VISUAL IMPACT REPORT

JOEL PLANT
SCOPING REPORT
JULY 2022

VISUAL IMPACT REPORT

Savannah Environmental, Free State

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ACRONYMS, ABBREVIATIONS AND GLOSSARY

Acronyms & Abbreviations	
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GYLA	Graham Young Landscape Architect
SACLAP	South African Council for the Landscape Architectural Profession
S&EIR	Scoping and Environmental Impact Report
VAC	Visual Absorption Capacity
VIA	Visual Impact Assessment
Glossary	
Aesthetic Value	Aesthetic value is the emotional response derived from the experience of the environment with its natural and cultural attributes. The response can be either to visual or non-visual elements and can embrace sound, smell and any other factor having a strong impact on human thoughts, feelings, and attitudes (Ramsay, 1993). Thus, aesthetic value encompasses more than the seen view, visual quality, or scenery, and includes atmosphere, landscape character and sense of place (Schapper, 1993).
Aesthetically significant place	A formally designated place visited by recreationists and others for the express purpose of enjoying its beauty. For example, tens of thousands ofpeople visit Table Mountain on an annual basis. They come from around the country and even from around the world. By these measurements,one can make the case that Table Mountain (a designated National Park) is an aesthetic resource of national significance. Similarly, a resource thatis visited by large numbers who come from across the region probably has regional significance. A place visited primarily by people whose place of origin is local is generally of local significance. Unvisited places either have no significance or are "no trespass" places. (after New York, Department of Environment 2000).
Aesthetic impact	Aesthetic impact occurs when there is a detrimental effect on the perceived beauty of a place or structure. Mere visibility, even startling visibility of a Project proposal, should not be a threshold for decision making. Instead a Project, by its visibility, must clearly interfere with or reduce (i.e. visual impact) the public's enjoyment and/or appreciation of the appearance of a valued resource e.g. cooling tower blocks a view from a National Park overlook (after New York, Department of Environment 2000).
Cumulative Effects	The summation of effects that result from changes caused by a development in conjunction with the other past, present, or reasonably foreseeable actions.
Glare	The sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted, which causes annoyance, discomfort, or loss in visual performance and visibility. *See* Glint. (USDI 2013:314)
Glint	A momentary flash of light resulting from a spatially localized reflection of sunlight. *See* Glare. (USDI 2013:314)
Landscape Character	The individual elements that make up the landscape, including prominent or eye-catching features such as hills, valleys, woods, trees, water bodies, buildings, and roads. They are generally quantifiable and can be easily described.
Landscape Impact	Landscape effects derive from changes in the physical landscape, whichmay give rise to changes in its character and how this is experienced (Institute of Environmental Assessment & The Landscape Institute 1996).

Study area	For the purposes of this report this Project the study area refers to the proposed Project footprint / Project site as well as the 'zone of potential influence' (the area defined as the radius about the centre point of the Project beyond which the visual impact of the most visible features will be insignificant) which is a 5,0km radius surrounding the proposed Project footprint / site.
Project Footprint / Site	For the purposes of this report the Project *site* / *footprint* refers to theactual layout of the Project as described.
Sense of Place (Geniusloci)	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. *A genius locus literally means* 'spirit of the place'.
Sensitive Receptors	Sensitivity of visual receptors (viewers) to a proposed development.
Viewshed analysis	The two-dimensional spatial pattern created by an analysis that defines areas, which contain all possible observation sites from which an object would be visible. The basic assumption for preparing a viewshed analysis is that the observer eye height is 1,8m above ground level.
Visibility	The area from which Project components would potentially be visible.Visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance.
Visual Exposure	Visibility and visual intrusion qualified with a distance rating to indicate the degree of intrusion and visual acuity, which is also influenced by weatherand light conditions.
Visual Impact	Visual effects relate to the changes that arise in the composition of available views because of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visual amenity available views because of changes to the landscape, to people's responses to the changes, and to the overall effects with respect to visualamenity.
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.
Visual absorption capacity	Visual absorption capacity is defined as the landscape's ability to absorb physical changes without transformation in its visual character and quality. The landscape's ability to absorb change ranges from low- capacity areas, in which the location of an activity is likely to cause visual change in the character of the area, to high-capacity areas, in which the visual impact of development will be minimal (Amir & Gidalizon 1990).
Worst-case Scenario	Principle applied where the environmental effects may vary, for example, seasonally or collectively to ensure the most severe potential effect isassessed.
Zone of Potential Visual Influence	By determining the zone of potential visual influence, it is possible to identify the extent of potential visibility and views which could be affected by the proposed development. Its maximum extent is the radius around an object beyond which the visual impact of its most visible features will be insignificant primarily due to distance.

