PROPOSED GRID CONNECTION INFRASTRUCTURE FOR THE GREAT KAROO CLUSTER OF RENEWABLE ENERGY FACILITIES

Northern Cape Province

VISUAL IMPACT ASSESSMENT

Produced for:

Great Karoo Renewable Energy (Pty) Ltd

On behalf of:

Savannah Environmental (Pty) Ltd
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- March 2022 -

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1. STUDY APPROACH

1.1. Qualification and experience of the practitioner

Lourens du Plessis, a specialist in visual impact assessment and Geographical Information Systems (GIS), undertook the Visual Impact Assessment (VIA).

He has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His expertise are often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

He is familiar with the "Guidelines for Involving Visual and Aesthetic Specialists in EIA Processes" (Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning) and utilises the principles and recommendations stated therein to successfully undertake visual impact assessments.

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities. He will not benefit from the outcome of the project decision-making.

1.2. Assumptions and limitations

This assessment was undertaken during the planning stage of the project and is based on information available at that time.

1.3. Level of confidence

Level of confidence[1] is determined as a function of:

- The information available, and understanding of the study area by the practitioner:
    - 3: A high level of information is available of the study area and a thorough knowledge base could be established during site visits, surveys etc. The study area was readily accessible.
    - 2: A moderate level of information is available of the study area and a moderate knowledge base could be established during site visits, surveys etc. Accessibility to the study area was acceptable for the level of assessment.
    - 1: Limited information is available of the study area and a poor knowledge base could be established during site visits and/or surveys, or no site visit and/or surveys were carried out.

[1] Adapted from Oberholzer (2005).

- The information available, understanding of the study area and experience of this type of project by the practitioner:

    - 3: A high level of information and knowledge is available of the project and the visual impact assessor is well experienced in this type of project and level of assessment.
    - 2: A moderate level of information and knowledge is available of the project and/or the visual impact assessor is moderately experienced in this type of project and level of assessment.
    - 1: Limited information and knowledge is available of the project and/or the visual impact assessor has a low experience level in this type of project and level of assessment.

These values are applied as follows:

Table 1: Level of confidence.

	Information on the project & experience of the practitioner			
Information on the study area		**3**	**2**	**1**
	3	9	6	3
	2	6	4	2
	1	3	2	1

The level of confidence for this assessment is determined to be ***9*** *and indicates that the author's confidence in the accuracy of the findings is high:*

- The information available, and understanding of the study area by the practitioner is rated as **3** and
- The information available, understanding and experience of this type of project by the practitioner is rated as **3**.

1.4. 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 infrastructure. A detailed Digital Terrain Model (DTM) for the study area was created from topographical data provided by the Japan Aerospace Exploration Agency (JAXA), Earth Observation Research Centre, in the form of the ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.

Visual Impact Assessment (VIA)

The VIA is determined according to the nature, extent, duration, intensity or magnitude, probability and significance of the potential visual impacts, and will propose management actions and/or monitoring programs, and may include recommendations related to the proposed grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities.

The visual impact is determined for the highest impact-operating scenario (worst-case scenario) and varying climatic conditions (i.e. different seasons, weather conditions, etc.) are not considered.

The VIA considers potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region.

The following VIA-specific tasks were undertaken:

- **Determine potential visual exposure**

  The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed grid infrastructure was not visible, no impact would occur.

  Viewshed analyses from the proposed infrastructure indicate the potential visibility.

- **Determine visual distance/observer proximity to the grid connection infrastructure**

  In order to refine the visual exposure of the grid connection infrastructure on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for the structures.

  Proximity radii for the proposed infrastructure are created in order to indicate the scale and viewing distance of the structures and to determine the prominence of the structures in relation to their environment.

  The visual distance theory and the observer's proximity to the grid infrastructure are closely related, and especially relevant, when considered from areas with a high viewer incidence and a predominantly negative visual perception of the proposed infrastructure.

- **Determine viewer incidence/viewer perception (sensitive visual receptors)**

  The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers, then there would be no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

  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 proposed infrastructure.

  It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer; regularity of sighting, cultural background, state of mind, and purpose of sighting which would create a myriad of options.

- **Determine the visual absorption capacity of the landscape**

  This is the capacity of the receiving environment to absorb the potential visual impact of the proposed structures. The visual absorption capacity (VAC) is primarily a function of the vegetation, and will be high if the vegetation is tall, dense and continuous. Conversely, low growing sparse and patchy vegetation will have a low VAC.

  The VAC would also be high where the environment can readily absorb the structure in terms of texture, colour, form and light / shade characteristics of the structure. On the other hand, the VAC for a structure contrasting markedly with one or more of the characteristics of the environment would be low.

The VAC also generally increases with distance, where discernible detail in visual characteristics of both environment and structure decreases.

The digital terrain model utilised in the calculation of the visual exposure of the grid connection infrastructure does not incorporate the potential VAC of the natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **Calculate the visual impact index**

  The results of the above analyses are merged in order to determine where the areas of likely visual impact would occur. These areas are further analysed in terms of the previously mentioned issues (related to the visual impact) and in order to determine the magnitude of each impact.

- **Determine impact significance**

  The potential visual impacts are quantified in their respective geographical locations in order to determine the significance of the anticipated impact on identified receptors. Significance is determined as a function of extent, duration, magnitude (derived from the visual impact index) and probability. Potential cumulative and residual visual impacts are also addressed. The results of this section are displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

  Mitigation measures will be proposed in terms of the planning, construction, operation and decommissioning phases of the project.

- **Reporting and map display**

  All the data categories, used to calculate the visual impact index, and the results of the analyses will be displayed as maps in the accompanying report. The methodology of the analyses, the results of the visual impact assessment and the conclusion of the assessment will be addressed in the VIA report.

- **Site visit**

  Undertake a site visit (December 2021) in order to verify the results of the spatial analyses and to identify any additional site specific issues that may need to be addressed in the VIA report.

2. BACKGROUND

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a 132kV central collector substation and a 132kV double circuit power line on a site located approximately 35km south-west of Richmond and 40km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province. The collector substation that comprises both the Eskom switching station and the IPP's substation is proposed on Portions 0 and 1 of Farm Rondavel 85. One grid corridor has been considered for assessment and placement of the 132kV double circuit power line. The grid corridor traverses the following farm properties:

- Portion 0 of Farm Annex Rondavel 86;
- Portion 1of Farm Uit Vlugt Fontein 265;
- Portion 0 of Farm Wynandsfontein 91;
- Portion 1 of Farm Wynandsfontein 91;
- Portion 3 of Farm Vlekfontein 90;
- Portion 0 of Farm Burgersfontein 92;
- Portion 0 of Farm Nieuwe Fontein 89;
- Portion 1 of Farm Nieuwe Fontein 89;
- Portion 0 of Farm Rondavel 85;
- Portion 1 of Farm Rondavel 85;
- Portion 0 of Farm Kleinfontein 93;
- Portion 1 of Farm Bult & Rietfontein 96; and
- Remaining Extent of Portion 3 of Farm Schietkuil.

The entire extent of the site falls within the Central Corridor of the Strategic Transmission Corridors. The grid connection infrastructure is known as the Great Karoo Electrical Grid Infrastructure (EGI).

The development of the 132kV central collector substation and 132kV power line is required to enable the connection for the Great Karoo Cluster of Renewable Energy Facilities, which comprises three (3) 100MW solar photovoltaic (PV) energy facilities, and two (2) 140MW wind farms, to the national grid for the evacuation of the generated electricity. The connection point into the national grid will be the existing Eskom Gamma Substation.

The projects which the proposed grid connection infrastructure will facilitate the grid connection for are known as:

- Angora Wind Farm;
- Merino Wind Farm;
- Nku Solar PV Energy Facility;
- Moriri Solar PV Energy Facility; and
- Kwana Solar PV Energy Facility.

Details of the proposed grid connection infrastructure and alternatives are provided in the table below:

Table 2: Details of the proposed grid connection infrastructure and alternatives.

