PROPOSED MERINO WIND FARM, 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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- November 2022 -

TABLE OF CONTENTS **Page**

FIGURES

MAPS

TABLES

1. STUDY APPROACH

1.1. Qualification and Experience of the Practitioner

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (SAGC), and specialises in Environmental GIS and 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 modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, Environmental Management Frameworks, State of the Environment Reports, Environmental Management Plans, tourism development and environmental awareness projects.

He holds a BA degree in Geography and Anthropology from the University of Pretoria and worked at the GisLAB (Department of Landscape Architecture) from 1990 to 1997. He later became a member of the GisLAB and in 1997, when Q-Data Consulting acquired the GisLAB, worked for GIS Business Solutions for two years as project manager and senior consultant. In 1999 he joined MetroGIS (Pty) Ltd as director and equal partner until December 2015. From January 2016 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in April 2017.

Lourens has received various awards for his work over the past two decades, including EPPIC Awards for ENPAT, a Q-Data Consulting Performance Award and two ESRI (Environmental Systems Research Institute) awards for *Most Analytical* and *Best Cartographic Maps*, at Annual International ESRI User Conferences. He is a co-author of the ENPAT atlas and has had several of his maps published in various tourism, educational and environmental publications.

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. Although the guidelines have been developed with specific reference to the Western Cape Province of South Africa, the core elements are more widely applicable (i.e. within the Northern Cape Province).

Savannah Environmental appointed Lourens du Plessis as an independent specialist consultant to undertake the visual impact assessment for the proposed Merino Wind Farm. 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. It is assumed that all information regarding the project details provided by the client is correct and relevant to the proposed project.

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.

- 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 facility. 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

[1] Adapted from Oberholzer (2005).

ALOS Global Digital Surface Model "ALOS World 3D - 30m" (AW3D30) elevation model.

The Plan of Study for the Visual Impact Assessment (VIA) is stated below.

The VIA will be 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 wind turbine generator (WTG) layout.

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

The VIA will consider potential cumulative visual impacts, or alternatively the potential to concentrate visual exposure/impact within the region (if applicable).

The following VIA-specific tasks have been 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 (or where) the proposed facility and associated infrastructure were not visible, no impact would occur.

The viewshed analyses of the proposed facility and the related infrastructure are based on an AW3D30 digital terrain model of the study area.

The first step in determining the visual impact of the proposed facility is to identify the areas from which the structures would be visible. The type of structures, the dimensions, the extent of operations and their support infrastructure are taken into account.

- **Determine visual distance/observer proximity to the facility**

In order to refine the visual exposure of the facility on surrounding areas/receptors, the principle of reduced impact over distance is applied in order to determine the core area of visual influence for this type of structure.

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

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

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

The next layer of information is the identification of areas of high viewer incidence (i.e. main roads, residential areas, settlements, etc.) that would be exposed to the project infrastructure.

This is done in order to focus the attention on areas where the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

Related to this dataset, is a land use character map, that further aids in identifying sensitive areas and possible critical features (i.e. tourist facilities, national parks, etc. – if applicable), that should be addressed.

- **Determine the visual absorption capacity (VAC) of the landscape**

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed facility. The 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.

- **Calculate the visual impact index**

The results of the above analyses are merged in order to determine the areas of likely visual impact and where the viewer perception would be negative. An area with short distance visual exposure to the proposed infrastructure, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This focusses the attention to the critical areas of potential impact and determines the potential **magnitude** of the visual impact.

Geographical Information Systems (GIS) software will be used to perform all the analyses and to overlay relevant geographical data sets in order to generate a visual impact index.

- **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 is displayed in impact tables and summarised in an impact statement.

- **Propose mitigation measures**

The preferred alternative (or a possible permutation of the alternatives) will be based on its potential to reduce the visual impact. Additional general 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 this VIA report.

- **Site visit and photo simulations**

A site visit was undertaken (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.

Photographs were taken from strategic viewpoints in order to simulate realistic post construction views of the WEF. This aids in visualising the perceived visual impact of the proposed WEF and place it in spatial context.

2. BACKGROUND AND PROPOSED INFRASTRUCTURE

Great Karoo Renewable Energy (Pty) Ltd is proposing the development of a commercial wind farm and associated infrastructure on a site located approximately 35km south-west of Richmond and 80km south-east of Victoria West, within the Ubuntu Local Municipality and the Pixley Ka Seme District Municipality in the Northern Cape Province.

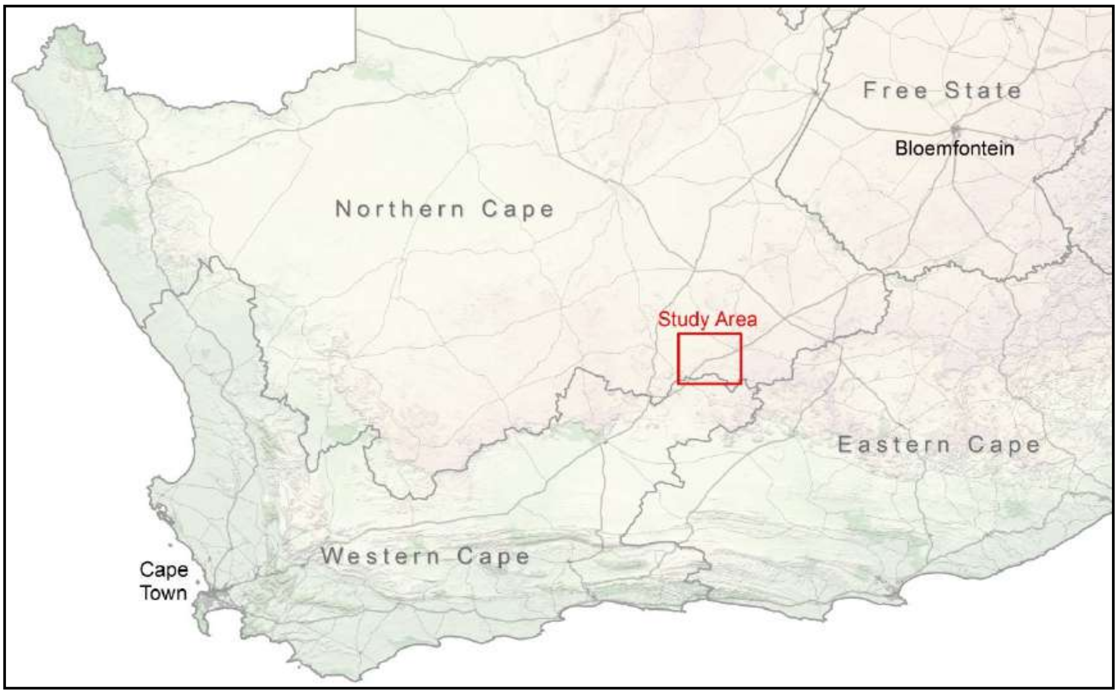


Figure 1: Regional locality of the proposed project area.

