	48 (Low)
Managed	**Probability of Impact**	**Sensitivity of receiving environment**	**Severity**	**Spatial scale**	**Duration of impact**	**Likelihood**	**Consequence**	**Significance**
Construction phase	2	3	2	2	2	5	6	30 (Low)
Operational phase	2	3	2	2	3	5	7	35 (Low)
Decommissioning	2	3	2	2	2	5	6	30 (Low)

From the above tables it is clear that before mitigation, the impact on visual resources through light pollution, particularly at night, is not likely to be highly significant during any of the development phases, with the greatest impact expected during the operational phase. This is mainly attributed to the fact that the only lighting sources associated with the proposed PV facilities are security lighting.

With improved technology and design techniques, PV facilities are no longer associated with glare, however PV facilities can create increased visibility and contrast through the creation of geometric patterns of reflected light caused by simultaneous reflection of sunlight from regularly-spaced metal surfaces in the collector array. The reflected light may not necessarily cause discomfort to the viewer, during the daytime, and may change dramatically as the observer moves (Royal Haskoning DHV, 2015). It should be noted that the PV panels will not contribute to night time light pollution in the area, since no reflection of the sun occurs at night.

5.2 Impact Statement

As the study area is located within a rural landscape, with undulating terrain characterized by grassland interspersed with mining activities and cultivated fields and limited sensitive receptors, the visual impact associated with the proposed development is considered moderately low. Sensitive receptors within the immediate vicinity (within a 2 km radius) will have the highest visual impact during the construction phase and immediately thereafter, however once the proposed PV facilities are operational the visual impact will be lowered as the PV facilities will form part of the existing industrial aspects of the landscape. The visual intrusion of the proposed PV facilities are visually less intrusive to not visible to sensitive receptors located further than 1 km, due to the undulating terrain. It can therefore be concluded that with adherence to the mitigation measures as outlined in this report (Section 5.5), the proposed development will not have a long term negative visual impact on the surrounding environment, and although it will increase the industrial structures in the landscape, the mining activities have already lowered the overall visual character of the landscape. .

5.3 Cumulative Impacts

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Cumulative visual impacts resulting from landscape modifications as a result of the proposed project in conjunction with the proposed powerlines and substations to which it will connect to, as well as any approved or future renewable energy facilities (wind and 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 broader region.

According to the SA Renewable Energy EIA Application (REEA) Database, renewable energy applications have been presented for the properties 1,2 km south of the study area namely: The Forzando North Coal Mine photovoltaic facility reference number NEAS:

DEA/EIA/0000991/2021, DEA: 14/12/16/3/3/1/452. Furthermore, this application was submitted in terms of the EIA Regulations, 2010, and submitted in 2012. Although powerlines and substations are relatively small developments when compared to renewable energy facilities, they may still introduce a more industrialised character into the landscape, thus altering the sense of place. The cumulative impact of additional traffic in the area on the local and regional roads as well as combined impacts from night-time lighting of the substations will also potentially affect the sense of place of the larger region.

5.4 Residual Impacts

Certain infrastructure components may remain present once decommissioning has occurred, leading to a permanent alteration of the visual environment. It is also possible that the development of the proposed infrastructure may lead to possible permanent alteration and damage to natural features, such as the permanent loss of watercourses, located within the study area. 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 impacted areas and rehabilitation of any impacted areas therefore 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 PV facilities will be decommissioned as the most likely scenario would be the extension of the lifespan of the solar facilities 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.

5.5 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;
- An efficient removal system of waste and rubble must be ensured during the construction phase;
- 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 indigenous vegetation being cleared as possible;
- Construction boundaries should be clearly demarcated, with a temporary fence, to minimise areas of surface disturbance;
- Direct loss of or damage to valuable natural visual resources such as the watercourses in the study area and surroundings should be actively avoided;
- 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.
- The height of any temporary structures such as soil stockpiles should be kept as low as possible.

Infrastructure placement

- Where infrastructure is sited within view of visually sensitive receptors (the farmhouse located north) within close proximity to the study area, it must be placed as far away as possible and as close as possible to the existing structures. Where full screening of infrastructure components is not possible, siting should take advantage of partial screening opportunities;
- Negotiations with the farmer could be investigated to plant more tall and dense trees along the fence line of the farm to obscure the view toward the proposed PV facilities;
- As far as possible and where feasible, infrastructure should be placed in areas that have already been disturbed.