Corridor width (for assessment purposes)	One grid connection corridor has been identified for the assessment and placement of the grid connection infrastructure. The grid connection corridor comprises a 1km wide power line corridor to allow for avoidance of environmental sensitivities, and suitable placement within the identified preferred corridor. Therefore, the entire corridor is being proposed for the development provided the infrastructure remains within the assessed corridor and environmental sensitivities within this corridor are avoided.
Power line capacity	580MVA at 132kV (double-circuit)
Tower height	Up to 32m
Power line servitude width	Up to 40m
Length of power line corridor	Collector Sub – Gamma **~** 37.5km
Development footprint of the Collector Substation (including the Eskom switching station)	1000mx700m
Capacity of the Collector Substation	580MVA at 132kV

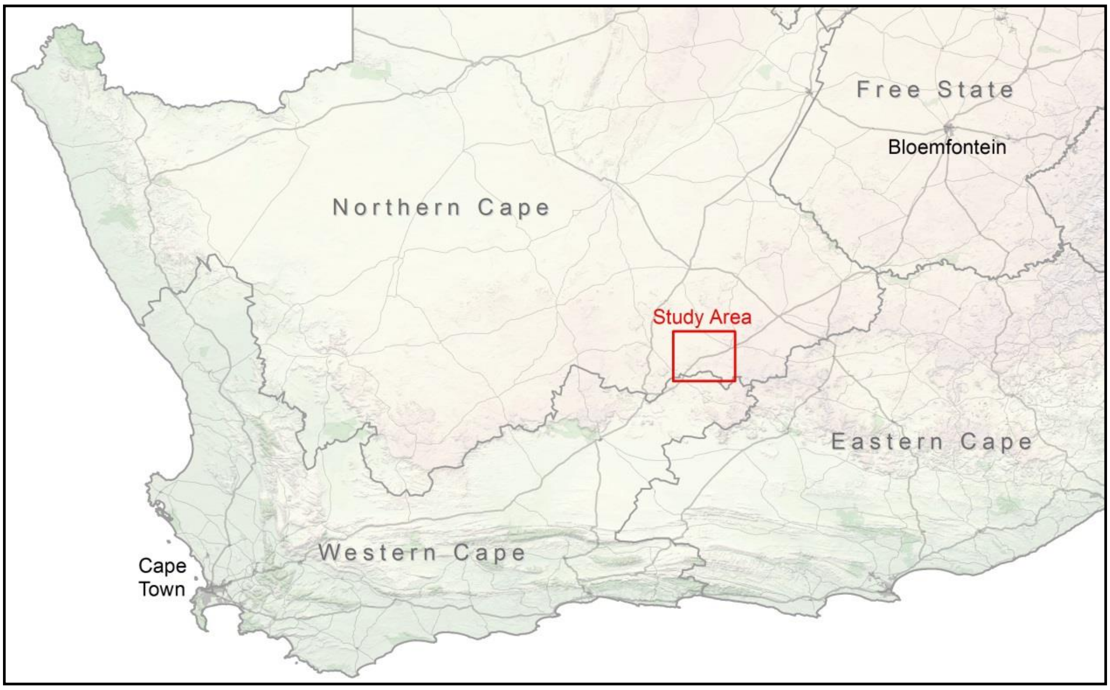

Figure 1: Regional locality of the study area.

The proposed grid connection infrastructure is indicated on the maps displayed within this report. Sample images of typical 132kV power line towers and a 132kV substation are displayed below.

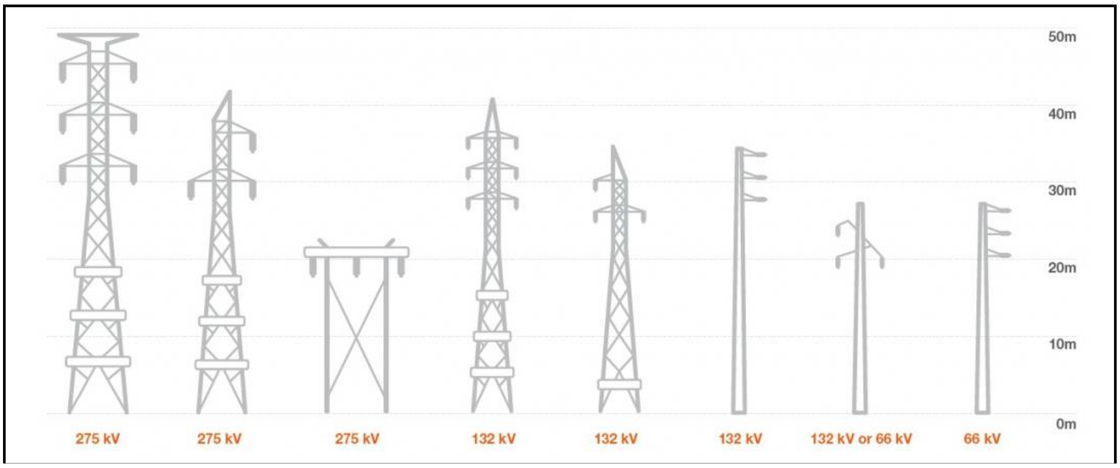

Figure 2: Schematic representation of power line towers.

Figure 3: Typical 132kV power line structures.

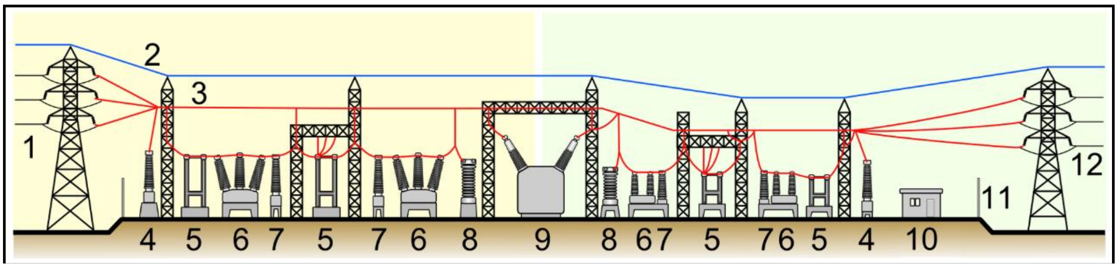

Figure 4: Schematic representation of the components of a substation. See below. (Source: *Shigeru23 - Own work, CC BY-SA 3.0).*

1. Primary power lines
2. Ground wire
3. Overhead lines
4. Transformer for measurement of electric voltage
5. Disconnect switch
6. Circuit breaker
7. Current transformer
8. Lightning arrester
9. Main transformer
10. Control building
11. Security fence
12. Secondary power lines

Figure 5: Typical substation.

3. SCOPE OF WORK

This report is the undertaking of a Visual Impact Assessment (VIA) of the proposed grid connection infrastructure as per the above mentioned.

The determination of the potential visual impacts is undertaken in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure.

The study area for the visual impact assessment encompasses a geographical area of respectively 3,514km² (the extent of the **Maps 1** and **2**) and 1,442km² (**Maps 3** to **5**). The study area includes a minimum 3km buffer zone (area of potential visual influence) from the power line alignment and substation sites.

Anticipated issues related to the potential visual impact of the proposed grid connection infrastructure include the following:

- The visibility of the infrastructure to, and potential visual impact on, observers travelling along the national, arterial and secondary roads within the study area.
- The visibility of the infrastructure to, and potential visual impact on residents of homesteads within the study area.
- The potential visual impact of the infrastructure on the visual character or sense of place of the region.
- The potential visual impact of the infrastructure on tourist routes or tourist destinations (if present).

- The visual absorption capacity of the natural vegetation (if applicable).

- Potential cumulative visual impacts (or consolidation of visual impacts), with specific reference to the location of the proposed infrastructure within the Central Power Corridor and within very close proximity to existing power line infrastructure.

- 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 constitute a visual impact at a local and/or potentially at a regional scale.

4. RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guidelines have been considered in the preparation of this report:

- The Environmental Impact Assessment Regulations, 2014 (as amended);
- Guideline on Generic Terms of Reference for EAPS and Project Schedules (DEADP, Provincial Government of the Western Cape, 2011).

5. THE AFFECTED ENVIRONMENT

The proposed grid connection infrastructure is located approximately 35km from the small town of Richmond and 40km south-east of Victoria West (at the closest). The substation site is located approximately 2km north-west of the N1 national road. The site is accessible from the N1 via the Hutchinson secondary road that veers off from the N1 near the Rondawel homestead and guest farm. The power line alignment runs parallel to the Droërivier/Hydra 1 & 3 400kV, Gamma/Hydra 1 765kV, Gamma/Perseus 1 765kV and south of the Droërivier/Hydra 2 400kV power lines. The proposed power line will be immediately adjacent to the former three power lines and approximately 1.5km from the latter power line virtually all the way to the Gamma Main Transmission Substation (MTS).

Topography, hydrology and vegetation

The study area occurs on land that ranges in elevation from approximately 1,170m above sea level (in the south-western corner of the study area) to 1,830m (at the top of the mountains to the east). The terrain along the proposed alignment is predominantly flat with some hills and ridges occurring predominantly to the south of the alignment. Two of the larger hills, or small mountains, are the Blouberg and the Platberg.