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1. INTRODUCTION

1.1. Project Overview and Background

Eco-Thunder Consulting was commissioned by Savannah Environmental (Pty) Ltd to carry out a Visual Impact Assessment (VIA) of the proposed Joel Plant Solar PV Facility near Theunissen in the Free State Province. The VIA focuses on the potential impact of the physical aspects of the proposed developments (i.e., form, scale, and bulk), and their potential impact within the local landscape and receptor context.

1.2. Project site and study area

Free Gold Harmony (Pty) Ltd, is looking to supplement its energy supply by implementing Photovoltaic (PV) generation, aiding their transition to a more sustainable and environmentally friendly energy mix.

Located north-east of the Harmony Joel operations, approximately ~20km north-east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The PV facility is located on Portion 0 of the Farm Leeuwbult 580.

A technically feasible project site, with an extent of 43.2ha has been identified by Free Gold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~36ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities. The size of the development footprint within the development area will be confirmed in the EIA Phase once the facility layout is available for assessment.

The development footprint will contain the following infrastructure to enable the Solar PV Facility to generate up to 18MW:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Overhead Power Lines (OHPL)

Grid connection solution which will tie-in to Shafts 1 & 2 HJ Joel Mining (6.6 / 132kV), via a 1.2km south-west overhead line with a capacity of 44kV.

As of 2019, the Industrial sector was the leading electricity consumer in South Africa, with up to 56 percent of the total consumption (*Ratshomo, 2019*). Mining and quarrying accounted for 10% of the industrial consumption while non-ferrous metals and non-metallic both accounted for 8% and 5%, respectively (*Chamber of Mines of South Africa, 2017*).

The successful development of the renewable energy projects will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the province and South Africa. This will assist the Free State in creating green jobs and reducing Green House Gas emissions, whilst reducing the energy demand on the National Grid.

1.3. Objective of the Specialist Study

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e., extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 600km² (the extent of the full-page maps displayed in this report) and includes a minimum 10km buffer zone (area of potential visual influence) from the proposed project site.

The study area includes predominantly mining land, farmland and industrial areas within the Theunissen area.

1.4. Specialist Details

Eco-Thunder Consulting (ETC) is a 100% woman-owned, private company that specializes in a range of specialist studies, such as Visual Impact Assessments, socio-economic research, economic development planning, development programme design and implementation as well as community trust management.

Eco–Thunder Consulting is registered with ECSA and landscape architects with interest and experience in landscape architecture, urban design, and environmental planning. The company has carried out visual impact assessments throughout Africa and specialize in project optimization in the environmental space. Aspects of this work also include landscape characterization studies, end-use studies for quarries, and computer modelling and visualization.

Based in Johannesburg, South Africa, Eco-Thunder has established itself as an expert on the conditions, needs and assets of communities that are linked to independent power generation facilities.

ETC also implements development programmes in energy communities, which ensures a comprehensive understanding of the how to drive positive social impact.