Infrastructure appearance and glint and glare

- 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, 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;

- The use of permanent signage and project construction signs should be minimised and visually unobtrusive;
- 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);
- The proposed design of the PV panels to be utilised for this project includes the use of anti-reflective tempered patterned glass, reducing the possibility of glint and glare. Recent studies indicated that an extra layer of anti-reflective material on the outer surface of the glass can further limit sunlight reflection (Sreenath *et. al.,* 2019);
- Another design feature to limit glint and glare is to roughen the protective glass surface, reducing specular reflection (Sreenath *et. al.*, 2019); and
- A possible mitigatory technique that can be employed is possible adjustment in the tilt and orientation angle of PV modules. These changes can alter the direction of solar reflection and hence the degree of glare impact. The Solar Glare Hazard Analysis Tool (SGHAT) can be used to check the glare potential for the proposed PV system design values. SGHAT has the capability to identify PV configurations that produce no glare and the design with maximum energy production can be selected (Sreenath *et. al.*, 2019).

Screening

- It must be ensured that existing vegetation is retained as far as possible during the construction and operational phases of the project to act as visual screens;
- As far as possible the PV facilities should be positioned in such a way as to maximise the screening effect of existing topography and existing mand-made structures and where possible placement of PV facilities where it will be exposed against the skyline should be avoided;
- It must be ensured, wherever possible, that existing natural vegetation is incorporated into the concurrent site rehabilitation especially in line of sight from sensitive receptors;
- If feasible, a row of tall dense trees on the northern periphery of the study area, where the farmhouse is located, should be planted to screen the view and reduce the glint and glare of the PV panels towards the farmhouse.

Erosion

- Erosion, which may lead to high levels of visual contrast and further detract from the visual environment, must be prevented throughout the lifetime of the project by means of putting soil stabilisation measures in place where required and through concurrent rehabilitation.

Dust

- During the construction phase all dirt and access roads, as well as other areas cleared of vegetation for construction purposes will require effective dust suppression such as regular watering;
- Access roads must be suitably maintained to limit erosion and dust pollution;
- Vehicle speed on unpaved roads must be reduced to limit dust creation. Speed limits are recommended as follows: 60km/h on the provincial road D622, 40km/h on site for normal vehicles and 20 km/h for heavy construction vehicles.

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 Sites, 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

- Concurrent/ progressive rehabilitation of temporary cleared areas, including reshaping and revegetation, must be implemented as soon as possible;
- 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

A visual impact will only occur if there are sensitive receptors present in the area to observe or experience the visual impact. Based on the desktop and field assessments it is evident that the study area is situated within a relatively remote area where sensitive receptors are very limited and sparse, and is confined to the provincial road D622 traveling along the proposed PV facility area and the farmhouse located directly north of the study area, on Portion 7 of the Farm Dunbar 189IS. Furthermore, the study area is situated adjacent to the active mining areas of the Halfgewonnen Colliery and proposed future mining expansions in the area, and large portions of the study area comprise crop fields. The undulating topography of the surrounding area and the relatively low height of the proposed structures, results in the proposed PV structures not being significantly visually intrusive on the receiving environment.

According to the National Web Based Screening Tool (2021) the overall sensitivity of the Archaeological and Cultural Heritage Combined Sensitivity of the study area is considered high due to the presence of the important Olifants River and the presence of a mountain or ridge. With the environment being classified as high cultural significance, a very high visual impact is deemed possible due to the sensitivity of the landscape. Based on the outcome of the desktop assessment it is evident that only a small portion of the proposed powerline traverses the Olifants River whereas the proposed PV facilities are located approximately 2,3 km north of the Olifants River, rendering no visibility of the proposed PV facilities. As such, the cultural aspect of the area is unlikely to be affected by the proposed PV development.