Other mountains and hills in closer proximity to the alignments include:

- Bobbejaankrans
- Bulberg
- Kamberg
- Kromhoek se Berg

The proposed alignment will traverse from 1,358m (the substation site) to 1,225m above sea level at the Gamma MTS. The overall terrain morphological description of the study area is described as *undulating plains* (lowlands), with *ridges*, *hills* and *mountains*. These hills and mountains are often referred to as *inselbergs* (island mountains) due to their isolated nature, or *mesas* (table mountains) due to their flat-topped summits. Refer to **Map 1** for a shaded relief map of the study area.

The larger region is known as the Great Karoo, and more locally as the Nama Karoo, consisting predominantly of large open plains and mountains. Due to the arid climate, the area is characterised by the occurrence of many non-perennial drainage lines traversing the study area. Some of the larger drainage lines, or dry river beds, include the *Bulbergspruit*, the *Ongers* and the *Brakpoort* rivers. Other than a number of man-made farm dams, there is no permanent surface water in the study area.

Vegetation cover in this semi-desert region (200 – 300mm mean annual rainfall) is predominantly *low shrubland* with *grassland* mainly along the dry water courses, and *bare rock and sand* in places (depending on the season). The vegetation types are described as *Eastern Upper Karoo* (along the plains) and *Upper Karoo Hardeveld* along the mountainous terrain. The entire study area falls within the *Upper Karoo Bioregion* of the *Nama-Karoo Biome.* Refer to **Map 2** for the land cover map of the study area.

Land use and settlement patterns

The majority of the study area is sparsely populated (less than 1 person per km^2), with the highest concentration of people living in the town of Richmond (population 5,122).

The study area consists of a landscape that can be described as remote due to its considerable distance from any major metropolitan centres or populated places. The scarcity of water and other natural resources has influenced settlement within this region, keeping numbers low, and distribution limited to the availability of water. Settlements, where they occur, are usually rural homesteads or farm dwellings.

Some of these in closer proximity to the substation development site and power line alignment include:

- Bultfontein
- Poortjie
- Rondawel
- Nieuwefontein
- Roggefontein
- Vlakfontein
- Delville
- Wynandsfontein
- Burgersfontein
- Uitvlugfontein
- Kleinfontein
- Kikvorsfontein

It is uncertain whether all of these farmsteads are inhabited or not. It stands to reason that farmsteads that are not currently inhabited will not be visually impacted upon at present. These farmsteads do, however retain the potential to be affected visually should they ever become inhabited again in the future. For this reason, the author of this document operates under the assumption that they are all inhabited.

The predominant land use in the area is stock farming (predominantly sheep, game or goat farming). Since rainfall is low and water is scarce, crop farming accounts for only a small portion of the land use and is largely confined to the more fertile floodplain valleys. Due to the low carrying capacity, farms are large and usually at least about 5km apart.

The N1 national road provides motorised access to the region and the proposed development site. This road is the connecting spine in between the Gauteng Province and Cape Town and is frequented by both tourists visiting the Western Cape Province and freight carriers transporting goods in between these two destinations. Other arterial or main roads within the study area include the R63 (near the Gamma MTS) and the R398 near Richmond.

There are no designated protected areas within the region and no major tourist attractions or destinations were identified within the study area. There are however two overnight facilities, namely the Bloemhof Karoo Farmstay and the Rondawel Guest Farm. The former facility appears to be located on the farm identified for the Angora Wind Farm.[2]

In spite of the rural and natural character of the study area, there are a large number of overhead power lines in the study area, all congregating at either the Gamma or Victoria Cap Substations. These include:

- Droërivier/Hydra 1, 2 & 3 400kV
- Gamma/Hydra 1 765kV
- Gamma/Perseus 1 765kV

Additional power lines to the north-west of the study area (at the Brakpoort Substation) include the Brakpoort/Hutchinson 1 132kV and Brakpoort/Laken 1 132kV lines.

These power lines (and the entire study area) all fall within the Central Strategic Transmission Corridor, one of five Gazetted corridors earmarked for electricity infrastructure development within South Africa.

In spite of the fact that the study area does not fall within a Renewable Energy Development Zone (REDZ), there have been a number of applications for renewable energy facilities within the region. Some of these within the study area, that have been authorised, include:

- Mainstream Wind and Solar Energy Facility at Victoria West
- Aurora Power Solutions Betelgeuse PV solar project near Murraysburg
- Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Distribution Grid Connection Infrastructure Near Murraysburg
- Proposed Trouberg 400MW wind energy facility near Beaufort West
- Proposed Wildebeest Karoo PV Solar Power Plant near Richmond
- Proposed Umsinde Emoyeni wind energy facility
- Blue Sky Solar (Pty) Ltd Brakpoort Karoo Photovoltaic Solar Facility near Victoria West

Notes:

- *Some of these applications include more than one phase.*
- *The data above is provided by the Department: Forestry, Fisheries and the Environment (DFFE). The author accepts no responsibility for the accuracy thereof.*

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[2] Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland), NLC2018 (ARC/CSIR), REEA_OR_2021_Q1 and SAPAD2021 (DFFE), Wikipedia.

The photographs below aid in describing the general environment within the study area and surrounding the proposed project infrastructure.

Figure 6: View along the Hutchinson secondary road looking north-west towards the proposed substation site.

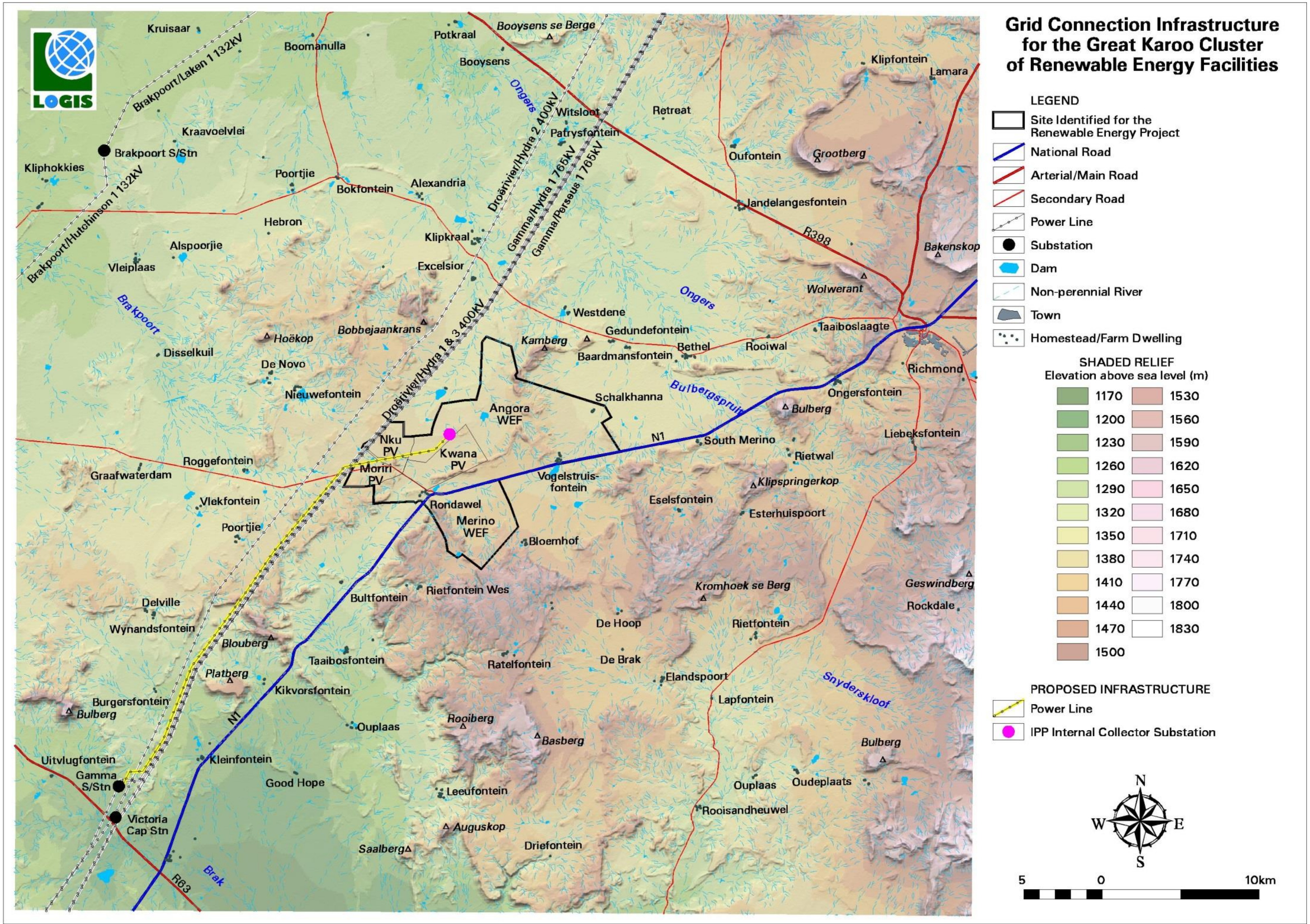
Figure 7: The general environment within the study area.