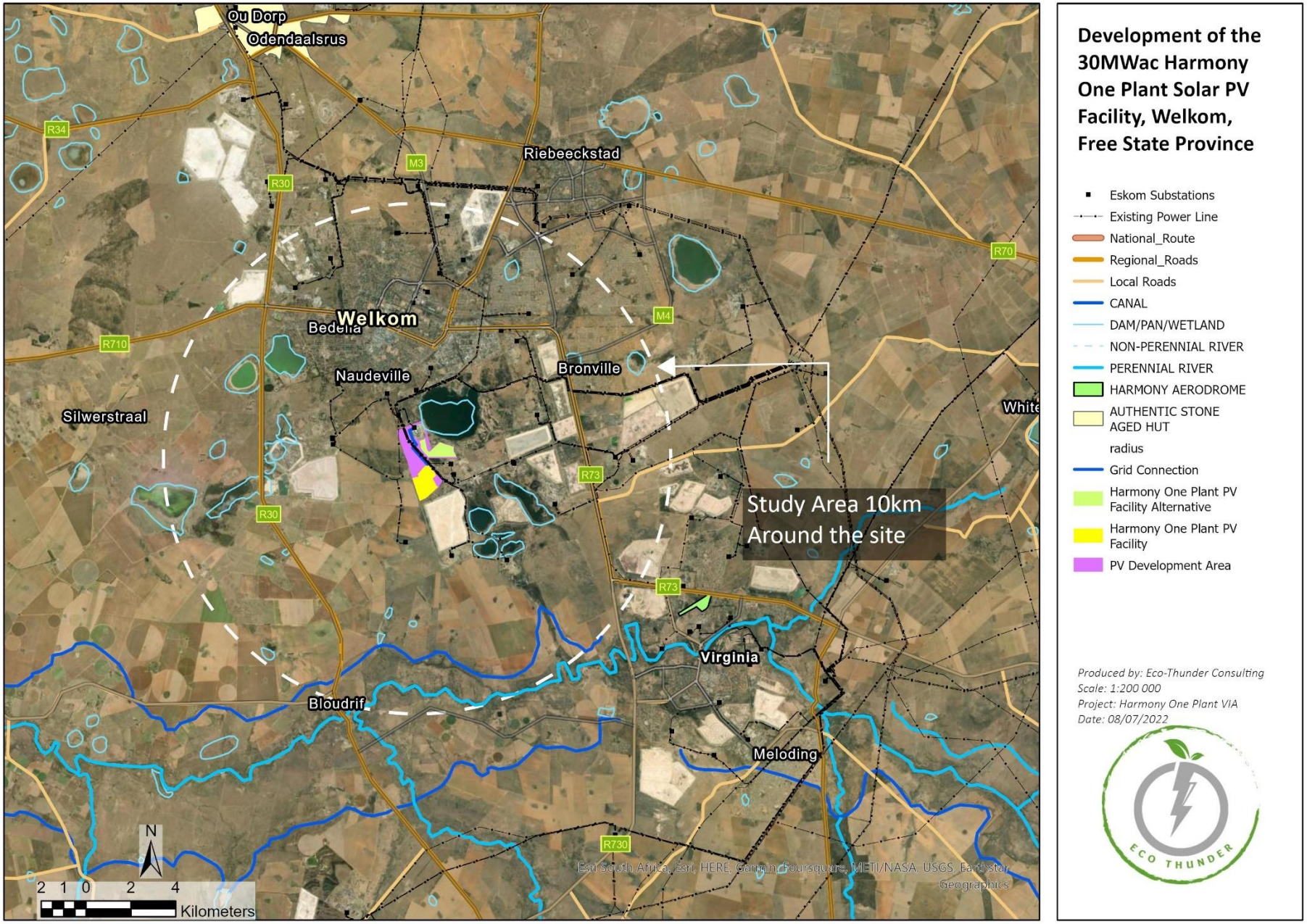


Figure 1: Proposed Development location map.

2. METHODOLOGY

2.1. Methodology

The study was undertaken using Geographical Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility.

The methodology utilized to identify issues related to the visual impact included the following activities:

- The creation of a detailed digital terrain model of the potentially affected environment.
- The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.
- The identification of sensitive environments or receptors upon which the proposed facility could have a potential impact.
- The creation of viewshed analyses from the proposed project site in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses consider the dimensions of the proposed structures and activities.

