THE PROPOSED LUTZBURG SOLAR POWER PLANT NEAR POSTMASBURG, NORTHERN CAPE PROVINCE

VISUAL IMPACT ASSESSMENT

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Prepared by:	**Prepared for:**
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EXECUTIVE SUMMARY

Project title: The Proposed Lutzburg Solar Power Plant Near Postmasburg, Northern Cape Province.

Lutzburg Solar Power Plant RF (Pty) Ltd. appointed Johan Botha to conduct a visual impact assessment (VIA) of the proposed photovoltaic energy facility on the remaining extent of the farm Ruby Vale 266, Registration Division Gordonia in the Northern Cape Province. A field survey was conducted on the 29th of February 2016.

The photovoltaic plant will be installed on a site on the above mentioned farm. The farm has the owner living on it and is surrounded by other farmland. The farm is mainly used for livestock grazing. The proposed development is located approximately 50km east from the town of Postmasburg.

The assessment was conducted according to standard Visual Assessment practice and aimed to identify expected visual impacts and assess their potential significance. The main conclusions are the following:

- ***Impacts*:** Nearby viewers will have a certain level of sensitivity resulting from the proposed development. Sensitivity will occur mainly on people travelling on the D3300 and on the Sishen Saldanha railway line and its service road. The proposed development will transform the site itself from a pleasant rural view into a more industrial view.
- ***Mitigation*:** Mitigation during the construction and decommissioning phase will mainly entail the control of dust, the implementation of good housekeeping and the management of construction plant on nearby roads. Mitigation during the operational phase will mainly entail the adding and maintenance of indigenous flora. It is recommended that indigenous flora be added after construction to prevent damage during construction which might result from construction plant and construction workers not noticing the newly added flora.
- ***Value of the landscape*:** Although the site itself offers a pleasant rural view, the nearby area is similar with extensive Camel thorn trees to be seen.
- ***Significance:*** The significance of the visual impact on sensitive viewers during the construction and decommissioning phase of the PV plant is **low** due to the short duration and provided that mitigation measures are implemented. The overall significance of the visual impact on sensitive viewers during the operational phase of the PV plant is **low** provided that mitigation measures are implemented.

Conclusion: Taking into account all positive factors of such a development including economic factors, social factors and sustainability factors, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view. **PLEASE NOTE** that the details of the line should be submitted with the South African Civil Aviation Authority (SACAA).

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1. INTRODUCTION

1.1 Purpose and Objectives

The purpose and objectives of this VIA report is to determine the following:

- Which visual receptors are present within the study area.
- Which visual receptors will be sensitive to the proposed development.
- The extend and significance of the visual impact.

The scope of the assessment included the PV Solar Energy Facility and its associated structures and infrastructure (such as the power line and access route). The impacts associated with the power line and access route that run beyond the site are considered to be negligible since the actual footprints of disturbance of the power lines is confined to the pylon bases. Furthermore, the power line and access route are aligned with existing roads as far as possible to avoid any negative environmental impacts.

1.2 Assumptions and Uncertainties

1.2.1 Spatial Data Accuracy

Spatial data used for visibility analysis originate from various sources and scales. Inaccuracy and errors are therefore inevitable. Where relevant, these will be highlighted in the report. Every effort was made to minimize their effect.

1.2.2 View Shed Analysis

Initial determination of the view sheds does not take into account the potential screening effect of vegetation and buildings. Since the height of the PV plant structures is 3.5m and the 132kV line 32m, it is likely that vegetation will play an important role in screening the PV plant from farmsteads and road users.

1.3 EIA Inclusion

This visual impact assessment (VIA) forms part of the overall environmental impact assessment (EIA) process that is being undertaken for the Proposed Lutzburg Solar Power Plant near Postmasburg in the Northern Cape Province. The EIA process is being undertaken by Environamics Environmental Consultants, on behalf of Lutzburg Solar Power Plant (RF) (Pty) Ltd.

1.4 EIA Regulations

The EIA Regulations, 2014 (GN. R.982) published in terms of the National Environmental Management Act (Act No. 107 of 1998) determine that an environmental authorisation is required for certain listed activities, which might have detrimental impacts on the environment. The following activities have been identified with special reference to the proposed development and are listed in the EIA Regulations:

- Activity 11(i) (GN.R. 983): *"The development of facilities or infrastructure for the transmission and distribution of electricity outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts."*
- Activity 1 (GN.R. 984): *"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more..."*
- Activity 15 (GN.R. 984): *"The clearance of an area of 20 hectare or more of indigenous vegetation..."*
- Activity 28 (ii) (GN.R. 983): *"Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 1998 and where such development (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare."*

1.5 Project Background

Lutzburg Solar Power Plant (RF) (Pty) Ltd. is proposing to develop a 115MW photovoltaic (PV) solar energy plant near Postmasburg situated in the Tsantsabane Local Municipality in the Northern Cape Province. The project will be known as the proposed Lutzburg Solar Power Plant near Postmasburg, Northern Cape Province.

The purpose of the proposed PV energy facility will be to evacuate the generated power into the Eskom Holdings SOC Ltd (Eskom) electricity grid. If successful, Lutzburg Solar Power Plant (RF) (Pty) Ltd. will be remunerated on a per kilowatt hour generated basis by Eskom in terms of a 20-year Power Purchase Agreement. Lutzburg Solar Power Plant (RF) (Pty) Ltd. will be required to apply for a generation license from the National Energy Regulator of South Africa (NERSA). Depending on the economic conditions following the lapse of this

period, the facility can either be decommissioned or the power purchase agreement may be renegotiated and extended.

1.6 Project Description and Location

Table 1: General site information

Description of affected farm portion	Remaining Extent of the farm Ruby Vale 266, Registration Division Gordonia, Northern Cape. Coordinates: 28° 13' 16.67" S 22° 34' 57.33" E
Type of technology	Photovoltaic solar energy facility
Structure Height	Panels ~3.5m, buildings ~4m, and power lines ~32m
Surface area to be covered	Approximately 300 hectares.
Laydown area dimensions	Approximately 300 hectares.
Structure orientation	The panels will either be fixed to a single-axis horizontal tracking structure where the orientation of the panel varies according to the time of the day, as the sun moves from east to west or tilted at a fixed angle equivalent to the latitude at which the site is located in order to capture the most sun.
Generation capacity	Approximately 115MW

The activity entails the development of a photovoltaic solar energy facility and associated infrastructure on the Remaining Extent of the farm Ruby Vale No. 266, Registration Division Gordonia, Northern Cape. The proposed development is located in the Northern Cape Province, in the north western interior of South Africa. The site is located approximately 50km east of the town of Postmasburg (**Map 1: Locality Map**).

The project entails the generation of approximately 115MW electrical power through photovoltaic (PV) panels. The total footprint of the project will be approximately 300 hectares. The key components of the proposed project are described below:

- PV Panel Array - To produce 115MW, the proposed facility will require numerous linked cells placed behind a protective glass sheet to form a panel. Multiple panels

will be required to form the solar PV arrays which will comprise the PV facility. Due to the fact that this project only requires 300 hectares of land, there is scope to avoid major environmental constraints through the final design of the facility. The PV panels will be tilted at a northern angle in order to capture the most sun.

- Wiring to Central Inverters - Sections of the PV array will be wired to central inverters. The inverter is a pulse width mode inverter that converts direct current (DC) electricity to alternating current (AC) electricity at grid frequency.

- Connection to the grid - Connecting the array to the electrical grid requires transformation of the low voltage from 480V to a medium voltage of for example 11kV, 22kV or 33kV to 132kV. The normal components and dimensions of a distribution rated electrical substation will be required. Output voltage from the inverter is expected to be 480V and this is fed into step up transformers to a maximum voltage of 132kV. An onsite substation will likely be required on the site to step the voltage up to 132kV, after which the power will be evacuated into the national grid. As Lutzburg Solar Power Plant (RF) (Pty) Ltd. has not yet received a cost estimate letter from Eskom the exact scope of the grid connection might differ. **Refer to Figure 1 for a mapped visual presentation of a similar line. Please note that the design might differ.**

- Supporting Infrastructure - A control facility with basic services such as water and electricity will be constructed on the site and will have an approximate footprint 400m². Other supporting infrastructure includes voltage and current regulators, protection circuitry.

- Roads – A short access road will be constructed from the D3300 and an internal site road network will be constructed to provide access to the solar field and associated infrastructure will be required. All site roads will require a width of between 5 and 6 meters.

- Fencing - For health, safety and security reasons, the facility will be required to be fenced off from the surrounding farm.

1.7 The nature of Visual Impact

What is visual impact?

Something that is produced by an agency, cause, result, or consequence that is perceivable by the sense of sight. Visual impact:

- Is subjective to the visual receptors.
- Can be beneficial to a certain geographical area.
- Can be adverse to a certain geographical area.