Figure 8: Existing power lines along the proposed alignment (looking to the north-east).

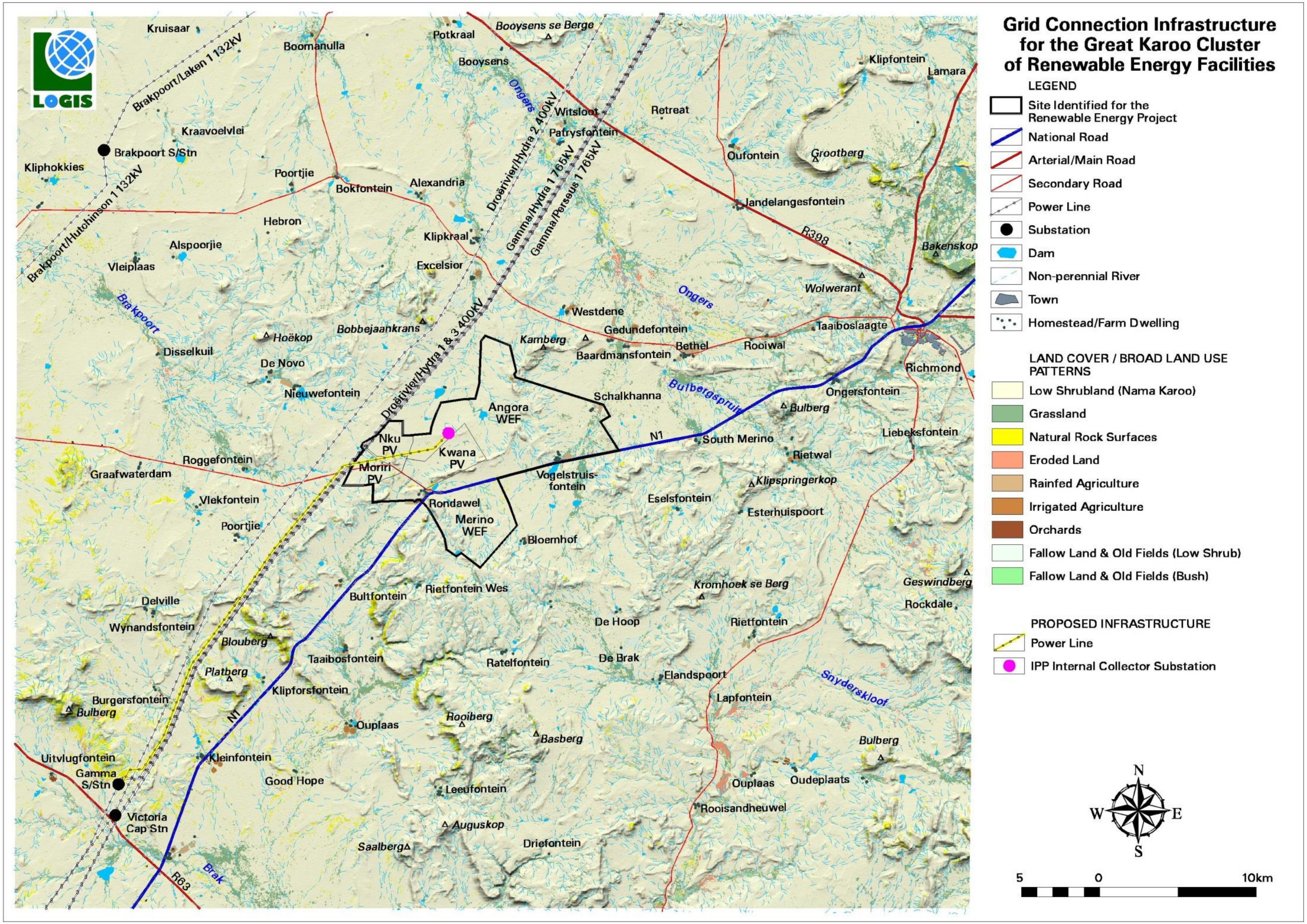
Figure 9: Existing power lines along the proposed alignment (looking to the south-west).

Figure 10: Typical Karoo homestead.

Figure 11: Typical Great Karoo scene as seen from the N1 national road.



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns. *Source*: *National Land-cover Database 2018.*

6. RESULTS

6.1. Potential visual exposure

The potential visual exposure (visibility) of the grid connection infrastructure) is shown on **Map 3**. The visibility analyses were undertaken from the proposed substation site and power line alignment at 32m above ground level (i.e. the approximate maximum height of the grid connection infrastructure). The viewshed analyses were restricted to a 3km radius due to the fact that visibility beyond this distance is expected to be negligible/highly unlikely for the relatively constrained vertical dimensions of this type of infrastructure (i.e. a 132kV substation and 132kV power line).

Map 3 also indicates proximity radii from the proposed grid connection infrastructure in order to show the viewing distance (scale of observation) of the structures in relation to their surrounds.

Figure 12: Examples of 132kV overhead power lines.

General

It is expected that the grid connection infrastructure may theoretically be visible within the 3km visual corridor and potentially highly visible within a 0.5 – 1,5km radius of the structures due to the generally flat terrain it traverses. Beyond 1,5km the visibility becomes more scattered due to the undulating nature of the topography and the presence of hills, ridges and mountains. The grid connection structures are unlikely to be visible beyond a 3km radius of the structures. This applies to the power line and to the proposed substation.

It should also be noted that the potential visual exposure will not occur in isolation, but rather in conjunction with the existing four larger power lines immediately south-east of it, as well as the single power line north-west of it.

0 – 0.5km

The majority of the exposed areas in this zone fall within vacant open space, generally devoid of observers or potential sensitive visual receptors. The Hutchinson secondary road will traverse within 380m from the proposed substation site and underneath the proposed alignment. There are no homesteads within a 0.5km radius of the proposed infrastructure.

0.5 – 1.5km

This zone contains sections of the Hutchinson secondary road. Other than this receptor site, the rest of the visually exposed areas fall within vacant farmland and open space. There are no homesteads within this zone.

1.5 – 3km

There are three potentially exposed receptor sites within this zone, namely observers residing at the Kleinfontein[3], Burgersfontein and Poortjie homesteads. Additional visual exposure may occur along a section of the R63 arterial road traversing south-west of the Gamma Substation. The power line infrastructure may briefly be visible (in transit) from the N1 national road near the Kleinfontein homestead. It should however be borne in mind that the four larger existing power lines south of the proposed 132kV power line would likely obstruct clear views of the power line.

Conclusion

In general terms it is envisaged that the grid connection infrastructure, where visible from shorter distances (e.g. less than 1.5km), and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence, potentially resulting in a visual impact. The incidence rate of sensitive visual receptors is however expected to be very low, due to the remote location of the proposed infrastructure and the low number of potential observers.

6.2. Potential cumulative visual exposure

Cumulative visual impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments. In this case the 'development' would be a new 132kV power line and a substation as seen in conjunction with the existing (or proposed/authorised) grid connection infrastructure in close proximity.

Cumulative visual impacts may be:

- Combined, where several power lines are within the observer's arc of vision at the same time;
- Successive, where the observer has to turn his or her head to see the various structures of a power line; and
- Sequential, when the observer has to move to another viewpoint to see different power line structures, or different views of the same power line (such as when travelling along a route).

[3] The names listed here are of the homestead or farm dwelling as indicated on the SA 1: 50 000 topographical maps and do not refer to the registered farm name.

The visual impact assessor is required (by the competent authority) to identify and quantify the cumulative visual impacts and to propose potential mitigating measures. This is often problematic as most regulatory bodies do not have specific rules, regulations or standards for completing a cumulative visual assessment, nor do they offer meaningful guidance regarding appropriate assessment methods. There are also not any authoritative thresholds or restrictions related to the capacity of certain landscapes to absorb the cumulative visual impacts of the power line infrastructure.