The moderately undulating terrain is characterised by grassland where cattle grazing and crop cultivation (bean and maize) activities are dominant. There are low hills also present within the landscape, contributing to the overall rural character of the larger region, the existing and ongoing mining activities lessen the rural character of the immediate surroundings. The Visual

Absorption Capacity (VAC) of the area is considered moderate, indicating that the proposed PV structures will be absorbed in the area, resulting in a moderately low visual intrusion.

The sense of place associated within the study area itself can be described as calm, tranquil and peaceful, with limited development and disturbance, with the exception of the agricultural fields and active mining activities in the immediate surroundings. However, taking the broader area into consideration as well as the powerline route, the sense of place is considered busy with the ongoing mining and coal processing taking place at the Halfgewonnen and Overlooked Collieries, and the roads are busy with heavy vehicles and coal tipper trucks. During the construction phase of the proposed Halfgewonnen Solar PV Project, the sense of place will be affected increasing the traffic on the local roads with construction vehicles and the study area itself with some earth moving equipment. Once the PV plant is operational there will be limited operational vehicular movement in and out of the study area, thus reducing the traffic on the local roads.

Based on the outcome of the impact assessment the visual impact associated with the proposed development is considered moderately low. This is mainly attributed to the study area being located within a rural landscape, with undulating terrain characterized by grassland interspersed with mining activities and cultivated fields and limited sensitive receptors. Sensitive receptors within the immediate vicinity (within a 1 km radius) will have the highest visual impact during the construction phase and immediately thereafter, however once the proposed PV facilities are operational the visual impact will be lowered as the PV facilities will form part of the existing industrial structures in the landscape.

Glint and glare may impair the visibility of observers and cause annoyance, discomfort, or loss in visual performance especially for the residents of the farmhouse located north of the study area, on Portion 7 of the Farm Dunbar 189IS. The proposed PV panels have anti-reflective tempered patterned glass in the front and tempered pattern glass at the rear end, therefore limiting the sunlight reflection, in turn lowering the possibility of glint and glare. Possible mitigation measure to further reduce the possibility of glint and glare include: an extra layer of anti-reflective material on the outer surface of the glass on the PV panels; roughen the protective glass surface, reducing specular reflection; and an adjustment in the tilt and orientation angle of PV modules (Sreenath et. al., 2019). These changes can alter the direction of solar reflection and hence the degree of glare impact. The Solar Glare Hazard Analysis Tool (SGHAT) can be used to check the glare potential for the proposed PV system design values. SGHAT has the capability to identify PV configurations that produce no glare and the design with maximum energy production can be selected (Sreenath et. al., 2019).

It can therefore be concluded that with adherence to the mitigation measures as outlined in this report, the proposed development will not have a long term negative visual impact on the surrounding environment, and although it will increase the industrial structures in the landscape, the mining activities have already lowered the overall visual character of the landscape.

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 this 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 (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

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructures that are possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/ impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the tables below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[2].

[1] The definition has been aligned with that used in the ISO 14001 Standard.

[2] Some risks/impacts that have low significance will however still require mitigation

The assessment of significance is undertaken twice. Initial significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's NEMA (Act 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table B1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	**RATING**
Highly unlikely: the event will occur only in exceptional circumstances	1
Possible: the event could occur but is not expected to occur	2
Likely: the event could occur	3
Highly likely: the event will probably occur in most circumstances	4
Definite: the event is expected to occur in most circumstances	5
Sensitivity of receiving environment	**RATING**
Visually not sensitive or important	1
Visually with limited sensitivity and/or importance	2
Visually moderately sensitive and/or important	3
Visually highly sensitive and/or important	4
Visually critically sensitive and/or important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	**RATING**
Insignificant: changes to visual landscape do not adversely affect surrounding landscapes; insignificant effect on surrounding important landscapes	1
Small: changes to visual landscape affect a low number of visual receptors (residents, tourists, etc.); noticeable change to important surrounding landscapes	2
Significant: changes to visual landscape affect a moderate number of visual receptors; moderate change to significant and/or important surrounding landscapes	3
Great: changes to visual landscape affect a large number of visual receptors; large changes to significant and/or important surrounding landscapes	4
Disastrous: significant changes to visual landscape affect visual receptors across the entire region; severe changes to significant and/or important surrounding landscapes	5
Spatial scale of impact	**RATING**
Activity specific: visible within the immediate vicinity of activity only	1
Development specific: visible from within the project boundary or up to 1km from the project boundary only	2
Local area: visible from within 5 km of the project boundary	3
Subregional: visible from within 10 km of the project boundary	4
Regional: visible from significant distances beyond 10km of the project boundary	5
Duration of impact	**RATING**
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table B2: Significance rating matrix