Sensitive Geographical Areas

Geographical areas can be sensitive properties that are evaluated for the potential for adverse visual impact. The sensitivity of a certain geographical area is the degree to which a particular area can accommodate change. An example of a sensitive geographical area would be when scenic quality was influential in its being. In other words, a geographical area is not sensitive to visual impact if visual aspects of its feeling and setting are not part of what makes it eligible.

When does a project have a significant visual impact to a certain geographical area?

When the proximity of the proposed project impairs aesthetic features or attributes of that area in a substantially visual way such that features or attributes are considered important contributing elements to the value of the resource.

1.8 Guidelines

Various guidelines for visual impact assessments are available, but with a very common approach. This assessment will be undertaken in accordance with:

- Government of the Western Cape – Guideline for Involving Visual and Aesthetic Specialists in EIA Processes (2005). This is the only local guideline which could be found during research.

- Texas Department of Transportation - Standard Operating Procedure for Visual Impact Assessments (2012).
- The Landscape Institute with the Institute of Environmental Management and Assessment – Guidelines for Landscape and Visual Impact Assessments, Second Edition (2002).

Together these documents provide a basis for the level of approach of a visual impact assessment.

1.9 Terms of Reference

The proposed TOR for this visual impact assessment is as follows:

- Conduct a desktop review of available information that can support and inform the specialist study;
- Describe the receiving environment and the visual absorption for the proposed project;
- Conduct a field survey to determine the actual or practical extent of potential visibility of the proposed development;
- Conduct a photographic survey of the landscape surrounding the development;
- Identify issues and potential visual impacts for the proposed project, to be considered in combination with any additional relevant issues that may be raised through the public consultation process;
- Identify possible cumulative impacts related to the visual aspects for the proposed project;
- Assess the potential impacts, both positive and negative, associated with the proposed project for the construction, operation and decommissioning phases;
- Identify management actions to avoid or reduce negative visual impacts; and to enhance positive benefits of the project; and
- Use mapping and photo-montage techniques as appropriate.

1.10 Assessment Methodology

Table 2 of this VIA report will be utilised as the rating system. This rating system is recommended by Environamics Environmental Consultants.

Table 2: Rating System

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
DURATION		
This describes the duration of the impacts. Duration indicates the Lutzburgtime of the impact as a result of the proposed activity.		
1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational Lutzburg of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).

4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.
INTENSITY/ MAGNITUDE		
Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
REVERSIBILITY		
This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.

4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high	The anticipated impact will have highly significant

	impact	positive effects.

1.11 Project team and experience

The project team will consist of one individual, Johan Botha.

Johan Botha graduated with an Honours degree in 2010 from the North West University in the field of Environmental Sciences specialising in Geography and Environmental Management. He also has a bachelor's degree in Education Sciences. He has been involved in various Eskom construction projects throughout the Northern Cape Province including expansions and construction of substations and power lines. He has also been involved in various projects regarding solar power plants where he conducted 14 Visual Impact Assessments. He has acquired the necessary skills to compile a Visual Impact Assessment report with the associated maps.