To complicate matters even further, cumulative visual impact is not just the sum of the impacts of two developments. The combined effect of both may be much greater than the sum of the two individual effects, or even less.

The cumulative impact of the proposed grid connection infrastructure on the landscape and visual amenity is a product of:

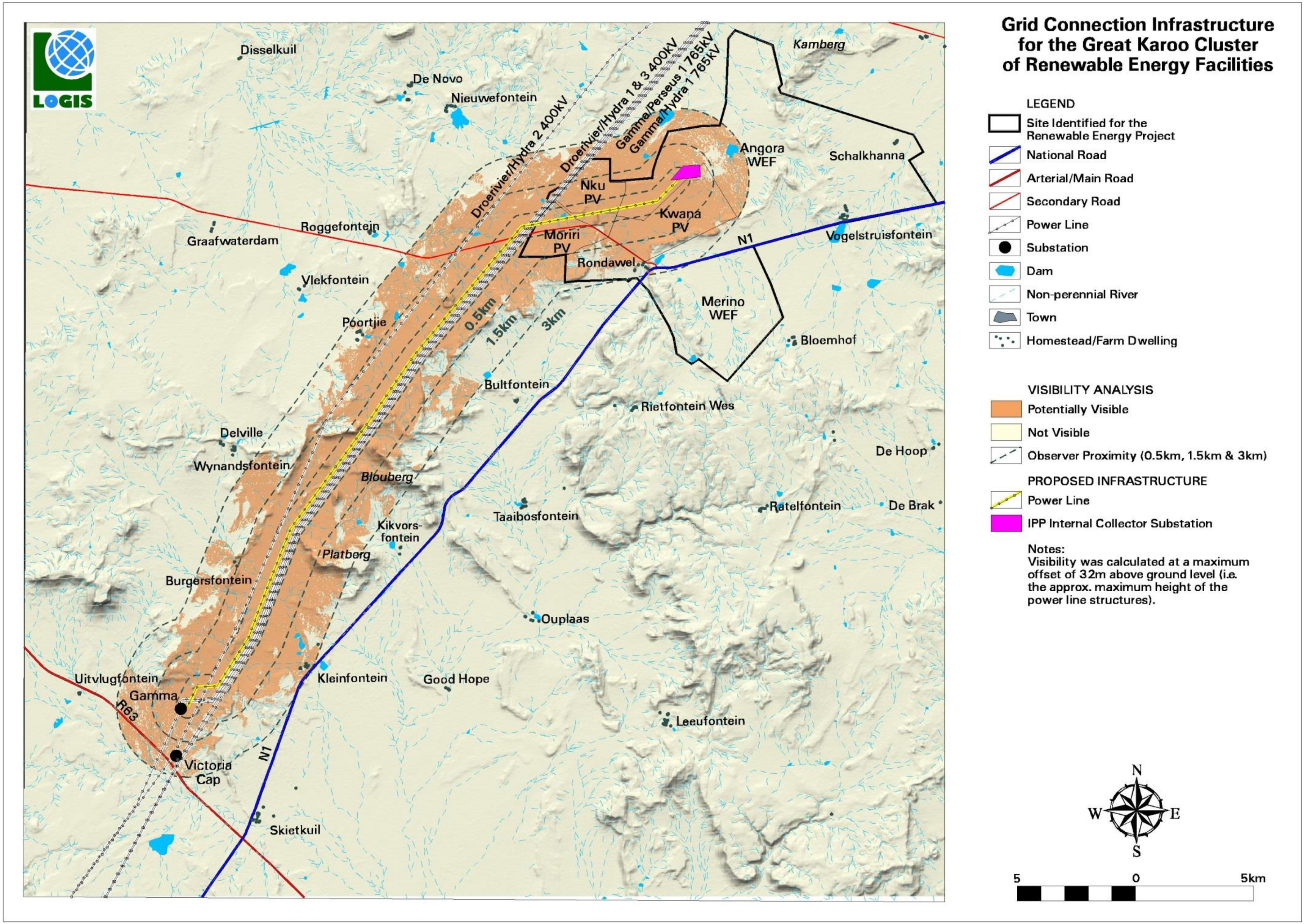
- The distance between the power lines and substations;
- The distance over which the structures are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the power line and substation; and
- The way in which the landscape is experienced.

The specialist is required to conclude if the proposed 'development' will result in any unacceptable loss of visual resource considering the industrial infrastructure proposed in the area.

Conclusion

The proposed power line infrastructure is located adjacent to larger existing power lines for most of its alignment. The visual amenity along this power line corridor (and at the Gamma Substation site) has already been compromised to a large degree. Admittedly, the frequency of visual exposure to power lines is expected to increase, but it is still preferable to consolidate the linear infrastructure as much as possible. To this end, the cumulative visual impact associated with the proposed power line is considered to be within acceptable limits.

The proposed substation site is located within an area that is earmarked for the development of the Nku, Moriri and Kwana PV facilities, and the Angora and Merino WEFs. It is expected that the PV and WEF facility infrastructure would largely overshadow the substation from a visual impact perspective. The proposed substation is also generally remote in terms of proximity to roads and homesteads, and is not expected to significantly contribute to the cumulative impact.



Map 3: Viewshed analysis of the proposed grid connection infrastructure.

6.3. Visual distance / observer proximity to the grid connection infrastructure

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger grid connection infrastructure (e.g. 400kV) and downwards for smaller structures (e.g. 132kV) due to variations in height. This methodology was developed in the absence of any known and/or accepted standards for South African power line infrastructure.

The proximity radii (calculated from the grid connection infrastructure) are indicated on **Map 4**, and include the following:

- 0 – 0.5km - Short distance view where the structures would dominate the frame of vision and constitute a very high visual prominence.
- 0.5 – 1.5km - Medium distance views where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 1.5 - 3km - Medium to longer distance view where the structures would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 3km - Long distance view where the structures may still be visible though not as easily recognisable. This zone constitutes a low visual prominence for the power lines.

The visual distance theory and the observer's proximity to the 132kV power line and substation are closely related, and especially relevant, when considered from areas with a higher viewer incidence and a potentially negative visual perception of the proposed infrastructure.

6.4. Viewer incidence / viewer perception

The number of observers and their perception of a structure determine the concept of visual impact. If there are no observers or if the visual perception of the structure is favourable to all the observers, there would be no visual impact.

It is necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed grid connection infrastructure. It would be impossible not to generalise the viewer incidence and sensitivity to some degree, as there are many variables when trying to determine the perception of the observer: regularity of sighting, cultural background, state of mind, purpose of sighting, etc. which would create a myriad of options.

Viewer incidence within the study area is anticipated to be the highest along the national, arterial and secondary roads traversing near or under the proposed project infrastructure. Travellers using these roads may be negatively impacted upon by visual exposure to the grid connection infrastructure.