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Joel Plant Solar PV Facility from a desktop level.

3. DESCRIPTION OF THE PROJECT

3.1. Project Facilities

Development of the 18MW$_{ac}$ Harmony Joel Plant Solar PV Facility, Theunissen, Free State Province.

The development of renewable energy facilities, overhead powerline and associated infrastructure is proposed by Free Gold Harmony (Pty) Ltd.

The project entails the development of a Photovoltaic (PV) Solar Energy Facility and associated infrastructure with a capacity of up to 18MW over 36ha of land and will be known as Harmony Joel Plant Solar PV Facility. The development will consist of a renewable energy facility, overhead powerline and associated infrastructure.

The Harmony Joel Solar PV Facility is based north-east of the Harmony Joel operations, approximately ~20km north-east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The anticipated operational life of the plant is approximately 25 years. Beyond this duration, the proposed Project may continue to operate subject to further approvals or be decommissioned. In this assessment, it is assumed that it would be decommissioned. The construction and commissioning duration of the PV facilities and grid connection infrastructure will be approximately 12 – 18 months.

4. ENVIROMENTAL SETTING

The study area lies completely within the Middle Vaal Water Management Area (WMA) and entirely within the Highveld ecoregion (Kleynhans et al., 2005). The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. Most properties situated within a 5km radius of the site is being used for livestock and crop cultivation.

The main characteristics of the study area includes mining, crop and livestock farming. Tourist attractions mostly occur on the outer edges of the study area, 20km radius, with the closests being the Allemanskraal Dam, approximately 16km South-East. The residential component of the study area includes farmsteads with associated workers housing as well as the towns of Virginia and Ventersburg and the townships of Meloding and Mmamahabane.

According to Mucina and Rutherford (2006) the site is situated in an a summer-rainfall seasonal precipitation region, with Mean Annual Precipitation (MAP) of 560mm. Much of the rainfall is of convectional origin and peaks in December to January. The overall Mean Annual Temperature (MAT) is around 15°C. Incidences of frost are relatively high (43 days on average).

The Lejweleputswa District Municipality is located in the North western part of the Free State and is one of five district municipalities in the Free State Province. The district covers an area of 31 686km² and is made up of five local municipalities, of which the Masilonyana Local Municipality (which covers the study area) is one. According to the Free State Provincial Growth and Development Strategy (FSPGDS) (2004-2014), Lejweleputswa District Municipality is the major contributor in the Free State Gross Geographic Product (GGP) and is also an important agricultural area. The district is predominantly known as the Free State Goldfield which forms a part of the larger Witwatersrand basin. The economy of the region is dominated by the gold mining industry and agriculture sectors in particular maize production.

The Masilonyana Local Municipality covers an area of 6 796km² and is located in the western part of the Free State Province within Lejweleputswa District Municipality. The Masilonyana Local Municipality consists of 5 Local Councils, Brandfort, Soutpan, Theunissen, Verkeerdevlei and Winburg. Theunissen is the administrative seat of the Masilonyana Local Municipality and is located approximately 102km north east of Bloemfontein. The majority of the commercial and industrial activities in the Masilonyana Local Municipality are based in Theunissen and Winburg.

The main source of income in the municipality is due to the agricultural and mining sector. The total population of Masilonyana Local Municipality which includes both male and female for all towns, that is, Theunissen/ Masilo, Brandfort/ Majwemasweu, Winburg/ Makeleketla, Soutpan/ Ikgomotseng, Verkeerdevlei/ Tshepong, Rural, Star Diamond Mine, Beatrix Mine and Joel Mine is estimated at 80 090. This population includes Blacks, Coloureds, Indians and Whites. The following 15 population groups constitute the following

percentages out of the total population group of the entire municipality, that is, Blacks (91,2%), Coloureds (1,28%), Indians (0,03%), and Whites (7,49%) respectively. The population has grown slightly due to the reduction of infant mortality, less people dying of HIV/ AIDS and economic migration caused by opening of new shafts at the Beatrix Mine and more people having to stay in Brandfort.