Map 1: Locality Map

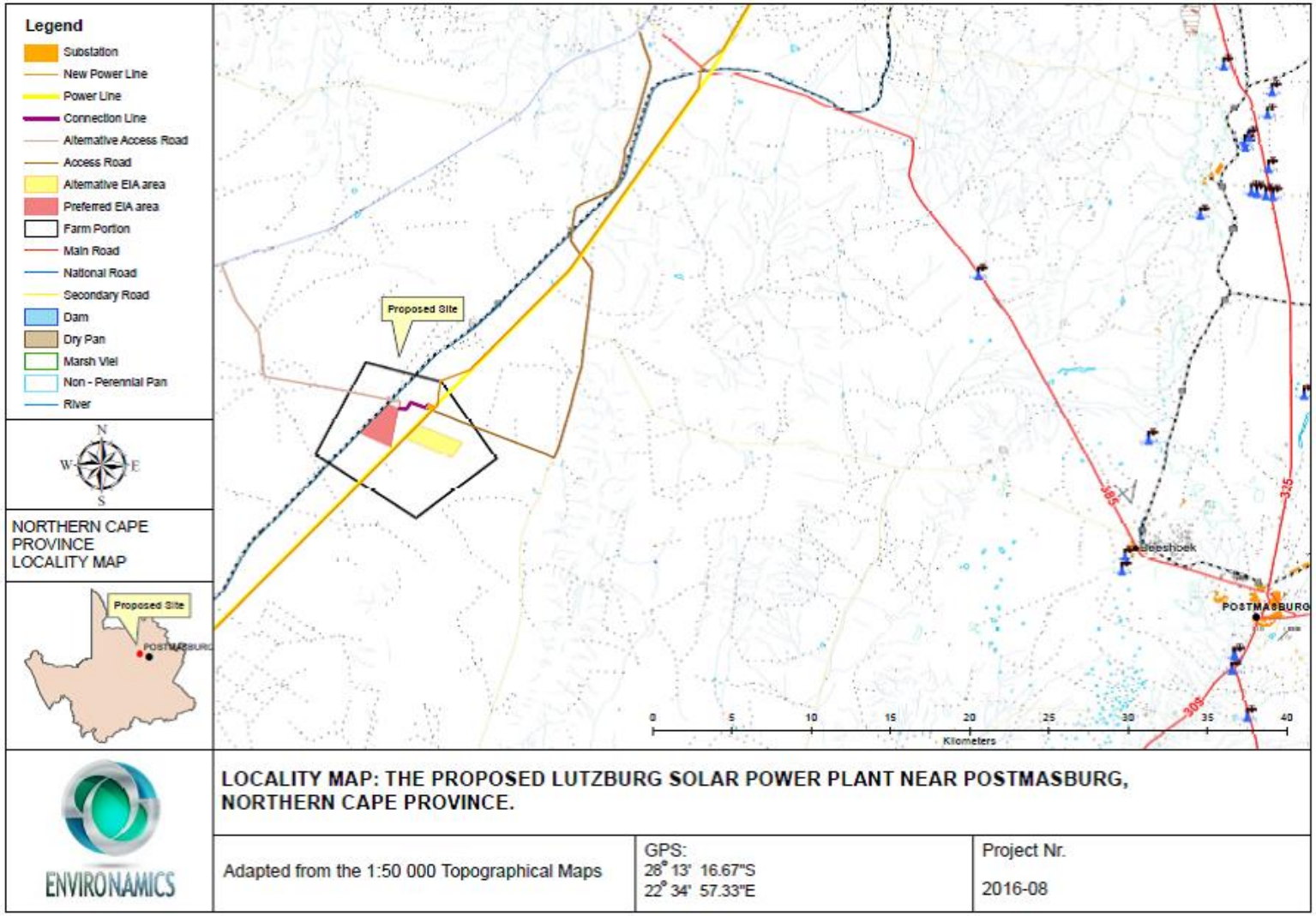


Figure 1: Aerial view of the proposed development

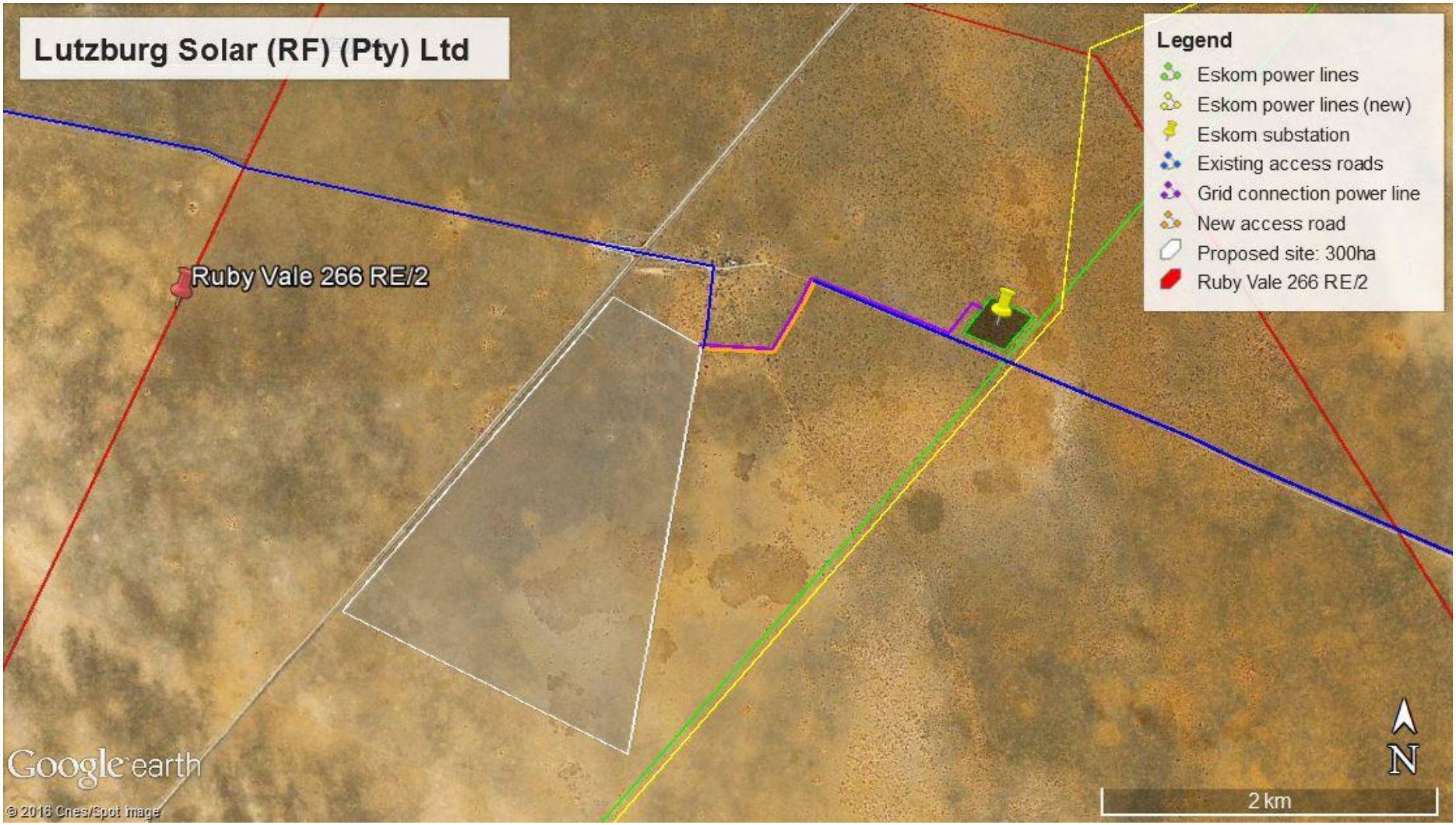
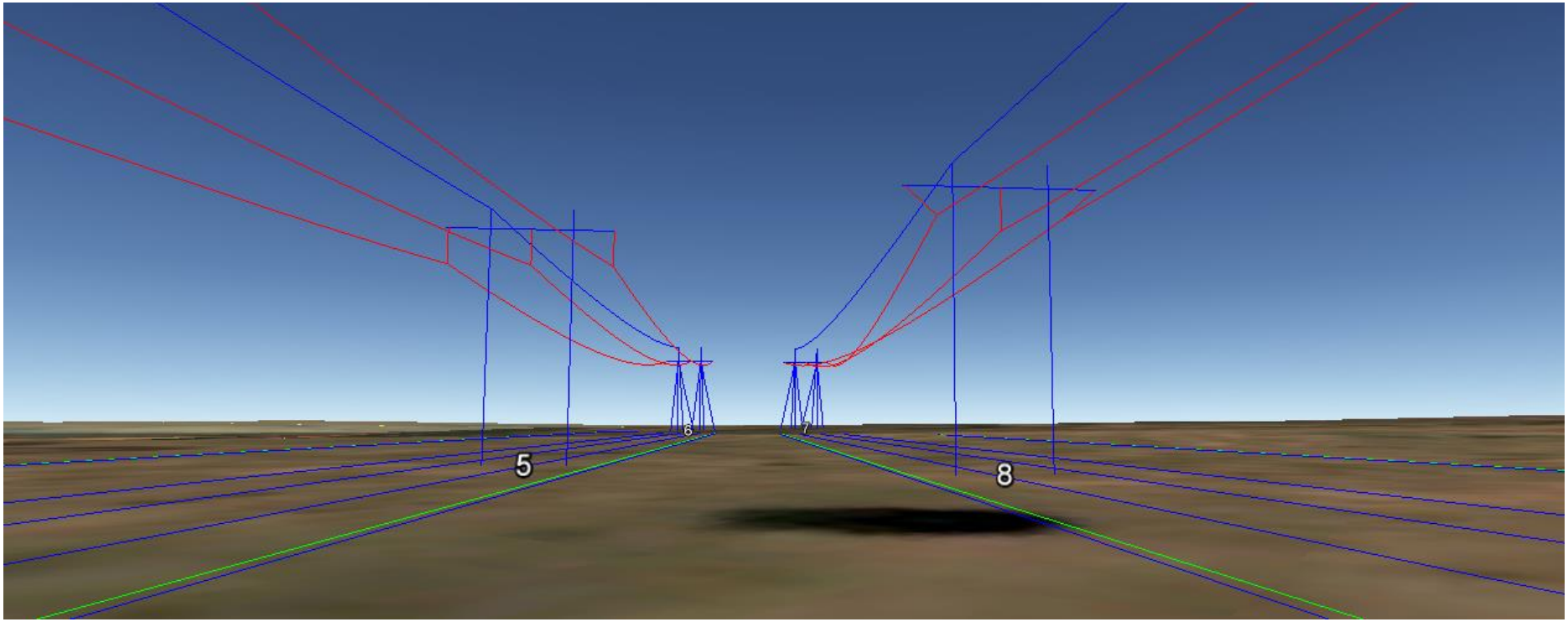


Figure 2: Mapped visual presentation of 132kV evacuation lines



2 EXISTING LANDSCAPE

It is possible that landscape change due to the proposed development could impact the character of an important landscape area.

Importance can be derived from specific features that can relate to urban or rural settings. They might include key natural, historic or culturally significant elements. Importance might also relate to landscapes that are uncommon or under threat from development.

Generally the most significant natural areas are afforded a degree of legal protection such as National Parks and Reserves; however, they might also have local significance and not be protected.

This section describes the types of landscape that may be impacted, indicating the likely degree of sensitivity and describes how the landscape areas are likely to be impacted.

2.1 Landscape Character

Landscape character is a composite of a number of influencing factors including:

- Landform and drainage.
- Nature and density of development.
- Vegetation patterns.

2.1.1 Landform and drainage

The preferred proposed development and alternative are not located in close proximity to any major rivers or dams. The area drains to the south west, towards the N14 national road approximately 14km from the development property.

The sites are located in an area with relatively low significance in elevation, meaning that the sites are not located on a mountain, at the foot of a mountain or in an area with a significant difference in elevation, except to the east where the Langeberge mountain range can be seen. The preferred site is located at an above mean sea level (amsl) of

approximately 1188m at the highest elevation and at an amsl of 1175m at the lowest elevation. The alternative site is located at an above mean sea level (amsl) of approximately 1234m at the highest elevation and at an amsl of 1186m at the lowest elevation. **Refer to Figures 2 to 4 for cross section profiles.**

The landform and drainage described above is unlikely to limit visibility. Areas within 5km from the proposed development might have a clear view without taking existing screening into account.

2.1.2 Nature and density of development

Development within the study area can be divided into the following types:

- **Industrial development** includes the Eskom Lewensaar substation on the same property and the Ferrum Garona existing Eskom power line.
- **Urban development** includes the town of Postmasburg located approximately 50km east from the development property and the town of Olifantshoek located approximately 30km north from the development property.
- **Agricultural development** is the main development type surrounding the proposed development. The site is located in an area mainly used for livestock grazing.
- **Service development** includes:
    - The D3300 gravel road located approximately 4,9km east from the proposed development.
    - The Sishen Saldanha railway line adjacent to the property.
    - The N14 national road approximately 14km to the west.
    - Other public gravel roads in close proximity.
- **Tourism development** includes accommodation facilities in Postmasburg and Olifantshoek, and game farms in the area. The Witsand nature reserve is located approximately 33km south west from the development property.

2.1.3 Vegetation patterns

The site is located within the Eastern Kalahari Bushveld Bioregion which forms part of the bigger Savanna Biome. It is characterized by a grassy ground layer and a distinct upper layer

of woody plants. Where this upper layer is near the ground the vegetation may be referred to as Shrubveld. A major factor delimiting the biome is the lack of sufficient rainfall which prevents the upper tree layer from dominating, coupled with fires and grazing, which keep the grass layer dominant. Summer rainfall is essential for grass dominance, which, with its fine material, fuels near-annual fires. In fact, almost all species are adapted to survive fires, usually with less than 10% of plants, both in the grass and tree layer, killed by fire. Even with severe burning, most species can re-sprout from the stem bases. The grass layer is dominated by C 4-type grasses, which are at an advantage where the growing season is hot. But where rainfall has a stronger winter component, C 3-type grasses dominate.