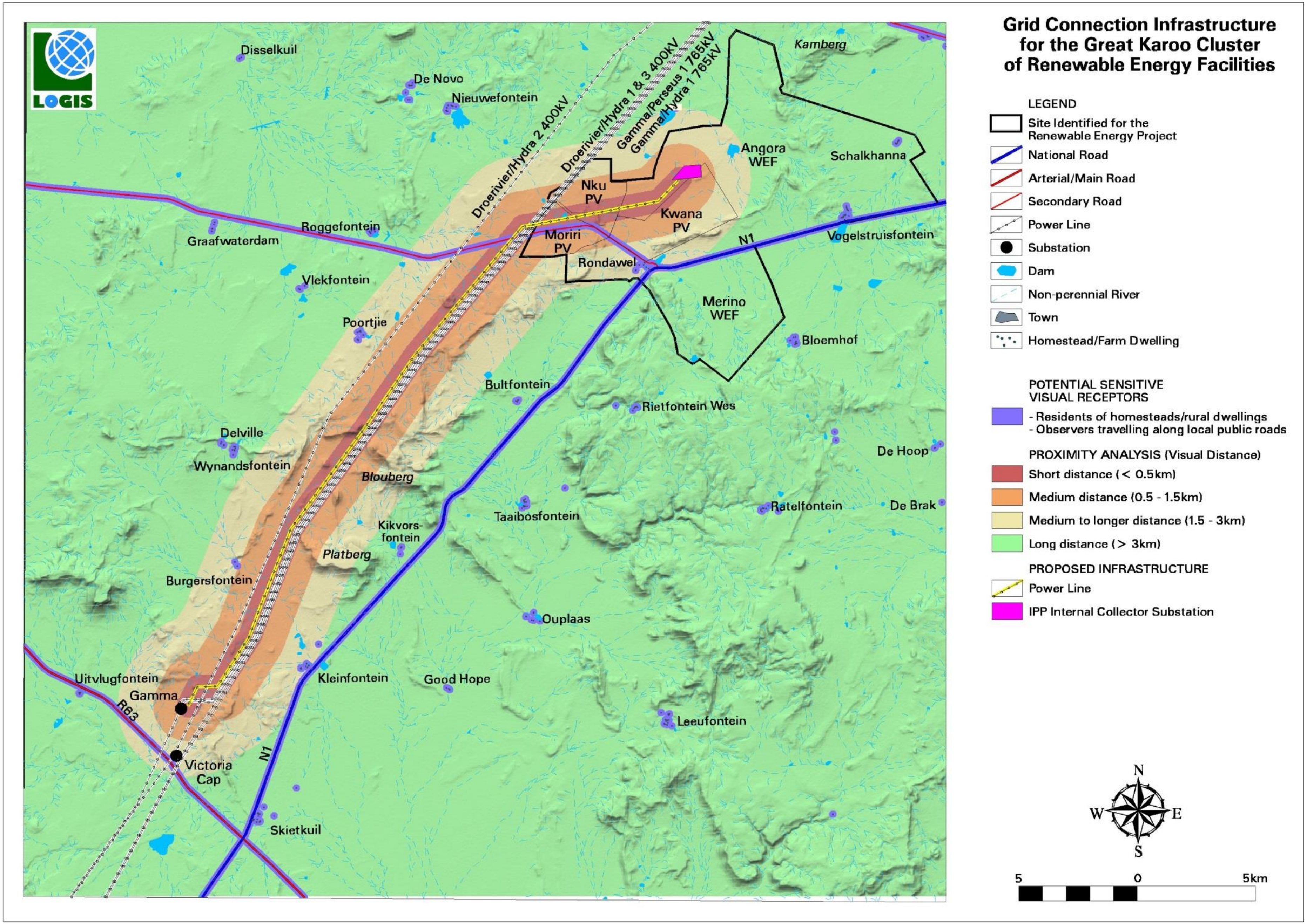
Additional sensitive visual receptors are located at the farm residences (homesteads) throughout the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the grid connection infrastructure, would generally be negative.

Due to the generally remote location of the proposed power line and substation, and the ill populated nature of the receiving environment, there are only a limited number of potential sensitive visual receptors in closer proximity to the proposed infrastructure.

Some of these include:

- Bultfontein
- Poortjie
- Rondawel
- Nieuwefontein
- Roggefontein
- Vlakfontein
- Delville
- Wynandsfontein
- Burgersfontein
- Uitvlugfontein
- Kleinfontein
- Kikvorsfontein

The potential sensitive visual receptor sites and areas of higher viewer incidence are indicated on **Map 4**.



Map 4: Proximity analysis and potential sensitive visual receptors.

6.5. Visual absorption capacity

Vegetation cover in this semi-desert region is predominantly *low shrubland* with *grassland* mainly along the dry water courses, and *bare rock and sand* in places (depending on the season). The vegetation types are described as *Eastern Upper Karoo* (along the plains) and *Upper Karoo Hardeveld* along the mountainous terrain.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment is low by virtue of the limited height (or absence) of the vegetation and the overall low occurrence of buildings, structures and infrastructure. In addition, the scale and form of the proposed structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics. Within this area, the VAC of vegetation will not be taken into account, thus assuming a worst case scenario in the impact assessment.

Where homesteads and settlements occur, some more significant vegetation and trees may have been planted, which would contribute to the visual absorption capacity (i.e. shielding the observers from the infrastructure). As this is not a consistent occurrence, however, VAC will not be taken into account for any of the homesteads or settlements, thus assuming a worst case scenario in the impact assessment.

Figure 13: Low shrubland, grassland and bare sand within the study area – low VAC.

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed grid connection infrastructure culminate in a visual impact index. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

The criteria (previously discussed in this report) which inform the visual impact index are:

- Visibility or visual exposure of the structures
- Observer proximity or visual distance from the structures
- The presence of sensitive visual receptors
- The perceived negative perception or objections to the structures (if applicable)
- The visual absorption capacity of the vegetation cover or built structures (if applicable)

An area with short distance visual exposure to the proposed grid connection infrastructure, a high viewer incidence and a potentially negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact and determining the potential **magnitude** of the visual impact.

The index indicates that **potential sensitive visual receptors** within a 500m radius of the project infrastructure may experience visual impacts of a **very high magnitude**. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 0.5 – 1.5km radius (where/if sensitive receptors are present) and **moderate** within a 1.5 – 3km radius (where/if sensitive receptors are present). Receptors beyond 3km are expected to have visual impacts of **low** or **negligible** magnitude.

The visual impact index and potentially affected sensitive visual receptors are indicated on **Map 5**. In general, there are only a limited number of receptor sites within closer proximity (3km) to the proposed project infrastructure, namely:

- A section of the Hutchinson secondary road
- The Kleinfontein homestead
- A section of the R63 arterial road
- The Burgersfontein homestead
- The Poortjie homestead

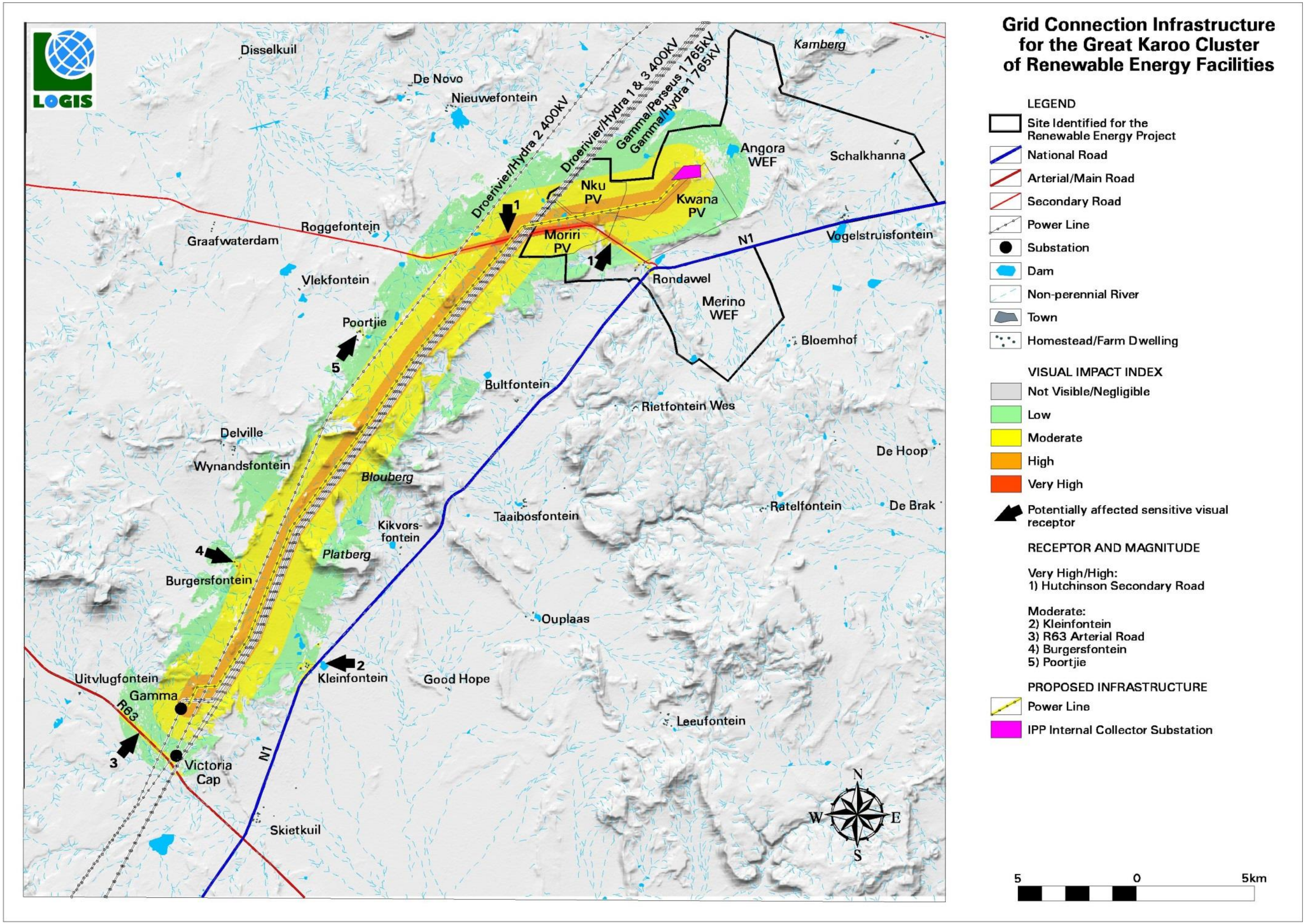
Magnitude of the potential visual impact

0 – 0.5km and **0.5 – 1.5km**

The majority of the exposed areas in this zone fall within vacant open space, generally devoid of observers or potential sensitive visual receptors. Sections of the Hutchinson secondary road may experience visual impacts of **high** to **very high** magnitude.