Due to the fact that mines cannot absorb all unemployment people, of which the youth are in majority in terms of unemployment and population stats; more emphasis must be put on training of unemployed (including youth, women and the disabled people) for self reliance and to avoid high and unrealistic dependence on grants and funding (IDP 2012-2017).

The proposed development is located on a terrain unit of rolling or irregular plains with low hills at an altitude of between 1,370 and 1,410 meters. During the pre-mining period the land on which the mine is now situated was used for agricultural purpose and mainly for cultivation of crops and grazing purposes.

The built environment surrounding the proposed development area ranges from high density low-income housing and informal rural type settlements to large mining and agriculture developments. Developments located adjacent to the proposed settlement are informal settlement, with limited infrastructure that only meets RDP Standards. Social facilities within the area are lacking, with the nearest school being located some few kilometres from the site. No infrastructure is currently in place on site; however, electricity, sewer and water will be connected onto existing bulk infrastructure currently servicing the surrounding areas. One access route to the site is proposed, via existing roads. Access to the majority of the area will take place from Main road (where a 60 – 80 m length of 6 m wide tarred road surface is proposed)

Land use activities within the broader region are predominantly described as maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The mining activities intensify further north (beyond the study area boundary), towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site.

The population density of the region is indicated as approximately 200 people per km2 , predominantly concentrated within the town of Virginia. An existing Eskom power line runs diagonally across the selected site, enabling a short distance for grid connection with minimal possible impact on avifauna or ecology.

In terms of geology, the power line corridor is located in the central part of the Main Karoo Basin, east of the line of latitude 24°E that is important for the stratigraphy of the Karoo Basin. These old rocks are unconformably overlain by Quaternary sands and alluvium. The Main Karoo Basin covers a large proportion of South Africa and represents some 120 million years of deposition. At the base is the Carboniferous-Permian Dwyka Group, then the Permian aged Ecca Group, Permian-Triassic Beaufort Group, the Triassic-Jurassic Stormberg Group, all capped by the Drakensberg basalts.

Intruding through the Karoo rocks are volcanic dykes of Jurassic age, and they were emplaced when the major Drakensberg basalts poured out and capped the Karoo sediments. These dolerite dykes are common in the area and because they are harder than the Karoo sediments they form ridges and hills.