The shrub-tree layer may vary from 1 to 20 m in height, but in the Bushveld typically varies from 3 to 7 m. The dominant protected tree species in the area of the proposed development is the Camel thorn tree (*Vachellia erioloba)*. The following vegetation is also obvious but not extensive:

- Small plantations of alien trees associated with small community settlements and farmsteads. This includes Eucalyptus tree plantations which were mainly introduced as a mean of providing shade and barricading against wind.
- Occasional groups of ornamental vegetation associated with farmsteads and towns or cities.

2.2 Landscape Character Assessment Summary

The industrial development is likely to be sensitive to the proposed development. Eskom staff doing maintenance work on the power lines and nearby substation will be most sensitive to the development due to close proximity. These workers are used to pleasant views of the surrounding area while doing maintenance work.

The town of Postmasburg will not be sensitive to the proposed development due to the fact that Postmasburg is a “mining town” and is located 50km on the opposite side of the Langeberge mountain range. The town of Olifantshoek is located 30km from the proposed development also screened by the Langeberge mountain range.

Regarding service development, road users on the D3300 gravel road will be most sensitive due to close proximity, especially if the alternative site is chosen. The preferred site is located 7,7km west from the D3300 with some existing screening that might limit sensitivity.

Users of the Sishen Saldanha railway line along with its service road will also be sensitive due to close proximity of 50m from the preferred site.

The majority of the affected area falls within the agricultural development area. Three farmsteads were identified with the closest one located 5,5km south. Residents of these farmsteads will not be sensitive due to distance from the proposed development and existing screening, like trees and bushes.

The preferred site will be the best option to limit visibility. The alternative site stretches over a slope to the east and with an amsl of approximately 46m higher than the preferred site's highest amsl. The slope can be seen in **Figure 2.**

Figures 5 to 8 are part of the photographic record showing the landscape and existing screening.

Figure 3: Cross Section Profile taken to indicate the slope

The red arrow indicates the exact position of the highest amsl of the slope on the alternative site.