A preferred project site with an extent of ~29 909ha and a development area of ~6 463ha within the project site has been identified by Great Karoo Renewable Energy (Pty) Ltd as a technically suitable area for the development of the Merino Wind Farm with a contracted capacity of up to 140MW that can accommodate up to 35 turbines. The development area consists of the four (4) affected properties, which include:

- Portion 1 of Farm Rondavel 85
- Portion 0 of Farm Rondavel 85
- Portion 9 of Farm Bult & Rietfontein 96
- Portion 0 of Farm Vogelstruisfontein 84

The Merino Wind Farm project site is proposed to accommodate the following infrastructure, which will enable the wind farm to supply a contracted capacity of up to 140MW:

- Up to 35 wind turbines with a maximum hub height of up to 170m. The tip height of the turbines will be up to 250m.
- Concrete turbine foundations to support the turbine hardstands.
- Inverters and transformers.
- Temporary laydown areas which will accommodate storage and assembly areas.
- Cabling between the turbines, to be laid underground where practical.
- A temporary concrete batching plant.
- 33/132kV onsite facility substation.
- Underground cabling from the onsite substation to the 132kV collector substation.
- Electrical and auxiliary equipment required at the collector substation that serves that wind energy facility, including switchyard/bay, control building, fences, etc.
- Battery Energy Storage System (BESS).
- Access roads and internal distribution roads.
- Site offices and maintenance buildings, including workshop areas for maintenance and storage.

The wind farm is proposed in response to the identified objectives of the national and provincial government and local and district municipalities to develop renewable energy facilities for power generation purposes. It is the developer's intention to bid the Merino Wind Farm under the Department of Mineral Resources and Energy's (DMRE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme, with the aim of evacuating the generated power into the national grid. This will aid in the diversification and stabilisation of the country's electricity supply, in line with the objectives of the Integrated Resource Plan (IRP) with the Merino Wind Farm set to inject up to 140MW into the national grid.

The construction phase of the WEF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The construction phase is expected to be ~? months. The lifespan of the facility is approximated at 20 to 25 years.

3. SCOPE OF WORK

This report is the Visual Impact Assessment (VIA) of the proposed Merino Wind Farm (or Wind Energy Facility – WEF) as described above.

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 assessment encompasses a geographical area of approximately 3,514km² (the extent of the full page maps displayed in this report) and includes a minimum 20km buffer zone from the proposed wind turbine structures.

Anticipated issues related to the potential visual impact of the proposed Merino Wind Farm include the following:

- The visibility of the facility from, and potential visual impact on observers travelling along the national (N1), arterial (R398) and secondary (local) roads within the study area.

- The visibility of the facility from, and potential visual impact on farmsteads and homesteads (rural residences) within the study area.

- The potential visual impact of the facility on the visual character and sense of place of the region, with specific reference to the expansive landscape and the scenic topographical features.

- The potential visual impact of the facility on tourist routes or tourist destinations (e.g. protected areas and other tourist attractions, if applicable/present).

- The potential visual impact of the construction of ancillary infrastructure (i.e. internal access roads, buildings, BESS, etc.) on observers in close proximity to the facility.

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

- Potential cumulative visual impacts (or consolidation of visual impacts) with specific reference to the construction of the WEF in close proximity to other authorized renewable energy facilities within the study area.

- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.

- The potential visual impact of shadow flicker.

- 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 regional scale.

4. RELEVANT LEGISLATION AND GUIDELINES

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

- National Environmental Management Act 107 of 1998 (NEMA);
- 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); and
- Guideline for involving visual and aesthetic specialists in EIA processes: Edition 1.

5. THE AFFECTED ENVIRONMENT

The proposed project site is located approximately 25km (at the closest) from the small town of Richmond and 24km north-east of the Eskom Gamma Main Transmission Substation (MTS). The site is traversed by the N1 national road and encompasses a surface area of approximately 5,516ha. The final surface area to be utilised for the wind energy facility (WEF) may be smaller, depending on the number of turbines erected, the final site layout and the placement of the wind turbines. The site is currently zoned as agricultural and has a rural and natural character.

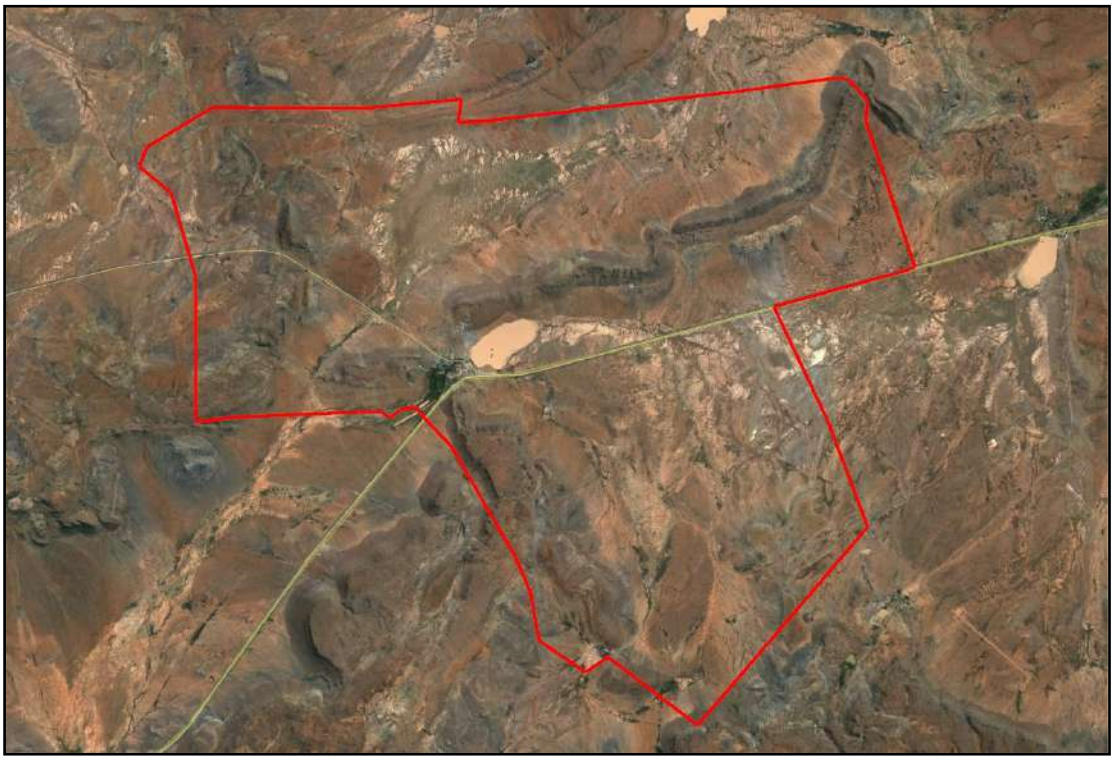


Figure 2: Aerial view of the proposed project site.