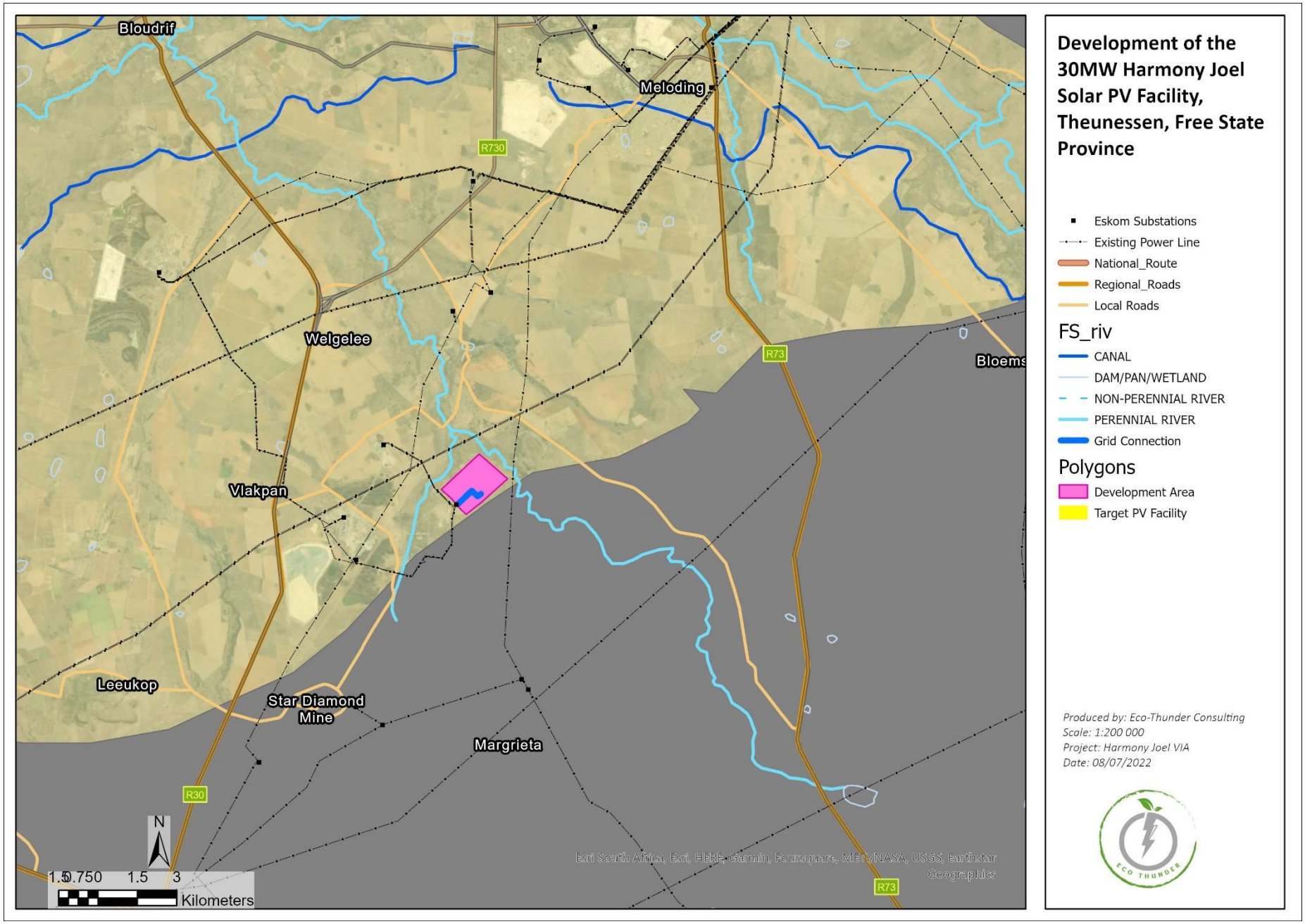
The land type unit represented within the corridor include the Bd 20 and Dc16 land types. Bd20 is eutrophic; red soils not widespread upland duplex and margalitic soils rare. Dc16 is prismacutanic and/or pedocutanic diagnostic horizons dominant. In addition, one or more of vertic melanic red structured diagnostic horizons.

The A horizon is normally coarse textured, and the B horizon is fine textured. The coarse textured A horizon has a law water holding capacity and the structure is usually weak (Tekle, 2004). The slopes are typically covered by well weathered unstructured red or yellow soils, while the valleys have clay deposits washed down from the slopes.