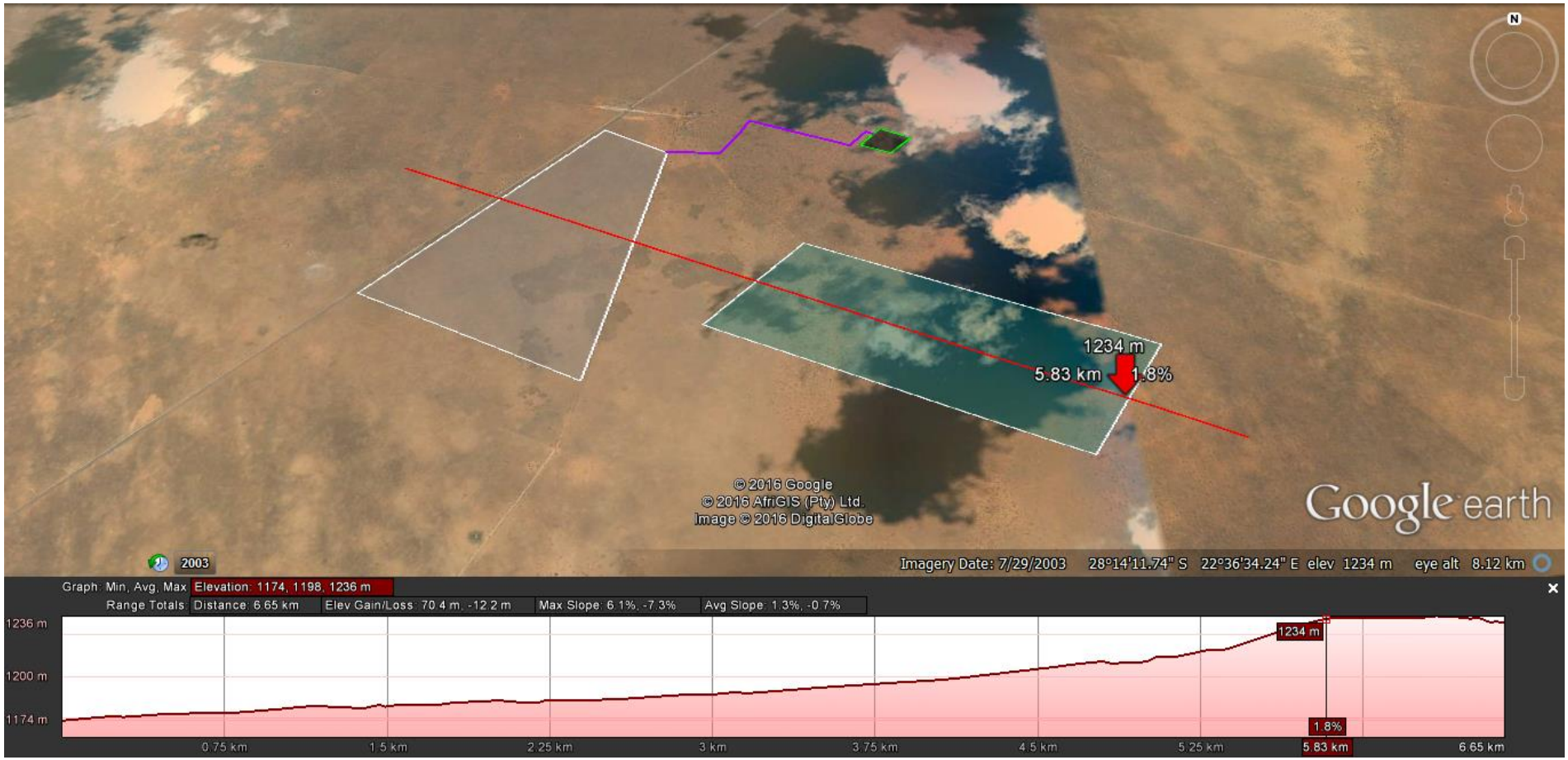


Figure 4: Cross Section Profile taken from north to south

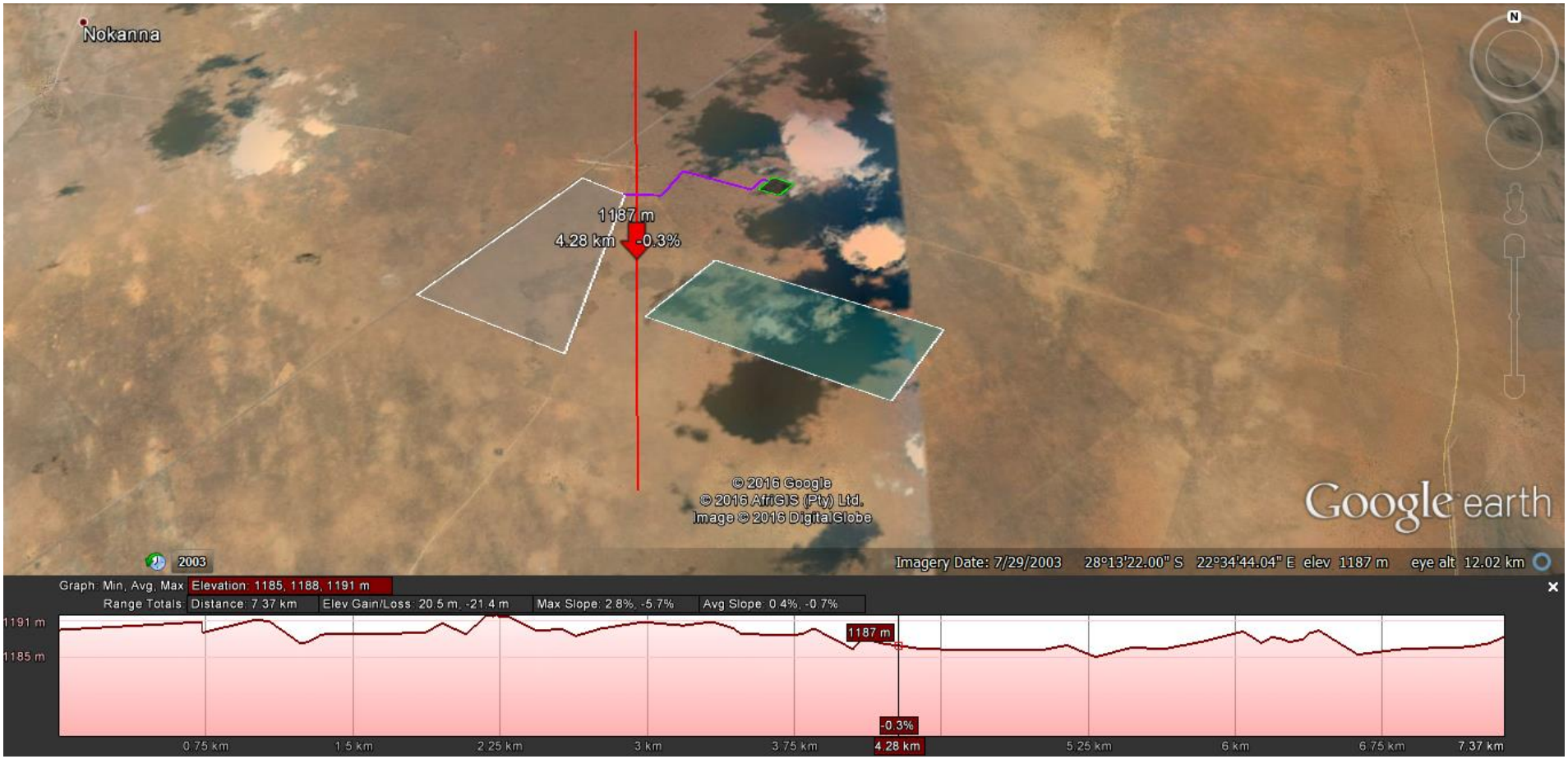


Figure 5: Cross Section Profile taken from west to east

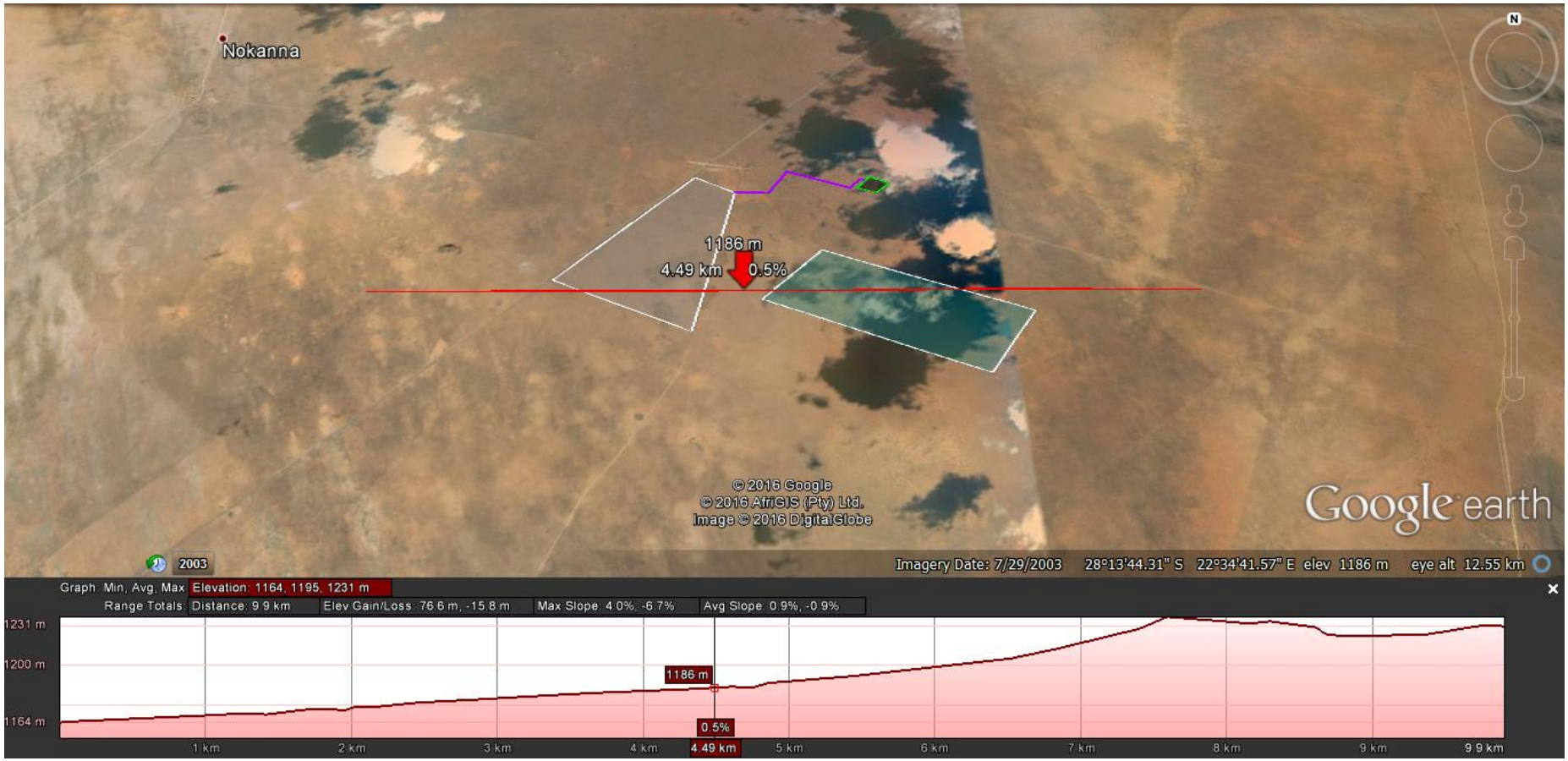


Figure 6: View of area from bridge towards a western direction

Figure 7: View of area from bridge towards an eastern direction

Figure 8: View of area from bridge towards a northern direction

Figure 9: View of area from bridge towards a southern direction

3 VISUAL RECEPTORS

Please note that the preferred line connection point forms part of the preferred site's assessment due to it only being a connection point and short line distance.

Visual Receptors can be defined as: "Individuals, groups or communities who are subject to the visual influence of a particular project."

3.1 Identified Visual Receptors

This section is intended to highlight possible Receptors within the landscape which, due to use, could be sensitive to landscape change. They include:

- **Area Receptors** which include the towns of Postmasburg and Olifantshoek.
- **Linear Receptors** which include:
    - The D3300 gravel road.
    - The Ferrum Garona Eskom line.
    - The Sishen Saldanha railway line and its service road.
- **Point Receptors** which include small groups of farmsteads that are generally associated with and located within the agricultural landscape that surrounds the proposed development. The Lewensaar Eskom substation.

Refer to **Map 2 & 3: Zone of Theoretical Visibility (ZTV)**. These maps indicate all areas that are in direct line of site from the proposed development up to a distance of 20km.

3.2 Likely significance of sensitive receptors

Uses such as guest houses or recreational areas are likely to rely on pleasant visual aspects as part of marketing campaigns and the overall positive client/tourist experience, thus important to maintain a pleasant visual attraction. Game farms in the area rely on the Camel thorn tree that forms part of the "Kalahari Experience" during hunting season. The Camel thorn tree forms part of the "image" of the Kalahari and thus an important aspect.

3.3 Impact on airports and aerodromes

3.3.1 Objects affecting airspace and applicable legislation

Any communications structure, building or other structure, whether temporary or permanent, which has the potential to endanger aviation in navigable airspace, or has the potential to interfere with the operation of navigation or surveillance systems or Instrument Landing Systems, including meteorological systems for aeronautical purposes, is considered an **obstacle** and shall be submitted to the Commissioner for Civil Aviation for evaluation **(refer to SA-CAR Part 139.01.33)**.

As navigable airspace is any airspace where "heavier than air" craft can operate, it means that any obstacle, anywhere, needs to be evaluated.

The main reason is to control or prevent structures that could have a serious effect on aviation safety, especially in the vicinity of an aerodrome. It also follows that the knowledge of where obstacles are, will add to aviation safety.

Lights and marking requirements

Obstacles are evaluated individually and marking (if any) are specified as requirements.
The following syntax is used:

1. **None**: There are no requirements as far as the marking of the structure is concerned and may be left as is.

2. **Night Markings**: Night markings are the addition of lights at the highest practical point of a structure to make such a structure more visible in darkness and poor light conditions. This will be found mostly on communications structures below 45m in height above ground where the need is identified to improve its visibility. The lights on top of these structures are always used in pairs, for redundancy purposes, and shall be approved steady burning, red aeronautical obstruction lights of at least 10 candela, unless specified differently. Night markings may also be applied to buildings or other substantial structures, which by its size and appearance cannot be overlooked in normal visibility conditions, such as a skyscraper, the cooling towers of a power station, mine headgear etc. but the need is identified to improve its visibility

at night and poor visibility conditions. Such structures shall be illuminated by aeronautical obstruction lights, as above, clearly defining the outline of the structure in accordance with **ICAO Annex 14 chapter 6**, unless specified differently. Where this is not achievable due to practical considerations, different means of compliance may be specified or allowed, after investigation. This may be in the form of flood lighting, effect lighting (such as illuminated advertisements) etc.

3. **Day and Night Markings:-**

Day and night markings apply to all structures exceeding 45m above the ground in South Africa by default (**refer SA-CAR Part 139.01.33**), or lower structures when specified. Such structures may include structures where the top of the structure exceeds 150m above the mean ground level, like on top of a hill, and the mean ground level considered to be the lowest point in a 3 Kilometre radius around such structure. Lower structures, which are otherwise considered as a danger to aviation, shall also be marked as such when specified.