Topography, hydrology and vegetation

The study area occurs on land that ranges in elevation from approximately 1,170m (in the south-western corner of the study area) to 1,830m (at the top of the mountains to the east). The terrain surrounding the site is predominantly flat to the north and the south, with a ridge (Bakenskop) traversing the centre of the site from the east to the west.

Other mountains and hills (that influence the viewshed pattern of the proposed WEF) in closer proximity to the site include:

- Bobbejaankrans
- Hoëberg
- Kamberg
- Bulberg
- Klipspringerkop
- Kromhoek se Berg
- Rooiberg
- Blouberg
- Platberg

The proposed development site itself is located at an average elevation of 1,389m above sea level. 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[2]).

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 areas. 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 are usually rural homesteads or farm dwellings.

There are quite a number of homesteads present within the study area. Some of these in closer proximity to the development site include:[3]

- Ratelfontein
- Taaibosfontein
- De Brak
- De Hoop
- Rietfontein Wes
- Bultfontein
- Bloemhof
- Poortjie
- Esterhuispoort
- Eselsfontein
- Rondawel
- Roggefontein
- Vogelstruisfontein
- South Merino
- Schalkhanna
- Nieuwefontein
- De Novo
- Bethel
- Baardmansfontein
- Gedundefontein
- Westdene
- Excelsior
- Klipkraal

[2] https://en.wikipedia.org/wiki/Richmond,_Northern_Cape.
[3] The names listed below 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.

- Hebron

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 Northern and Western Cape Provinces and freight carriers transporting goods in between the abovementioned destinations. Other arterial or main roads within the study area include the R63 (near the Gamma MTS) and the R398 near Richmond.[4]

There are no designated protected areas within the region and no major (famous or acclaimed) 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 Bloemhof Karoo Farmstay is located on Portion 1 of the Farm Bloemhof 98, one of the farms where the Merino Wind Farm is located. The following farms form part of the Ratelfontein Private Game Reserve (RPGR):

- Portion 1 of the Farm Bloemhof 98
- Portion 6 of the Farm Bult and Rietfontein 96
- Ratelfontein 100 (Remainder)
- Portion 1 of the Farm Ratelfontein 100
- Portion 6 of the Farm Elandspoort 101
- Portion 11 of the Farm Elandspoort 101

The RPGR borders the proposed Merino Wind Farm property to the south and operates as a commercial game farming, hunting and eco-tourism facility. The game farm is not formally protected (i.e. not proclaimed), but is considered as a local tourist destination that rely on the natural environment of the region in order to function effectively. As such, the owner(s) of this reserve view the construction and operation of wind energy facilities within the region as a threat to the natural environment and eco-tourism within which they operate.[5]

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

[4] 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.

[5] Information obtained during site visits and consultation with land owners.

These power lines traverse the north-western boundary of the proposed development site.

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.*

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

Figure 3: View of the Bakenskop ridge from the N1 national road.

Figure 4: The general environment within the study area.

Figure 5: Existing power lines traversing north-west of the proposed WEF site.

Figure 6: Existing power lines crossing the Hutchinson secondary road (looking to the south-west).

Figure 7: Typical Karoo homestead.