Figure 2: Road View of proposed PV Facility

Figure 3: Aerial View of Proposed PV Facility

Figure 4: Site Topography and Slope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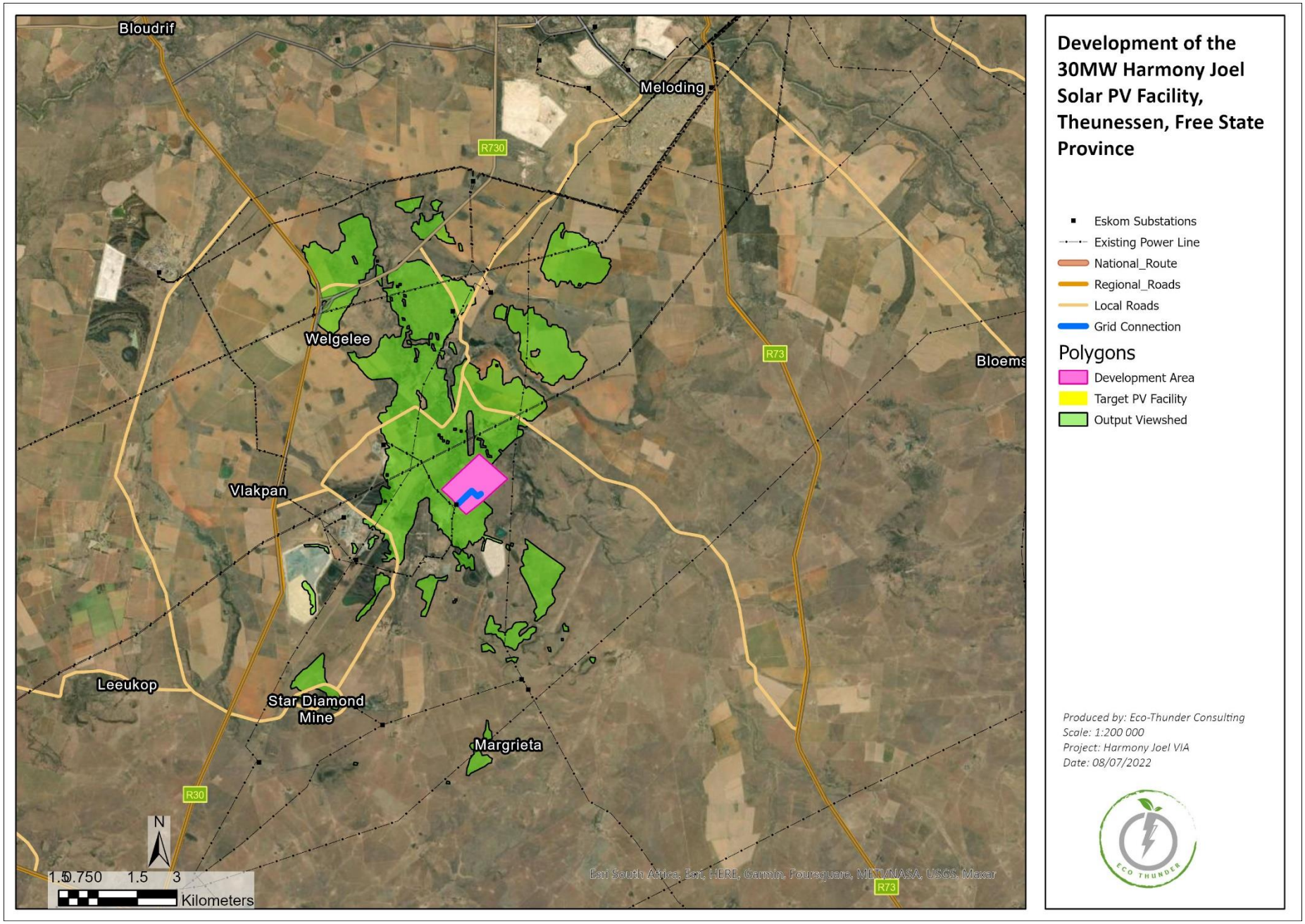
PERENNIAL RIVER
Grid Connection
Polygons
Development Area
Target PV Facility
Produced by: Eco-Thunder Consulting
Scale: 1:200 000
Project: Harmony Joel VIA
Date: 08/07/2022
ECO THUNDER

Figure 13: Viewshed Analysis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Output Viewshed
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Scale: 1:200 000
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ECO THUNDER

5. VISUAL IMPACT ASSESSMENT

5.1. Impact Index

The viewshed analysis was undertaken from a number of vantage points within the development footprint at an offset of 6m above ground level. This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures (PV panels, inverters and BESS) associated with the facility.

The viewshed analysis will be further refined once a preliminary and / or final layout is completed and will be regenerated for the actual position of the infrastructure on the site and actual proposed infrastructure during the EIA phase of the project.