Paint markings (Day markings) shall be in compliance with **ICAO Annex 14 chapter 6** and shall consist of seven painted bands, each one seventh of the length of the structure, and shall consist of bands of International Orange (or Post Office red) alternated by brilliant white, starting and ending in orange/red, to a maximum length of 30 metres per band (i.e. a 210m mast). Thereafter it becomes 9 bands, each one ninth of the length of the mast up to 270m, 11 bands up to 330m etc.

Lights (Night marking) to be used shall consist of a pair of steady burning approved red aeronautical obstruction lights of at least 32 candela each at the highest practical point of the structure. This may be substituted by a medium intensity Type B flashing red light (20 – 60 flashes per minute), of 2000 candela (±25 %) intensity in accordance with **ICAO Annex 14 Table 6-3**.

Intermediate lights shall be placed at a position midway between the top of the structure and the ground and shall consist of at least three steady burning red aeronautical obstruction lights of at least 32 candela each, on the same vertical plane and spaced not more than 120 degree horizontally. At least two lights shall be

visible through any azimuth of 360 degree and no light shall be spaced more than 30m apart, on the horizontal plane of any structure. Multiple lights may be required to satisfy this requirement. The vertical spacing of lights shall be as far as practical be evenly spaced and shall not exceed 45m between vertical levels.

The Commissioner may require more stringent markings in specific situations and may require that lights be powered from a no-break power source (UPS).

Power lines

Power lines, overhead wires and cables are considered as obstacles and the detail shall be communicated to the Commissioner at an early planning stage.

The Commissioner shall require the route of the power line, the co-ordinates (*latitude and longitude in degree, minute, seconds and tenth of seconds format*) of turning points in the line, the maximum height of the structures above ground level and the name of the power line. The Commissioner shall evaluate the route and require those sections of the line (if any), which is considered a danger to aviation to be marked or rerouted.

Power lines shall be marked when crossing a river, valley or major highway with marker spheres of a diameter of not less than 60 cm. The spheres shall be of one colour and displayed alternately orange/red and white or a colour that is in sharp contrast to the background as seen from an airborne perspective. The spacing between the spheres and between the spheres and the supporting towers shall not exceed 30m. On lines with multiple cables, the spheres shall be fitted to the highest cable.

The marker spheres shall be visible from at least 1000m from an airborne perspective and 300m from the ground.

Where power lines crosses a river or valley, the co-ordinates (*latitude and longitude in degree, minute, seconds and tenth of seconds format*) and the height of the line above the valley or river, shall be communicated to the Commissioner for publication in the appropriate media.

The Commissioner may require that supporting towers be marked and lighted.

Cranes

Where cranes are erected, prior permission shall be obtained from the Commissioner. The co-ordinates (*latitude and longitude in degree, minute, seconds and tenth of seconds format*), the ground elevation of the site above mean sea level, the height of the crane, the dimensions of the jib as well as the erecting date and duration of the project must be communicated to the Commissioner for evaluation and publication in the relevant media.

The Commissioner shall specify markings, if required.

When markings are required, the crane shall be painted in a conspicuous colour which in a sharp contrast to the background from an airborne perspective. Illumination shall clearly define the shape of the crane and the extremities of the structure shall be illuminated by medium intensity Type B flashing red light (20 – 60 flashes per minute), of 2000 candela (±25 %) intensity in accordance with **ICAO Annex 14 table 6-3**.

Variations on Markings

Written, motivated request for the variation of any of the requirements for the marking of structures may be addressed to the Commissioner.

Specifications on markings

Specification on the lighting and painting of structures can be found in **ICAO Annex 14 chapter 6** and the specifics in **Annex 14 APPENDIX 1**. COLOURS FOR AERONAUTICAL GROUND LIGHTS, MARKINGS, SIGNS AND PANELS

3.3.2 Glare

Solar panels are designed to absorb light, and accordingly only reflect a small amount of the sunlight that falls on them compared to most other everyday objects **(Refer to Figure 9 & 10)**. Most notably, solar panels reflect significantly less light than flat water.

In fact, glass, one of the uppermost and important components of a solar panel, reflects only a small portion of the light that falls on it–about 2-4%, depending on whether it has undergone an anti-reflective treatment. These days, to increase solar panel efficiency and power output, most panels are treated with some kind of anti-reflective coating.

Numerous airports around the world have solar installations located on their premises **(Refer to Figure 11)**. The majority of examples in which solar panels have been installed at, on or near airports are testament to fact that they are not automatically a hazard to pilots.

Figure 10: Reflection Characteristics of normal glass (left) and PV glass (right)

Figure 11: Reflection Comparison of everyday objects

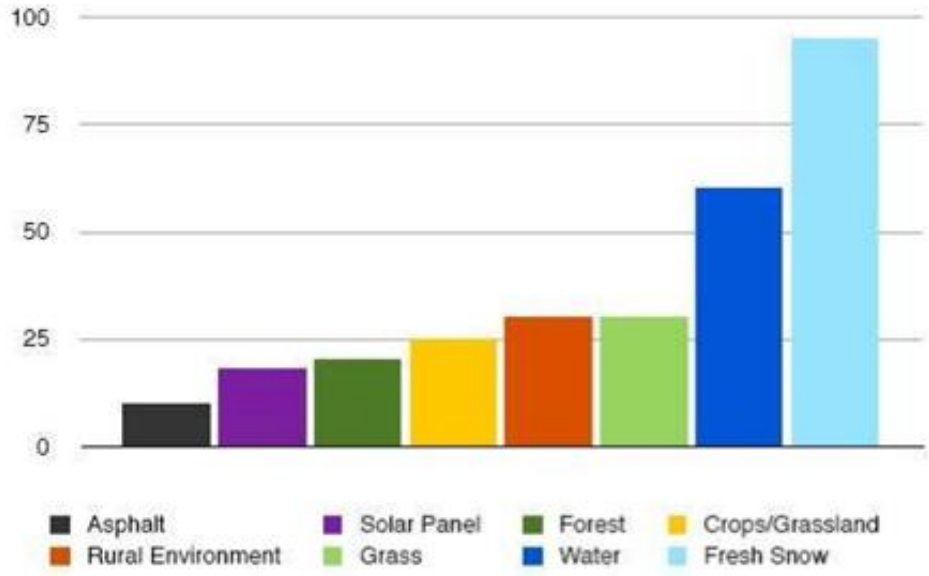


Figure 12: The Indiana Solar Farm at the Indianapolis International Airport

Table 3: ZTV Assumptions

Radius	Impact Magnitude
0-5km	High
5-10km	Medium-High
10-15km	Medium-Low
15-20km	Low

The assessment includes the preferred site, alternative site and preferred line connection point;

- The D3300 gravel road. This road falls within the 5-10km ZTV zone, thus likely to be impacted by the proposed development.

  Magnitude: Medium-High

- The Sishen Saldanha railway line and its service road. This railway line and service road falls within the 0-5km ZTV zone, thus likely to be impacted by the proposed development.

  Magnitude: High
- The Lewensaar Eskom substation. This substation falls within the 0-5km ZTV zone, thus likely to be impacted by the proposed development.