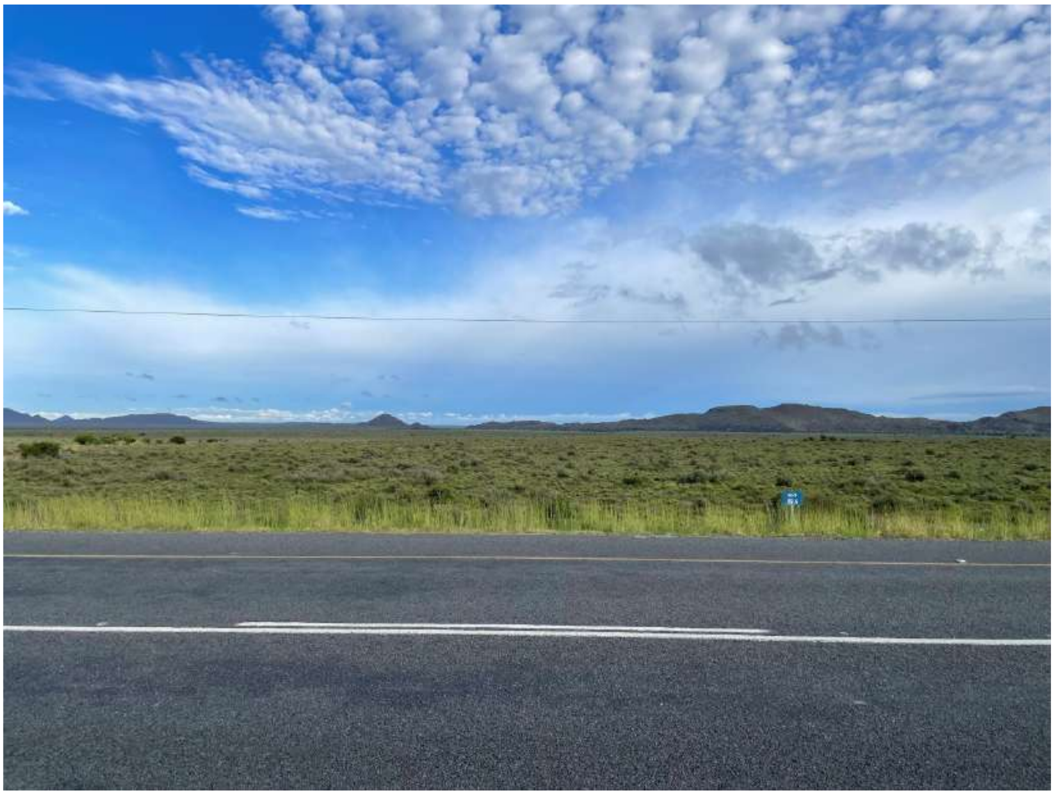
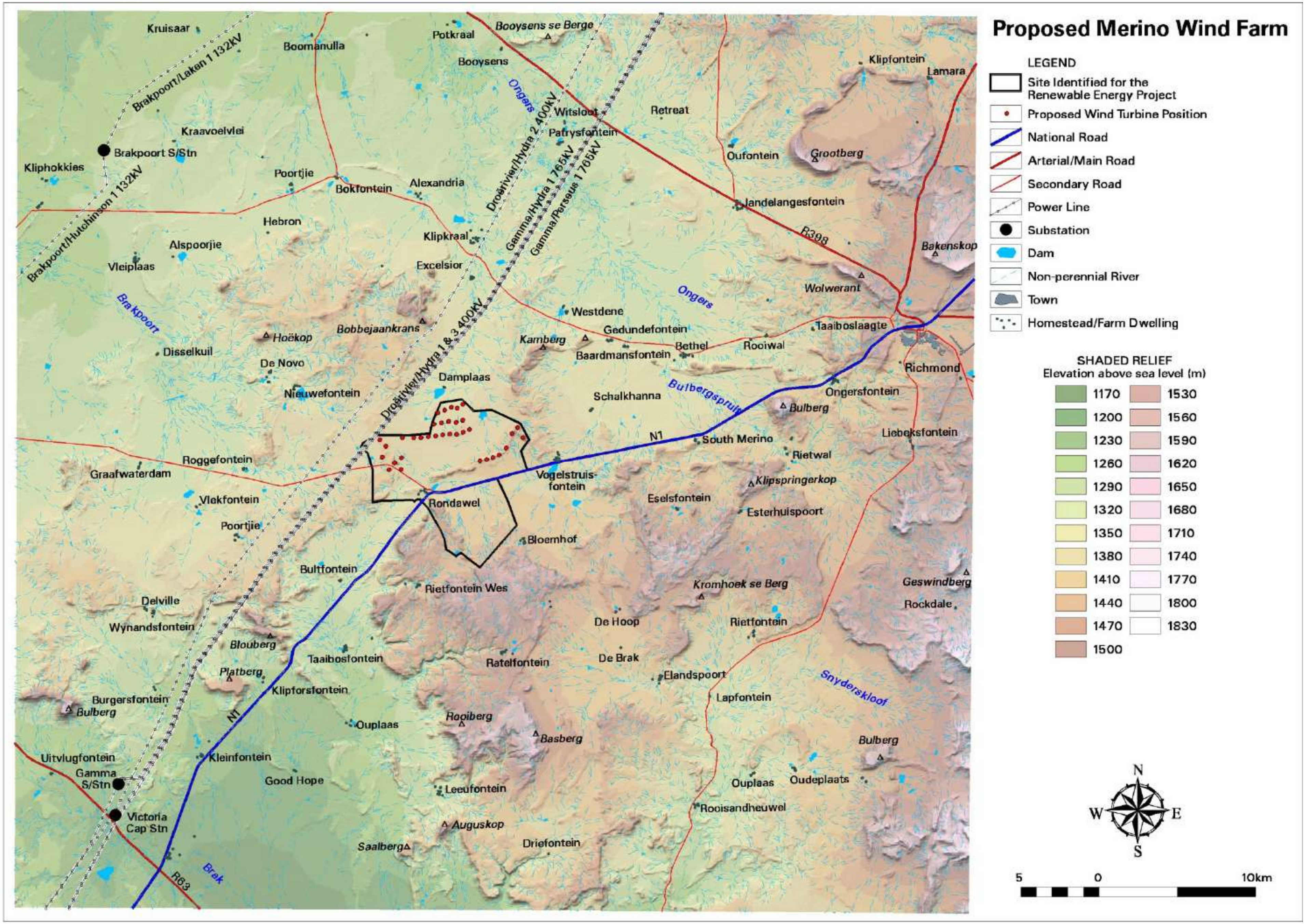
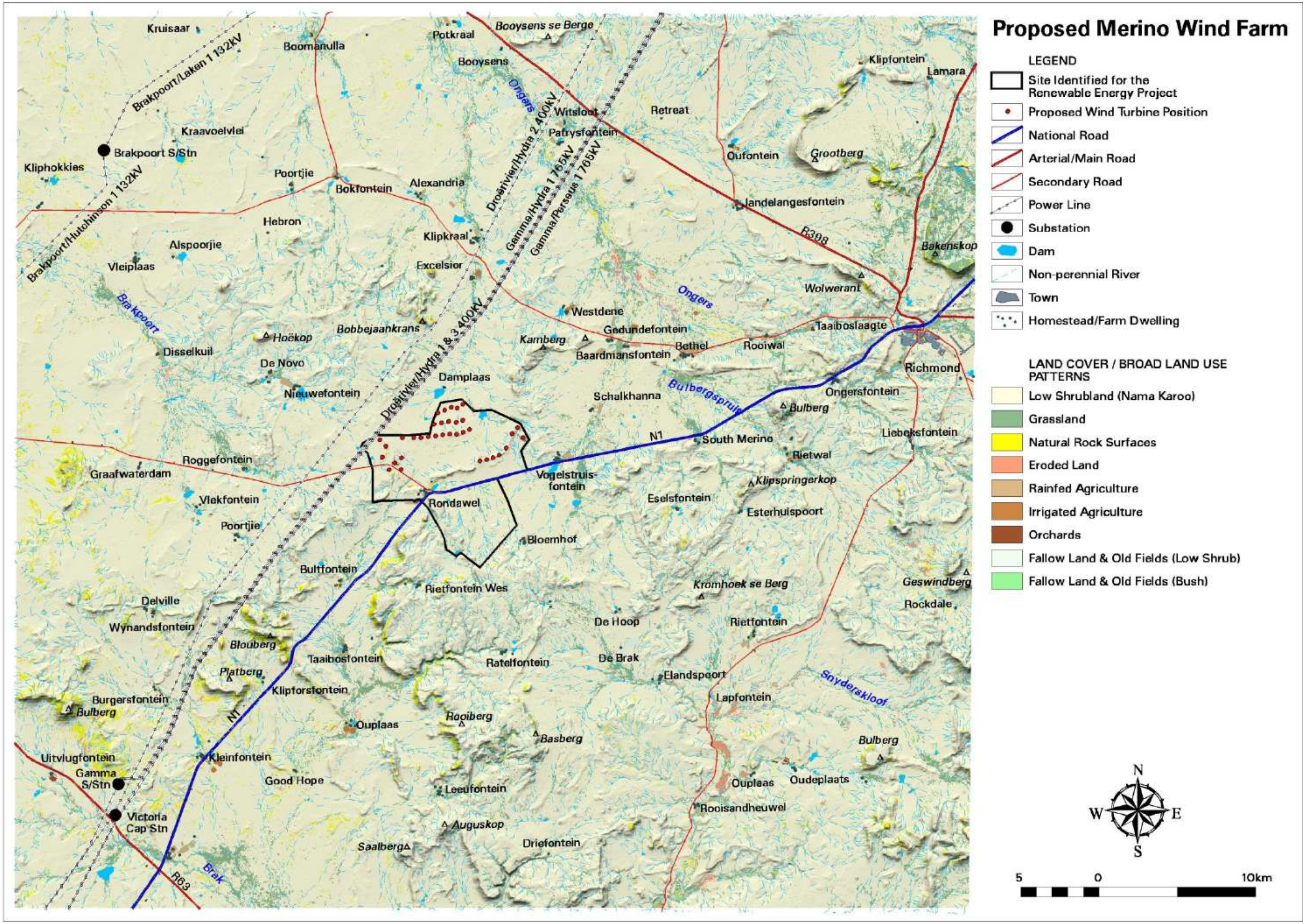