5.2. Visual Impact Assessment

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

5.3. Anticipated Issues Related to the Visual Impact

Anticipated issues related to the potential visual impact of the proposed PV facility include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along the secondary road (unnamed road) in closer proximity to the proposed infrastructure.
- The visibility of the facility to, and potential visual impact on residents of dwellings within the study area, with specific reference to the farm residence in closer proximity to the proposed development.
- The potential visual impact of the facility on the visual character or sense of place of the region.
- The potential visual impact of the facility on tourist routes or tourist destinations / facilities (if present).
- The potential visual impact of the construction of ancillary infrastructure (i.e., internal access roads, buildings, power line, etc.) on observers in close proximity to the facility.
- The visual absorption capacity of the natural vegetation (if applicable) or built structures / mining infrastructure.
- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the placement of the PV facility within a predominantly mining area.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.
- Potential visual impact of solar glint and glare as a visual distraction and possible air / road travel hazard.
- Potential visual impact of solar glint and glare on static ground-based receptors (residents of homesteads) in close proximity to the PV facility.
- Potential visual impacts associated with the construction phase.
- The potential to mitigate visual impacts and inform the design process.

It is envisaged that the issues listed above may potentially constitute a visual impact at a local and / or regional scale. These need to be assessed in greater detail during the EIA phase of the project.

Table 1: Impact table of Visual impacts of the proposed PV Facility

Impact

Visual impact of the facility on observers in close proximity to the proposed PV facility infrastructure and activities. Potential sensitive visual receptors include:

- Residents of homesteads and farm dwellings (in closer proximity to the facility)
- Observers travelling along the secondary roads traversing near the proposed development

Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the PV facility infrastructure and activities	The potential negative experience of viewing the infrastructure and activities	Primarily observers situated within a 1km (and potentially up to 3km) radius of the facility	N.A.

Description of expected significance of impact

Extent: Local
Duration: Long term
Magnitude: Moderate
Probability: Probable
Significance: Medium
Status (positive, neutral or negative): Negative
Reversibility: Recoverable
Irreplaceable loss of resources: No
Can impacts be mitigated: Yes

Gaps in knowledge & recommendations for further study

A finalised layout of the PV facility and ancillary infrastructure are required for further analysis. This includes the provision of the dimensions of the proposed structures and ancillary equipment.

Additional spatial analyses are required in order to create a visual impact index that will include the following criteria:

- Visual exposure
- Visual distance / observer proximity to the structures / activities
- Viewer incidence / viewer perception (sensitive visual receptors)
- Visual absorption capacity of the environment surrounding the infrastructure and activities

Additional activities:

- Identify potential cumulative visual impacts
- Undertake a site visit
- Recommend mitigation measures and / or infrastructure placement alternatives

Refer to the Plan of Study for the EIA phase of the project below.

6. CONCLUSION

The fact that some components of the proposed Joel Plant Solar PV Facility and associated infrastructure may be visible does not necessarily imply a high visual impact. Sensitive visual receptors within (but not restricted to) a 3km buffer zone from the facility need to be identified and the severity of the visual impact assessed within the EIA phase of the project.

It is recommended that additional spatial analyses be undertaken in order to create a visual impact index that will further aid in determining potential areas of visual impact. This exercise should be undertaken for the core PV facility as well as for the ancillary infrastructure, as these structures (e.g. the BESS structures and power line) are envisaged to have varying levels of visual impact at a more localised scale. The site-specific issues (as mentioned earlier in the report) and potential sensitive visual receptors should be measured against this visual impact index and be addressed individually in terms of nature, extent, duration, probability, severity and significance of visual impact.

This recommended work must be undertaken during the Environmental Impact Assessment (EIA) Phase of reporting for this proposed project. In this respect, the Plan of Study for the EIA is as follows:

- Visual Impact Assessment (VIA)
- Determine potential visual exposure
- Determine visual distance / observer proximity to the facility
- Determine viewer incidence / viewer perception (sensitive visual receptors)
- Determine the visual absorption capacity of the landscape
- Calculate the visual impact index
- Determine impact significance
- Propose mitigation measures
- Reporting and map display
- Site visit

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