1.5 – 3km

There are four potential sensitive receptor sites within this zone, namely observers residing at the Kleinfontein, Burgersfontein and Poortjie homesteads, and a section of the R63 arterial road traversing south-west of the Gamma Substation. The magnitude of the visual impact is expected to be **moderate**.



Map 5: Visual impact index and potentially affected sensitive visual receptors.

6.7. Visual impact assessment: impact rating methodology

The previous section of the report identified specific areas where likely visual impacts would occur. This section will attempt to quantify these potential visual impacts in their respective geographical locations and in terms of the identified issues (see **Section 3:** SCOPE OF WORK) related to the visual impact.

The methodology for the assessment of potential visual impacts states the **nature** of the potential visual impact (e.g. the visual impact on users of major roads in the vicinity of the proposed power line alignment) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - site only (very low = 1), local (low = 2), regional (medium = 3), national (high = 4) or international (very high = 5)[4].
- **Duration** - very short (0-1 yrs. = 1), short (2-5 yrs. = 2), medium (5-15 yrs. = 3), long (>15 yrs. = 4), and permanent (= 5).
- **Magnitude** - None (= 0), minor (= 2), low (= 4), medium/moderate (= 6), high (= 8) and very high (= 10)[5].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).
- **Reversibility** - reversible (= 1), recoverable (= 3) and irreversible (= 5).
- **Significance** - low, medium or high.

The **significance** of the potential visual impact is equal to the **consequence** multiplied by the **probability** of the impact occurring, where the consequence is determined by the sum of the individual scores for magnitude, duration and extent (i.e. **significance = consequence (magnitude + duration + extent) x probability**).

The significance weighting for each potential visual impact (as calculated above) is as follows:

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium/moderate (where the impact could influence the decision to develop in the area)
- >60: High (where the impact must have an influence on the decision to develop in the area)

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[4] Local = within 0.5 – 1.5km of the grid connection infrastructure. Regional = between 1.5 - 3km from the infrastructure.

[5] This value is read from the visual impact index. Where more than one value is applicable, the higher of these will be used as a worst case scenario.

6.8. Visual impact assessment

The primary visual impacts of the proposed grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities are assessed below.

6.8.1. Construction impacts

Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed grid connection infrastructure.

During construction, there may be an increase in heavy vehicles utilising the roads to the power line servitude and substation site that may cause, at the very least, a visual nuisance to other road users and landowners in the area.

Construction activities may potentially result in a **low** (significance ratings = 20 and 16) temporary visual impact both before and after mitigation.

Table 3: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed grid connection infrastructure.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed grid connection infrastructure.		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(20)**	Low **(16)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: Planning: ➢ Retain and maintain natural vegetation immediately adjacent to the development footprint/servitude. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction phase. ➢ Plan the placement of lay-down areas (if required) and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction area and existing access roads. ➢ Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed of regularly at licensed waste facilities. ➢ Reduce and control construction dust using appropriate and effective dust suppression techniques as and when required (i.e. whenever dust becomes apparent). ➢ Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts. ➢ Rehabilitate all disturbed areas immediately after the completion of construction works.
Residual impacts: None, provided rehabilitation works are carried out as specified.

6.8.2. Potential visual impact on sensitive visual receptors located within a 1.5km radius of the grid connection infrastructure during the operation phase

The grid connection infrastructure is expected to have a **low** visual impact (significance rating = 28) on observers within a 1.5km radius of the grid connection infrastructure. The visual impact of the power line will largely be absorbed by the presence of the existing power lines. The location of the proposed substation is also relatively remote and generally far removed from potential sensitive visual receptors.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 4: Visual impact on observers in close proximity to the proposed grid connection infrastructure.

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads in close proximity to the power line structures		
	Without mitigation	***With mitigation***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(28)**	Low **(28)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No

Can impacts be mitigated?	No

Mitigation / Management:

Planning:

- Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint.

Operations:

- Maintain the general appearance of the infrastructure.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts:

The visual impact will be removed after decommissioning, provided the power line infrastructure is removed. Failing this, the visual impact will remain.

6.8.3. Potential visual impact on sensitive visual receptors within the region (1.5 – 3km radius) during the operation of the grid connection infrastructure

The grid connection infrastructure will have a **low** visual impact (significance rating = 22) on observers traveling along the roads and residents of homesteads within a 1.5 - 3km radius of the infrastructure.

No mitigation of this impact is possible (i.e. the structures will be visible regardless), but general mitigation and management measures are recommended as best practice. The table below illustrates this impact assessment.

Table 5: Visual impact of the proposed grid connection infrastructure within the region.

Nature of Impact:

Visual impact on observers travelling along the roads and residents at homesteads within a 1.5 – 3km radius of the grid connection infrastructure.

	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(26)**	Low **(26)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

- Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude.

Operations:

- Maintain the general appearance of the servitude as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use.
- Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

Residual impacts: The visual impact will be removed after decommissioning, provided that the grid connection infrastructure is removed. Failing this, the visual impact will remain.

6.9. Visual impact assessment: secondary impacts

The potential visual impact of the proposed grid connection infrastructure on the sense of place of the region.

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), plays a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

The greater environment has a predominantly rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality, except where urban development and power generation/distribution infrastructure represents existing visual disturbances.

The anticipated visual impact of the proposed grid connection infrastructure on the regional visual quality (i.e. beyond 3km of the proposed infrastructure), and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** significance.

Table 6: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact of the development of the proposed grid connection infrastructure on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Regional **(3)**	Regional **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Minor **(2)**	Minor **(2)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(18)**	Low **(18)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the servitude as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		

Residual impacts: The visual impact will be removed after decommissioning, provided the grid connection infrastructure is removed. Failing this, the visual impact will remain.

The potential cumulative visual impact of the proposed grid connection infrastructure on the visual quality of the landscape.

The construction of the grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities may increase the cumulative visual impact of industrial type infrastructure within the region.

The anticipated cumulative visual impact of the proposed grid connection infrastructure is expected to be of **moderate** significance (significance rating = 42). This is considered to be acceptable from a visual impact perspective.

Table 7: The potential cumulative visual impact on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of the grid connection infrastructure on the visual quality of the landscape.		
	Overall impact of the project considered in isolation (with mitigation)	***Cumulative impact of the project and other projects within the area (with mitigation)***
Extent	Local **(2)**	Local **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Improbable **(2)**	Probable **(3)**
Significance	Low **(28)**	Moderate **(42)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible **(1)**	Reversible **(1)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude. Operations: ➢ Maintain the general appearance of the servitude as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the grid infrastructure is removed. Failing this, the visual impact will remain.		

6.10. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the proposed grid connection infrastructure is not possible to mitigate. The functional design of the structures cannot be changed in order to reduce visual impacts.

Secondary impacts anticipated as a result of the proposed grid connection infrastructure (i.e. visual character and sense of place) are also not possible to mitigate.

The following mitigation is, however possible:

- Retain/re-establish and maintain natural vegetation in all areas immediately adjacent to the development footprint/servitude. This measure will help to soften the appearance of the grid connection infrastructure within its context.

- Mitigation of visual impacts associated with the construction phase, albeit temporary, would entail proper planning, management and rehabilitation of the construction site. Recommended mitigation measures include the following:

    - Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
    - Plan the placement of laydown areas (if required) and any potential temporary construction camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
    - Restrict the activities and movement of construction workers and vehicles to the immediate construction area and existing access roads.
    - Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
    - Reduce and control construction dust through the use of appropriate and effective dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
    - Restrict construction activities to daylight hours as far as possible, in order to negate or reduce the visual impacts associated with lighting.
    - Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works. If necessary, an ecologist must be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the grid connection infrastructure will ensure that the infrastructure does not degrade, therefore aggravating visual impact.