Figure 8: Typical Great Karoo scene as seen from the N1 national road.



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

6. RESULTS

6.1. Potential visual exposure

A visibility analysis was undertaken from each of the wind turbine positions (35 in total) at an offset of 250m (blade tip-height) above ground level. The result of the visibility analysis is displayed on **Map 3**.

The result of the viewshed analysis displays the potential areas of visual exposure, as well as the potential frequency of exposure. The frequency of exposure indicates the number of turbines that may be exposed i.e. more turbines may be visible in the darker orange areas than in the yellow areas. Land that is more elevated is typically more exposed to the proposed WEF, whilst lower lying areas such as valleys are shielded, or not as exposed.

Map 3 also indicates proximity radii from the proposed development area in order to show the viewing distance (scale of observation) of the facility in relation to its surrounds.

The following is evident from the viewshed analyses:

0 – 5km

The proposed WEF would have a large core area of potential visual exposure within a 5km radius of the development site. This is due to the tall wind turbine structures and the predominantly flat topography. However, there are some ridges and hills to the south (Bakenskop ridge), east and west of the proposed wind turbine structures. The shielding effect of these ridges is noticeable on the viewshed analysis map, where the frequency of visual exposure in these areas is reduced.

Exposed receptor sites within this zone include the following homesteads:

- Damplaas
- Vogelstruisfontein
- Schalkhanna
- Rondawel

The wind turbine structures, especially the eight turbines located on the Bakenskop ridge (see **Figure 9** below) will also be highly exposed to observers travelling along the N1 national road. The turbines are indicated in red on Figure 9 and their numbers range from M28 to M35. The Rondawel to Hutchinson secondary road will similarly be exposed to the wind turbines, as it traverses the proposed development site.

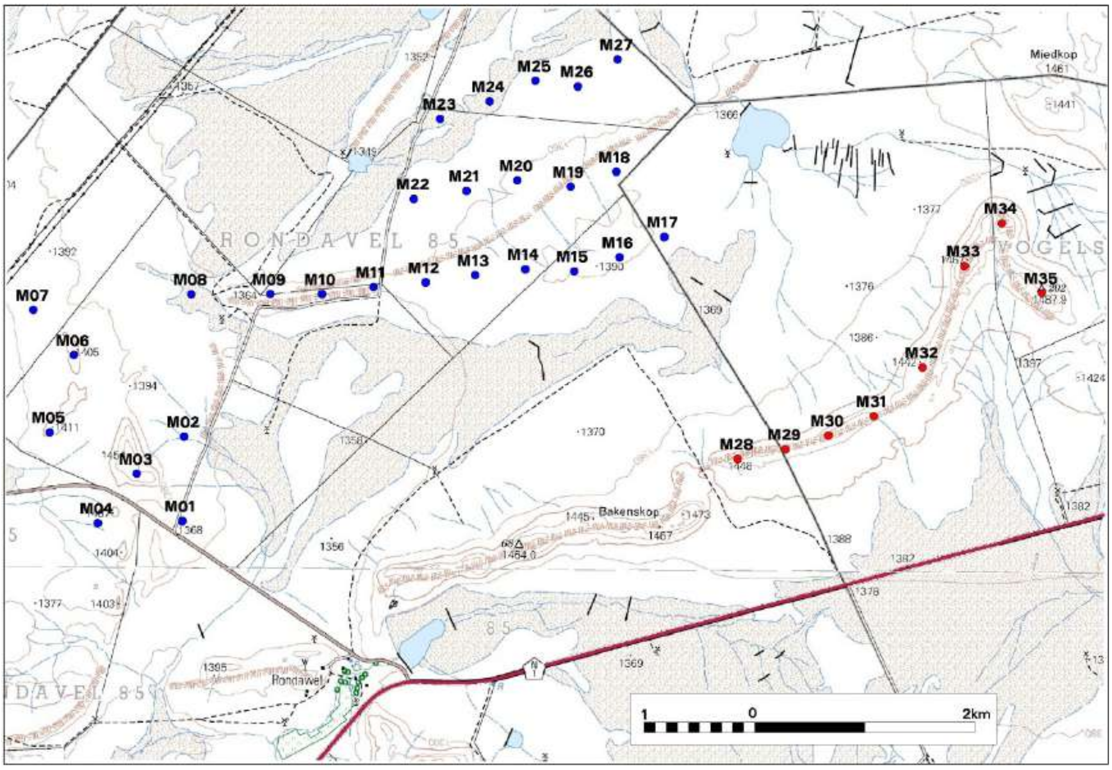


Figure 9: Merino wind turbine layout (indicating the eight Bakenskop turbines in red).

5 – 10km

Visual exposure will remain high in the medium distance (i.e. between 5 and 10km). The shielding effect of the hills and ridges surrounding the proposed development site does however create a more scattered viewshed pattern. The Hoëkop, Bobbejaankrans and Kamberg hills shield observers to the north-west and north-east of the proposed development site. Observations from the N1 national road and the Hutchinson secondary road is highly likely, especially the eight turbines located on top of the Bakenskop ridge.