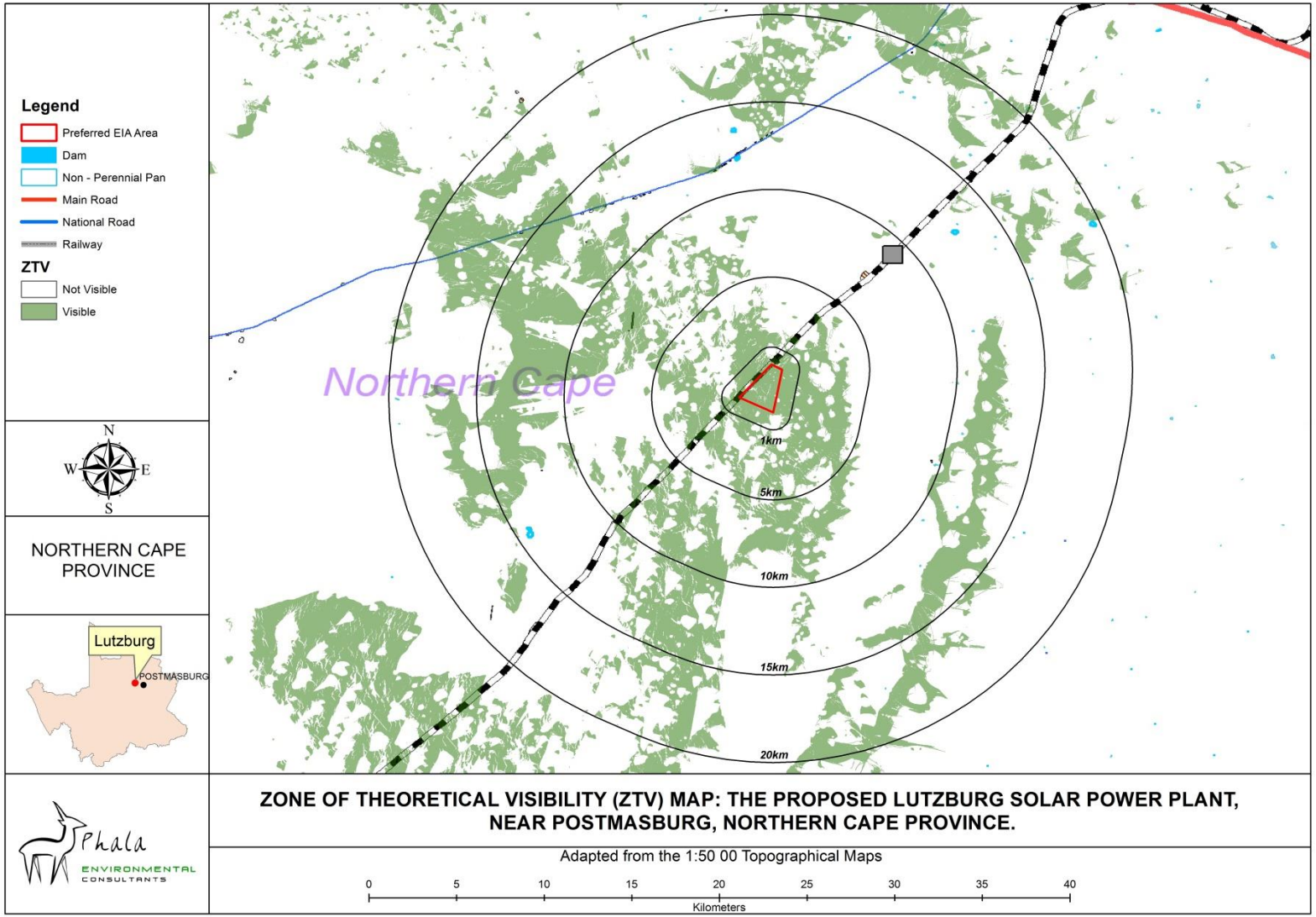
  Magnitude: High
- The Ferrum Garona power line. This power line falls within the 0-5km ZTV zone, thus likely to be impacted by the proposed development.

  Magnitude: High
- There are three nearby farmsteads identified which are likely to be impacted by the proposed development. All of these farmsteads fall within the 5-10km ZTV zone.

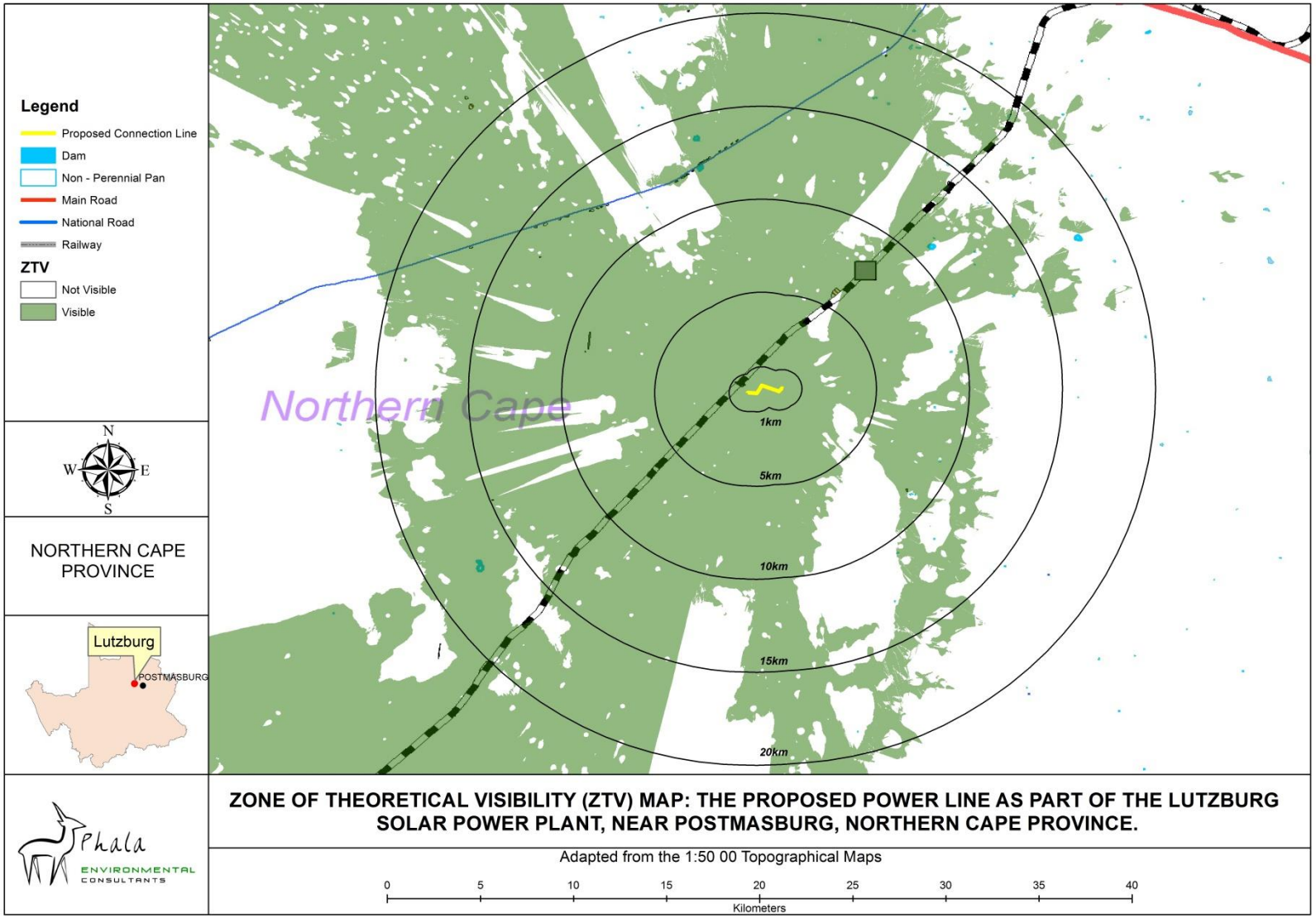
  Magnitude: Medium-High

Please note that during the ZTV assessment, no existing screening was part of the assessment.

Map 2: Preferred Site: Zone of Theoretical Visibility (ZTV)



Map 3: Preferred Line Connection Point: Zone of Theoretical Visibility (ZTV)



4 SIGNIFICANCE OF IMPACTS ON VIEWERS

This section includes the assessment of the visual impact of the solar power plant, including the preferred line connection as part of the overall assessment, during the ***Construction Phase***, ***Operational Phase*** and ***Decommissioning Phase*** of the preferred and alternative site. The rating system reflected in section 1.8 of this VIA report will be utilised to determine the significance of the impacts.

Similar proposed developments in the area which might have a negative effect on the cumulative impact include:

- The Proposed Life Solar Power Plant near Postmasburg, Northern Cape Province, on the same property.
- The Jasper Power Company renewable energy project, on the adjacent property to the north east.

Other power infrastructure projects include:

- The new Ferrum Nieuwehoop 400kV Eskom line, on the same property.

4.1. Preferred Site: Construction Phase

Table 4: Preferred Site - Significance of visual impacts during construction phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Definite (4)
Duration	Short term (1)	Short term (1)
Magnitude	Medium (2)	Low (1)
Reversibility	Barely reversible (3)	Partly reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The construction of the PV facility may increase the	

	cumulative visual impact together with farming activities, dust on gravel roads, existing Eskom power infrastructure and new projects, mines in the area and the 6 proposed solar power facilities in the area.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative low (26)**	**Negative low (12)**
Can impacts be mitigated?	Yes, mitigation is possible. Dust generation will be the main factor/problem during the construction phase. Due to the rather level terrain, mitigation measures will only solve the problem to a certain extent. Measures include: • Dust suppression will play an important role to minimise the visibility of dust. • Contractors must avoid using roads not relevant to the project. • Construction vehicle must limit travelling on nearby roads during peak hours when possible. • Contractors should try using public roads not used that often by the residents of the area. • New road construction must be avoided if possible. • Good housekeeping should be implemented. • Proper rehabilitation of disturbed areas after construction. • Risk assessments relating to fire hazards, “No Smoking” signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water. • Partial screening is possible by adding indigenous flora.	