- Roads must be maintained to forego erosion and to suppress dust, and rehabilitated areas must be monitored for rehabilitation failure. Remedial actions must be implemented as a when required.

- Once the grid connection infrastructure has exhausted its life span, all associated infrastructure not required for the post rehabilitation use of the site/servitude should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to give input into rehabilitation specifications.

- All rehabilitated areas should be monitored for at least a year following decommissioning, and remedial actions implemented as and when required.

Good practice requires that the mitigation of both primary and secondary visual impacts, as listed above, be implemented and maintained on an ongoing basis.

7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities, may have a visual impact on the study area, especially within (but potentially not restricted to) a 0.5 - 1.5km radius of the power line and substation structures. The visual impact will differ amongst places, depending on the distance from the infrastructure.

Overall, the significance of the visual impacts is expected to range from **moderate** to **low** as a result of the generally undeveloped character of the landscape. No visual impacts of a high significance are expected to occur.

Given the remote location of the infrastructure, the general absence of sensitive visual receptors and the close proximity of the proposed alignments next to each other, either of the power line alternatives would be acceptable.

A number of mitigation measures have been proposed (**Section 6.10.**). Regardless of whether or not mitigation measures will reduce the significance of the anticipated visual impacts, they are considered to be good practice and should all be implemented and maintained throughout the construction, operation and decommissioning phases of the proposed grid connection infrastructure.

If mitigation is implemented as recommended, it is concluded that the significance of most of the anticipated visual impacts will remain at or be managed to acceptable levels. As such, the grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities is considered to be acceptable from a visual impact perspective.

8. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities indicate that the visual environment surrounding the power line and substation, especially within a 1.5km radius, may be visually impacted upon for the anticipated operational lifespan of the grid connection infrastructure.

This impact is applicable to the proposed grid connection infrastructure and to the potential cumulative visual impact of the infrastructure in association with existing power line infrastructure (and future power generation infrastructure) within the region.

The following is a summary of impacts remaining, assuming mitigation as recommended is implemented:

- During the construction phase, there may be an increase in heavy vehicles utilising the roads to the power line that may cause, at the very least, a visual nuisance to other road users and landowners in the area. Construction activities may potentially result in a **low** temporary negative visual impact after mitigation.

- The grid connection infrastructure is expected to have a **low** visual impact on observers within a 1.5km radius of the grid connection infrastructure. The visual impact of the power line (both alternatives) will largely be absorbed by the presence of the existing power lines. The location of the proposed substation is also relatively remote and generally far removed from potential sensitive visual receptors.

- The grid connection infrastructure is expected to have a **low** negative visual impact on observers traveling along the roads and residents of homesteads within a 1.5 - 3km radius of the structures.

- The anticipated visual impact of the proposed grid connection infrastructure on the regional visual quality, and by implication, on the sense of place, is difficult to quantify, but is generally expected to be of **low** negative significance. This is due to the relatively low viewer incidence within close proximity to the proposed grid connection infrastructure.

- The anticipated cumulative visual impact of the proposed grid connection infrastructure is expected to be of **moderate** negative significance, which is considered to be acceptable from a visual perspective. This is once again due to the relatively low viewer incidence within close proximity to the power line and substation infrastructure.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **moderate** to **low** significance. No visual impacts of a high significance are expected to occur. Anticipated visual impacts on sensitive visual receptors in close proximity to the power line are not considered to be fatal flaws for the proposed project.

Considering all factors, it is recommended that the development of the grid connection infrastructure as proposed be supported; subject to the implementation of the recommended mitigation measures (**Section 6.10.**) and management programme (**Section 9.**).

9. MANAGEMENT PROGRAMME

The following management plan tables aim to summarise the key findings of the visual impact report and suggest possible management actions in order to mitigate the potential visual impacts. Refer to the tables below.

Table 8: Management Programme: Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed grid connection infrastructure.		
Project component/s	Grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities.	
Potential Impact	Primary visual impact due to the presence of the grid connection infrastructure in the landscape.	
Activity/risk source	The viewing of the grid connection infrastructure by observers near the infrastructure as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure so as to minimise visual impact.	
Mitigation: Action/control	Responsibility	Timeframe
Implement an environmentally responsive planning approach for the development of roads and infrastructure to limit cut and fill requirements. Plan with due cognisance of the topography.	Project proponent / design consultant	Planning phase.
Consolidate infrastructure and make use of	Project proponent /	Planning phase.

already disturbed sites rather than natural areas, as far as practically feasible.	design consultant	
Performance Indicator	No visible degradation of access roads and other associated infrastructure from surrounding areas.	
Monitoring	Not applicable.	

Table 9: Management Programme: Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed grid connection infrastructure.		
Project component/s	Construction activities associated with the development of the 132kV power line and substation.	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing.	
Activity/risk source	The viewing of general construction activities by observers near the development areas.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.	
Mitigation: Action/control	Responsibility	Timeframe
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Project proponent / contractor	Early in the construction phase.
Plan the placement of laydown areas (if required) and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent / contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction area and existing access roads.	Project proponent / contractor	Throughout the construction phase.
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Project proponent / contractor	Throughout the construction phase.
Reduce and control construction dust through the use of appropriate and effective dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent / contractor	Throughout the construction phase.
Restrict construction activities to daylight hours, as far as possible, in order to negate or reduce the visual impacts associated with lighting.	Project proponent / contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, consult an ecologist to give input into rehabilitation specifications.	Project proponent / contractor	Throughout and at the end of the construction phase.
Performance Indicator	Vegetation cover within the servitudes and in the vicinity of the grid connection infrastructure has been maintained as far as possible and disturbed areas have been rehabilitated with no evidence of erosion.	
Monitoring	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas post construction.	

Table 10: Management Programme: Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed grid connection infrastructure.		
Project component/s	Grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities.	
Potential Impact	Visual impact of vegetation rehabilitation failure.	
Activity/risk source	The viewing of the above mentioned by observers near the infrastructure.	
Mitigation: Target/Objective	Well-rehabilitated and maintained servitudes.	
Mitigation: Action/control	Responsibility	Timeframe
Maintain roads to forego erosion and to suppress dust.	Project proponent / operator	Throughout the operation phase.
Monitor rehabilitated areas, and implement remedial action as and when required.	Project proponent / operator	Throughout the operation phase.
Performance Indicator	Intact vegetation within servitudes and in the vicinity of the infrastructure.	
Monitoring	Monitoring of rehabilitated areas.	

Table 11: Management Programme: Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed grid connection infrastructure.		
Project component/s	Grid connection infrastructure for the Great Karoo Cluster of Renewable Energy Facilities.	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/risk source	The viewing of the residual scarring and vegetation rehabilitation failure by observers along or near the areas where the grid connection infrastructure was constructed.	
Mitigation: Target/Objective	Rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	Responsibility	Timeframe
Remove infrastructure not required for the post-decommissioning use of the site/servitude.	Project proponent / operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the sites. If necessary, consult an ecologist to give input into rehabilitation specifications.	Project proponent / operator	During the decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Project proponent / operator	Post decommissioning.
Performance Indicator	Intact vegetation along and in the vicinity of the servitude.	
Monitoring	If rehabilitation is successful then no further monitoring is required.	

10. REFERENCES/DATA SOURCES

Chief Directorate National Geo-Spatial Information, varying dates. *1:50 000 Topographical Maps and Data.*

CSIR, 2017. *Delineation of the first draft focus areas for Phase 2 of the Wind and Solar PV Strategic Environmental Assessment.*

CSIR, 2015. *The Strategic Environmental Assessment for wind and solar photovoltaic energy in South Africa.*

DFFE, 2018. *National Land-cover Database 2018 (NLC2018).*

DFFE, 2021. *South African Protected Areas Database (SAPAD_OR_2021_Q1).*

DFFE, 2021. *South African Renewable Energy EIA Application Database (REEA_OR_2021_Q1).*

DEA&DP, 2011. Provincial Government of the Western Cape. *Guideline on Generic Terms of Reference for EAPS and Project Schedules.*

Department of Environmental Affairs and Tourism (DEA&T), 2001. *Environmental Potential Atlas (ENPAT) for the Northern Cape Province.*

JAXA, 2021. Earth Observation Research Centre. *ALOS Global Digital Surface Model (AW3D30).*

National Botanical Institute (NBI), 2004. *Vegetation Map of South Africa, Lesotho and Swaziland (Unpublished Beta Version 3.0)*

Oberholzer, B. (2005). *Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.*

The Environmental Impact Assessment Amendment Regulations. In Government Gazette Nr. 33306, 18 June 2010.