Exposed receptor sites within this zone include the following homesteads:

- Excelsior
- Westdene
- Gedundefontein
- Baardmansfontein
- Bloemhof (Bloemhof Karoo Farmstay located on the RPGR)
- Bultfontein
- Roggefontein
- Nieuwefontein
- De Novo

The most northern parts of the RPGR, especially the north-facing slopes of this game farm, also fall within this zone.

It is expected that the wind turbine structures would be clearly visible from the abovementioned receptor sites.

10 – 20km

In the medium to longer distance (i.e. between 10 and 20km), visual exposure will be somewhat reduced, especially towards the north-west and the south-east. This zone also includes a number of homesteads that may be exposed to the project infrastructure. These include:

- Alexandria
- Klipkraal
- Witsloot
- Patrysfontein
- Jandelangesfontein
- Taaiboslaagte
- Rooiwal
- Bethel
- South Merino
- Rietwal
- Eselsfontein
- De Hoop
- De Brak
- Ouplaas
- Taaibosfontein
- Poortjie
- Graafwaterdam
- Disselkuil
- Vleiplaas

The central to southern sections of the RPGR, especially the north-facing slopes of the Rooiberg and Basberg, fall within this zone.

It is expected that the wind turbine structures would still be visible and recognisable from the abovementioned receptor sites.

> 20km

Visual exposure beyond a 20km radius is significantly reduced, especially in the south-east. The wind turbine structures may however still be visible from a number of homesteads within the study area, namely:

- Booysens
- Retreat
- Oufontein
- Kleinfontein
- Kraanvoelvlei
- Kruisaar
- Boomanulla

Conclusion

It is envisaged that the WEF structures would be easily and comfortably visible to observers (i.e. people travelling along roads, residing at homesteads or visiting the region), especially within a 10km radius (and potentially up to a radius of 20km) from the WEF and would constitute a high visual prominence, potentially resulting in a high visual impact.

6.2. Cumulative visual assessment

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 practice the terms ‘effects’ and ‘impacts’ are used interchangeably.

Cumulative visual impacts may be:

- Combined, where the wind turbines of several WEFs 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 WEF’s wind turbines; and
- Sequential, when the observer has to move to another viewpoint to see different developments, or different views of the same development (such as when travelling along a route).

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 wind turbines.

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 WEF development on the landscape and visual amenity is a product of:

- The distance between individual WEFs (or turbines);
- The distance over which the wind turbines are visible;
- The overall character of the landscape and its sensitivity to the structures;
- The siting and design of the WEFs themselves; 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 all the projects existing and proposed in the area.

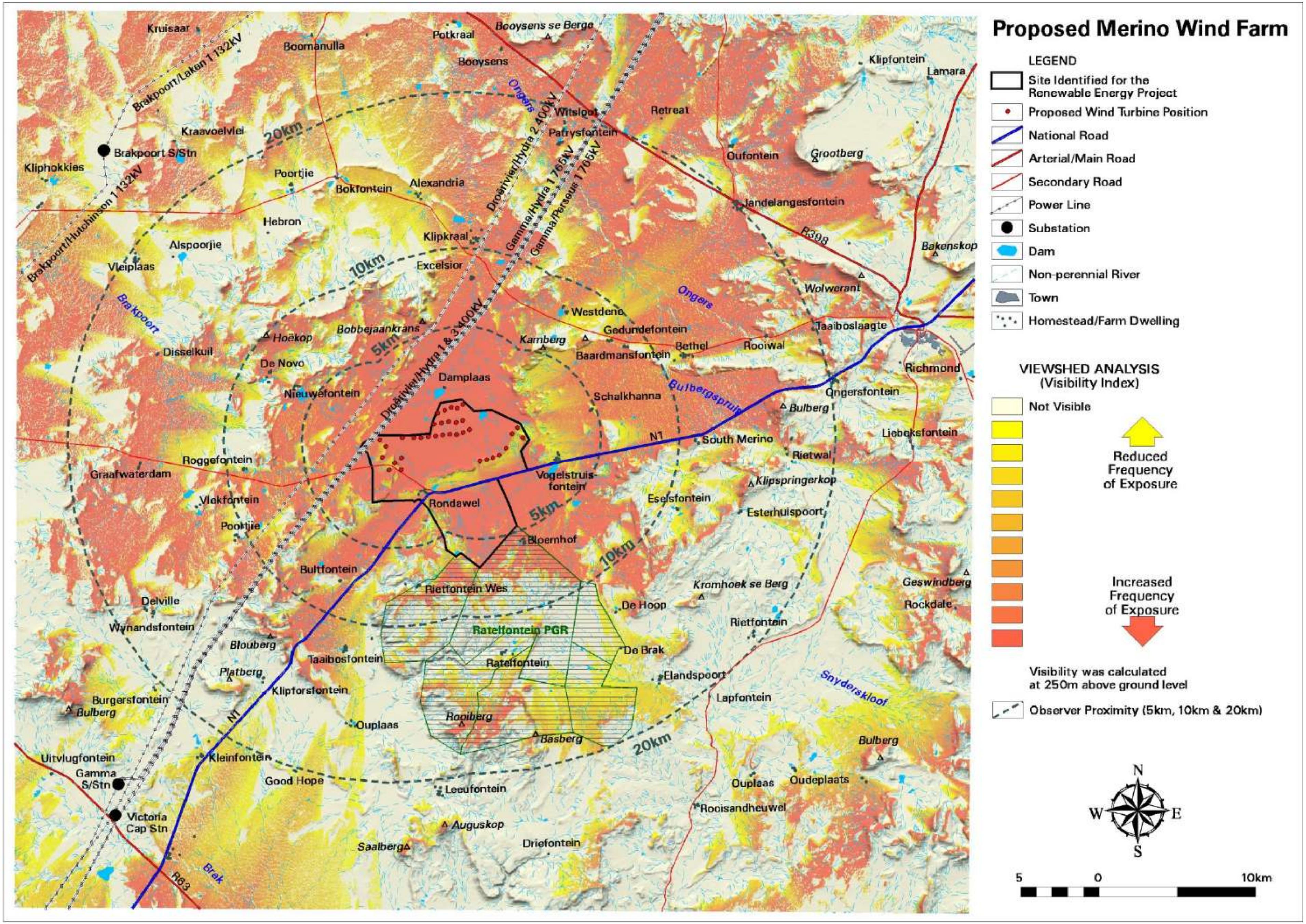
Proposed (authorised) renewable energy generation projects within the study area are shown on **Map 4**. It should be noted that Map 4 indicates the farm portions identified for the projects, and that the actual development footprints may be smaller. Projects to the south include the Umsinde Emoyeni (31km) and the Ishwati Emoyeni (17km) WEFs, to the west the Victoria West WEF (14km), and to the north-west the Brakpoort Solar Energy Facility (SEF) (20km). The EIA for the proposed Angora WEF, located immediately north-east of the Merino project site, is still in process. No wind turbine layouts for these projects were available at the time of the drafting this VIA report, therefore no cumulative (or combined) viewshed analyses were produced. It is however expected that the overall combined cumulative visual impact within the **larger region** would generally be of moderate significance, due to the relatively long distances in between the proposed WEFs.