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

Table B3: **Positive/ Negative Mitigation Ratings**

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very High	126-150	Very strict measures to be implemented to mitigate impacts.	Actively promote the project.
High	101-125	Ensure designs take visual sensitivities into account and ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Promote the project and monitor performance.
Medium High	76-100	Ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Implement measures to enhance the positive aspects of the project while managing any negative impacts.
Medium Low	51-75	Ensure management and housekeeping is maintained and attention to impact minimisation is paid.	Implement measures to enhance the positive aspects of the project while actively managing any negative impacts.
Low	26-50	Promote the project and ensure management and housekeeping is maintained.	Monitor project performance and pay attention to minimising potential negative environmental impacts.
Very Low	1-25	Promote the project.	Actively seek measures to implement impact minimisation and identify positive ecological aspects to be promoted.

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the project's area of influence encompassing:
  - Primary project site and related facilities that the client and its contractors develops or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/ Impacts were assessed for all stages of the project cycle including:
  - Pre-construction;
  - Construction;
  - Operational; and
  - Closure/ Decommissioning and Rehabilitation
- Residual and post-closure/ decommissioning impacts were also considered;
- If applicable, transboundary or global effects were assessed;

- Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed; and
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed construction.

- Mitigation and performance improvement measures and actions that address the risks and impacts 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; and
- 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.

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 during all project phases throughout the life of the operation from planning, through to construction and operation through to after care and maintenance.

APPENDIX C – VEGETATION TYPE

Eastern Highveld Grassland (Gm 12)

Figure D1: Gm 12 Eastern Highveld Grassland: Grasslands of the Warburton area (Mpumalanga) with species of *Berkheya* and *Ipomoea* prominent in the foreground. Image by T. Steyn.

Table D1: Climate of the *Eastern Highveld Grassland* (Mucina & Rutherford, 2012).

Climate	**Strongly seasonal summer rainfall, with very dry winters.**				
	MAP (mm)	**MAT (°C)**	**MFD (days)**	**MAPE (mm)**	**MASMS (%)**
	726	14.7	32	1926	73

Table D2: Floristic species of *The Eastern Highveld Grassland* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Low Shrubs	*Anthospermum rigidum* subsp. *pumilum*, *Seriphium plumosum*.
Forb layer	
Herbs	*Berkheya setifera* (d), *Haplocarpha scaposa* (d), *Justicia anagalloides* (d), *Pelargonium luridum* (d), *Acalypha angustata*, *Chamaecrista mimosoides*, *Dicoma anomala*, *Euryops gilfillanii*, *E. transvaalensis* subsp. *setilobus*, *Helichrysum aureonitens*, *H. caespititium*, *H. callicomum*, *H. oreophilum*, *H. rugulosum*, *Ipomoea crassipes*, *Pentanisia prunelloides* subsp. *latifolia*, *Selago densiflora*, *Senecio coronatus*, *Hilliardiella elaeagnoides*, *Wahlenbergia undulata*.
Geophytic herbs	*Gladiolus crassifolius*, *Haemanthus humilis* subsp. *hirsutus*, *Hypoxis rigidula* var. *pilosissima*, *Ledebouria ovatifolia*.
Succulent herbs	*Aloe ecklonis*.
Graminoid layer	
Graminoids	*Aristida aequiglumis* (d), *A. congesta* (d), *A. junciformis* subsp. *galpinii* (d), *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Digitaria monodactyla* (d), *D. tricholaenoides* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. curvula* (d), *E. plana* (d), *E. racemosa* (d), *E. sclerantha* (d), *Heteropogon contortus* (d), *Loudetia simplex* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *S. pectinatus* (d), *Themeda triandra* (d),

	Trachypogon spicatus (d), *Tristachya leucothrix* (d), *T. rehmannii* (d), *Alloteropsis semialata* subsp. *eckloniana*, *Andropogon appendiculatus*, *A. schirensis*, *Bewsia biflora*, *Ctenium concinnum*, *Diheteropogon amplectens*, *Eragrostis capensis*, *E. gummiflua*, *E. patentissima*, *Harpochloa falx*, *Panicum natalense*, *Rendlia altera*, *Schizachyrium sanguineum*, *Setaria nigrirostris*, *Urelytrum agropyroides*.