4.2. Preferred Site: Operational Phase

Table 5: Preferred Site - Significance of visual impacts during operational phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Probable (3)
Duration	Long term (3)	Long term (3)
Magnitude	Medium (2)	Low (1)
Reversibility	Barely reversible (3)	Partially reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The operation of the plant may increase the cumulative visual impact together with dust from the nearby gravel roads, farming activities, existing Eskom power infrastructure and new projects, and new proposed solar power facilities in the area.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative medium (30)**	**Negative low (13)**
Can impacts be mitigated?	Yes, but due to the rather level terrain mitigation measures will only solve the problem to a certain extent. Measures include: • Dust suppression will play an important role to minimise the visibility of dust. • Operators must avoid using roads not relevant to the project. • Contractors and operators should try using public roads not used that often by the residents of the area. • Good housekeeping should be implemented. • Risk assessments relating to fire hazards, “No Smoking” signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water.	

	• Partial screening is possible by adding and maintaining indigenous flora.

4.3. Preferred Site: Decommissioning Phase

Table 6: Preferred Site - Significance of visual impact during decommissioning phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Definite (4)
Duration	Short term (1)	Short term (1)
Magnitude	Medium (2)	Low (1)
Reversibility	Barely reversible (3)	Partly reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The decommissioning of the plant may increase the cumulative visual impact together with farming activities, people using existing gravel roads, existing Eskom power infrastructure and new projects, and the new proposed solar power facilities in the area. Dust and housekeeping will be the main factors to take into account.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative low (26)**	**Negative low (12)**
Can impacts be mitigated?	Yes, mitigation is possible. Dust generation and housekeeping will be the main factors/problems during the decommissioning phase. Due to the rather level terrain, mitigation measures will only solve the problem to a certain extent. Measures include: • Dust suppression will play an important role to minimise the visibility of dust. • Contractors must avoid using roads not relevant to the project. • Construction vehicles must limit travelling on nearby roads during peak hours when possible. • Contractors should try using public roads not used that often by the residents of	

	the area. • New road construction must be avoided if possible. • Good housekeeping should be implemented. • Proper rehabilitation of disturbed areas after decommissioning. • Risk assessments relating to fire hazards, "No Smoking" signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water.

4.4. Alternative Site: Construction Phase

Table 7: Alternative Site - Significance of visual impacts during construction phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Definite (4)
Duration	Short term (1)	Short term (1)
Magnitude	Medium (2)	Medium (2)
Reversibility	Barely reversible (3)	Partly reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The construction of the PV facility may increase the cumulative visual impact together with farming activities, dust on gravel roads, existing Eskom power infrastructure and new projects, and the new proposed solar power facilities in the area.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative low (26)**	**Negative low (24)**
Can impacts be mitigated?	Yes, mitigation is possible. Dust generation will be the main factor/problem during the construction phase. Due to the rather level terrain, mitigation measures will only solve the problem to a certain extent. Measures include:	

	• Dust suppression will play an important role to minimise the visibility of dust. • Contractors must avoid using roads not relevant to the project. • Construction vehicle must limit travelling on nearby roads during peak hours when possible. • Contractors should try using public roads not used that often by the residents of the area. • New road construction must be avoided if possible. • Good housekeeping should be implemented. • Proper rehabilitation of disturbed areas after construction. • Risk assessments relating to fire hazards, "No Smoking" signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water. • Partial screening is possible by adding indigenous flora.

4.5. Alternative Site: Operational Phase

Table 8: Alternative Site - Significance of visual impacts during operational phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Probable (3)
Duration	Long term (3)	Long term (3)
Magnitude	Medium (2)	Low (1)
Reversibility	Barely reversible (3)	Partially reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The operation of the plant may increase the cumulative visual impact together with dust from the nearby gravel roads, farming activities, existing Eskom power infrastructure and new	

	projects, and the new proposed solar power facilities in the area.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative medium (30)**	**Negative low (13)**
Can impacts be mitigated?	Yes, but due to the rather level terrain mitigation measures will only solve the problem to a certain extent. Measures include: • Dust suppression will play an important role to minimise the visibility of dust. • Operators must avoid using roads not relevant to the project. • Contractors and operators should try using public roads not used that often by the residents of the area. • Good housekeeping should be implemented. • Risk assessments relating to fire hazards, "No Smoking" signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water. • Partial screening is possible by adding and maintaining indigenous flora.	

4.6. Alternative Site: Decommissioning Phase

Table 9: Alternative Site - Significance of visual impact during decommissioning phase

Visual intrusion	Pre-mitigation impact rating	Post mitigation impact rating
Status (positive or negative)	Negative	Negative
Geographical Extent	Local (2)	Local (2)
Probability	Definite (4)	Definite (4)
Duration	Short term (1)	Short term (1)
Magnitude	Medium (2)	Medium (2)
Reversibility	Barely reversible (3)	Partly reversible (2)
Irreplaceable loss of resources	No loss of resources (1)	No loss of resources (1)
Cumulative impact	Low cumulative impact (2). The decommissioning of the plant may increase	

	the cumulative visual impact together with farming activities, people using existing gravel roads, existing Eskom power infrastructure and new projects, and the new proposed solar power facilities in the area. Dust and housekeeping will be the main factors to take into account.	
Formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.		
Significance	**Negative low (26)**	**Negative low (24)**
Can impacts be mitigated?	Yes, mitigation is possible. Dust generation and housekeeping will be the main factors/problems during the decommissioning phase. Due to the rather level terrain, mitigation measures will only solve the problem to a certain extent. Measures include: • Dust suppression will play an important role to minimise the visibility of dust. • Contractors must avoid using roads not relevant to the project. • Construction vehicles must limit travelling on nearby roads during peak hours when possible. • Contractors should try using public roads not used that often by the residents of the area. • New road construction must be avoided if possible. • Good housekeeping should be implemented. • Proper rehabilitation of disturbed areas after decommissioning. • Risk assessments relating to fire hazards, “No Smoking” signs and the implementation of smoking areas. • Proper fire fighting equipment should be available on site. Not only fire extinguishers but also equipment like a water truck which can store large amounts of water.	

4.7 Monitoring Requirements

The following monitoring requirements are recommended to ensure the visual impact of the proposed development is limited:

- The ECO and ELO should monitor the amount of litter on site during construction on a daily basis to ensure litter prevention.
- The ECO and ELO should monitor housekeeping during construction to ensure neat and tidy laydown areas.
- The ECO and ELO should monitor the amount of dust seen up to 20km from site during construction. Dust suppression should be implemented on a daily basis.
- The ECO and ELO should ensure and monitor all rehabilitation after construction for at least the first 6 months to ensure all vegetation is established in a proper and healthy way. This will also depend on the amount of rainfall and season after construction which might shorten the monitoring requirement.
- Permanent workforce should monitor the health and progress of the added vegetation to ensure proper screening is maintained. This monitoring can be implemented for at least the first 5 years after construction **IF** drought tolerant vegetation is added, otherwise on a permanent basis.
- Any other monitoring requirements set out by the EA, EMP and SACAA.

5 CONCLUSION

Referring to the assessment score in **Section 4** of this VIA report, the post mitigation impact is a "*Negative Low"* impact during the construction, decommissioning and operational phase of both the preferred and alternative sites. A small amount of visual receptors are likely to be impacted by both the preferred and alternative sites due to close proximity. The preferred site will be most suitable as the alternative is located on a slope with a higher altitude and more protected vegetation to be cleared. Rural areas are clearly defined particularly from a distance and it is assumed that the majority of people would prefer rural views over views of heavy industrial development.

The cumulative impacts will play an important role. It is impossible at this stage to determine which of the proposed solar power projects, listed in Section 4 of this report, will receive preferred bidder status. This aspect will determine the cumulative impact.

In terms of possible landscape degradation, the landscape does appear to have excellent existing screening mainly provided by Camel thorn trees. Camel thorn trees are abundant surrounding the proposed development.

What mitigation measures are concerned, a search and rescue programme for Camel thorn trees and other protected trees should be implemented. This will be effective mainly for smaller trees. The smaller trees can be relocated to areas around the proposed development where existing screening is minimal. The unnecessary destruction of existing trees should also be avoided where possible. Other indigenous flora can also be added for screening purposes. Contractors and operators should also avoid using public roads during daytime peak times where possible due to the population numbers in and around nearby towns, thus avoiding traffic and people.

What line connections are concerned, the preferred line connection shown in **Image 1** will have the least negative visual impact on viewers and will form part of the preferred site. The line is short in distance where it connects to the Lewensaar substation. According to SACAA, details of the power line should be submitted for evaluation to determine if the power line will be an object affecting airspace.

Taking into account all positive factors of such a development including economic factors, social factors and sustainability factors, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view.

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