In this case, and due to the relative long distance between the WEFs in the study area, the potential cumulative visual impact will more likely be sequential[6] rather than combined.[7] This statement relates specifically to observers travelling along the N1 national road, where sequential observations of wind turbines (once constructed and depending on the proximity of the infrastructure to this road), may cause a cumulative visual impact.

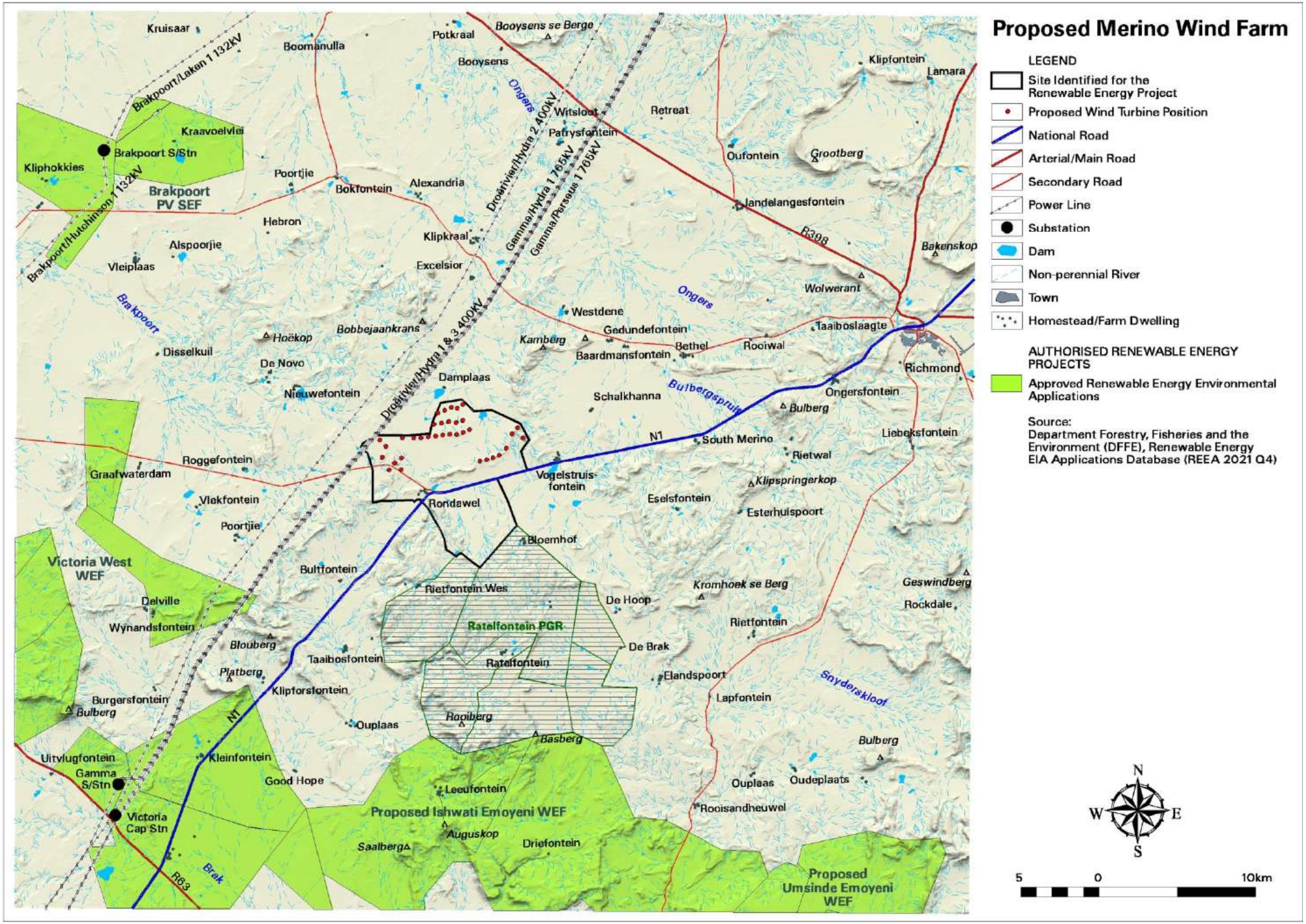
It should also be noted that the RPGR is located in between the proposed Ishwati Emoyeni and Merino WEFs, potentially causing a higher cumulative visual impact at locations (e.g. viewpoints or tracks) within the game farm that may be exposed to wind turbines from both these proposed WEFs.

[6] The observer has to move to another viewpoint to see different developments, or different views of the same development.

[7] The wind turbines of several WEFs are within the observer's arc of vision at the same time.



Map 3: Viewshed analysis of the proposed Merino Wind Farm.



Map 4: Authorised renewable energy environmental applications.

6.3. Visual distance / observer proximity to the WEF

The proximity radii are based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger WEFs (e.g. more than 50 wind turbines) and downwards for smaller WEFs (e.g. less than 50 turbines). This methodology was developed in the absence of any known and/or accepted standards for South African WEFs.

The principle of reduced impact over distance is applied in order to determine the core area of visual influence for these types of structures. It is envisaged that the nature of the structures and the rural character of the study area would create a significant contrast that would make the facility visible and recognisable from greater distances.

The proximity radii for the wind turbines were created in order to indicate the scale and viewing distance of the facility and to determine the prominence of the structures in relation to their environment. It should be noted that even though the proximity radii are indicated as (near) concentric circles from the wind turbines, the visual prominence of the structures will only apply where they are visible, as determined in the previous section (**Section 6.1**) of this report.

The proximity radii, based on the dimensions of the proposed development footprint are indicated on **Map 5**, and include the following:

- 0 - 5km. Short distance view where the WEF would dominate the frame of vision and constitute a very high visual prominence.
- 5 – 10km. Short to medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 10 - 20km. Medium to long distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a moderate visual prominence.
- > 20km. Long distance view of the facility where the structures are not expected to be immediately visible and not easily recognisable. This zone constitutes a lower visual prominence for the facility.