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 acknowledged 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 **intimate** due to the undulating terrain of the area, limiting the view of the observer to the immediate surroundings.
Enclosure	Tight	Enclosed	Open	Exposed	The landscape is considered **enclosed,** with the undulating terrain and low hills and existing mine dumps in the area forming part of the skyline.
Diversity	Uniform	Simple	Diverse	Complex	The study area and surrounding area is characterised by grassland with crop cultivation and existing mining activities in the area resulting in the area being **diverse.**
Texture	Smooth	Textured	Rough	Very rough	The texture associated with the landscape is **textured** due to the dominant grass and cultivation layer throughout the greater area.
Form	Vertical	Sloping	Rolling	Horizontal	The dominant form of the landscape is rolling due to the undulating topography of the area.
Line	Straight	Angular	Curved	Sinuous	The line landscape element is **curved** due to the undulating topography, with limited linear anthropogenic elements present.
Colour	Monochrome	Muted	Colourful	Garish	The colours associated with the landscape are **muted**, with vegetation forming the dominant colour palette of shades of green and brown. Some seasonal colour is however expected.
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.
Movement	Dead	Still	Calm	Busy	The level of movement within the area is **calm**, with the exception shephards looking after their cattle grazing in the area, pedestrians walking in the veld and people traveling along the roads in the immediate vicinity.

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 been 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 F1). 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 and bean fields) to high height (isolated tree clumps and maize fields) with continuous ground cover, however bare ground is present adjacent to the roads. Even though there is continuous vegetative cover, the relatively low height thereof provides minimal screening ability.
Soil contrast	**3**	Surface disturbance would result in a low degree of contrast in colour with the surrounding area due to the brown colour of the waste rock dumps and bare ground present in the vicinity of the study area. Vegetation clearing is kept to a minimum and vegetation growth will be promoted underneath the PV panels once operational, resulting in limited bare ground present.
Visual variety	**2**	The vegetative cover within the study area is relatively diverse with it being characterised by grassland, watercourses and bean fields. The area is therefore textured with a moderately high diversity, thus when viewed from a distance, there is visual variety present. The anthropogenic features such as the existing mining infrastructure, powerlines, fences and gravel roads, serve to create visual variety in terms of lines, colour and texture.
Topographical diversity	**2**	The topography of area is moderately undulating, with few low hills present as well as existing mine dumps with a well-established vegetative cover.
Recovery time	**2**	Due to the dominant vegetation within the study area comprising grass and sedge species with some complexity, recovery time is expected to be moderate.
Total	**11**	**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, 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	**3**	The landscape associated with the study area and surroundings provide moderate topographical variety in the form of undulating terrain with few low hills and existing well-established mine dumps. The Olifants River and other watercourses within the area also provide increased visual interest.
Vegetation	**3**	The vegetation composition within the study area and surrounds are characterised by grasslands, watercourses, cultivated fields (beans and maize) isolated tree clumps therefore there is vegetative variety in the landscape.
Water	**3**	There are watercourses present within the study area and the southern portion of the proposed powerline traverses the Olifants River, however these watercourses are not dominant in the landscape.
Colour	**3**	There is variety in colour and contrast in soil and vegetation in the landscape.
Adjacent Scenery	**3**	Adjacent scenery, which is similar to the study area, 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**	Due to existing overhead powerlines and other anthropogenic structures such as gravel roads, fences and mining infrastructure, the proposed project will not introduce discordant elements into the environment.
Total	**16**	Medium

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

In order 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 surface infrastructure area.

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

APPENDIX J – 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.

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APPENDIX K – 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

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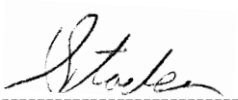
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Scientist at South African 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 an independent specialist in this assessment;
- 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).