Figure 10: Schematic representation of a wind turbine from 1, 2, 5 and 10km under perfect viewing conditions.

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

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 WEF and its related 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.

General

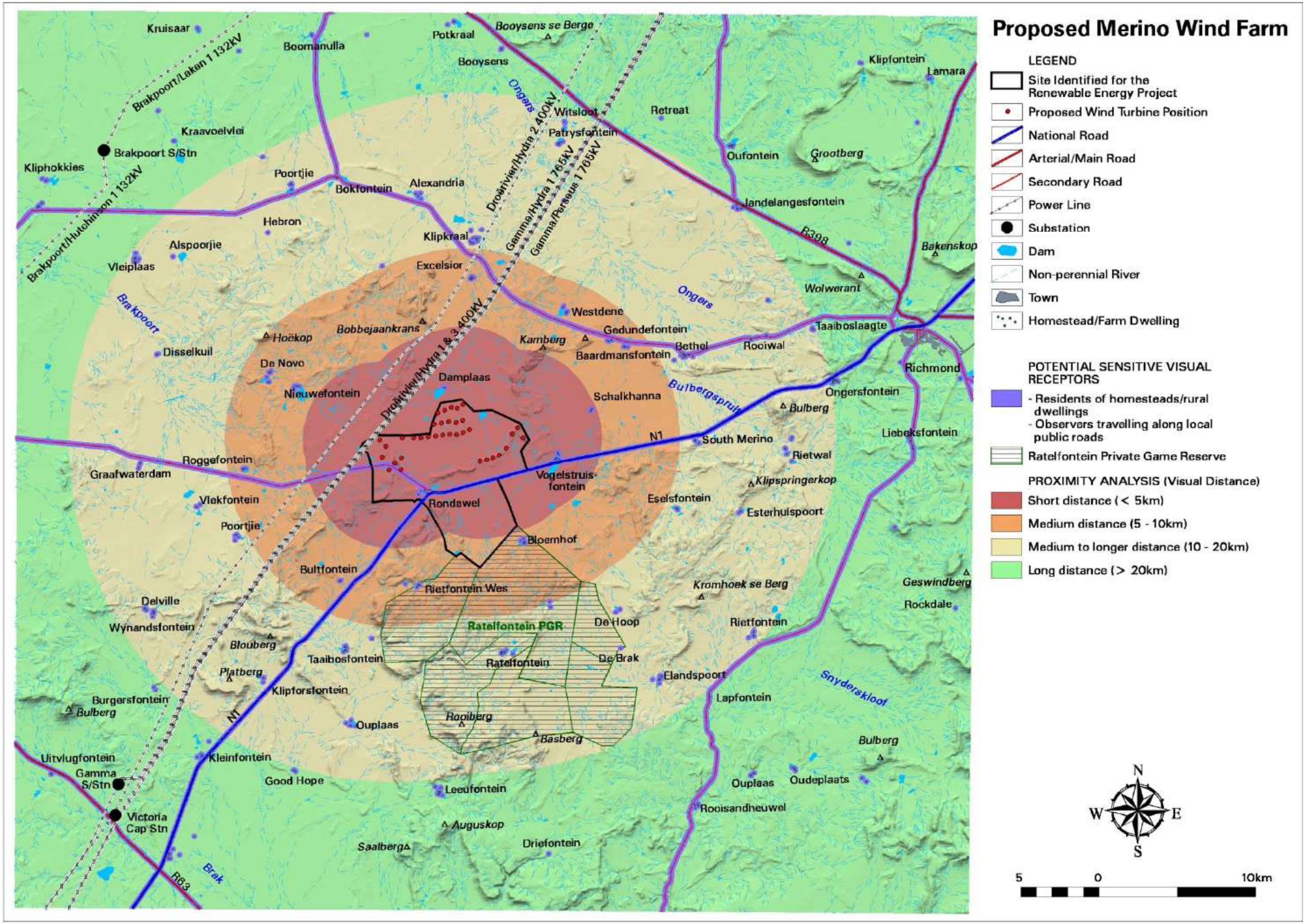
Viewer incidence is calculated to be the highest along the public roads within the study area. The N1 national road is identified (in the Western Cape Province) as a tourist route, namely the 'Cape Karoo Route'. It stands to reason that this road, even though the section within the study area is located within the Northern Cape Province, will contain observers that may be sensitive to wind turbine infrastructure. Travellers or visitors to the region using this road (and the connecting arterial roads within the study area) may be negatively impacted upon by visual exposure to the WEF.

Additional potential sensitive visual receptors are residents and visitors to the homesteads and rural residences within the study area. It is expected that the viewer's perception, unless the observer is associated with (or supportive of) the WEF, would generally be negative. Refer to **Section 6.1** for the exposed homesteads within the study area.

Specific objections

The author received information relating to a specific landowner during consultation and fieldwork that have objected to the construction and operation of wind farms within closer proximity to his/their properties. The landowners' farms are indicated on **Maps 3** and **4** and the farm portion names are listed under **Section 5**. The six farms in question comprise the RPGR, as previously discussed.

It is expected that receptors sites within the game farm may experience visual impacts ranging from moderate, high, to very high magnitude, depending on the observers' proximity to the wind turbine structures, and due to their sensitivity (aversion) to the infrastructure. Refer to **Map 5** for the location of the potential sensitive visual receptors discussed above.



Map 5: 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).

Low shrubland is described as:

Natural / semi-natural low shrub dominated areas, typically with < ± 2m canopy height, specifically associated with the Nama-Karoo Biome. It includes a range of canopy densities encompassing sparse to dense canopy covers. Very sparse covers may be associated with the bare ground class. Note that taller tree / bush / shrub communities within this vegetation type are typically classified separately as one of the other tree or bush dominated cover classes.

Overall, the Visual Absorption Capacity (VAC) of the receiving environment and especially the area in close proximity to the proposed WEF is deemed low by virtue of the nature of the vegetation and the absence of urban development.

The significant height of wind turbine structures adds to the potential visual intrusion of the WEF against the background of the horizon. In addition, the scale and form of the structures mean that it is unlikely that the environment will visually absorb them in terms of texture, colour, form and light/shade characteristics.

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

6.6. Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Merino Wind Farm are displayed on **Map 6**. 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 infrastructure, a high viewer incidence and a potentially negative perception (i.e. a sensitive visual receptor) 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.

General

The index indicates that **potentially sensitive visual receptors** within a 5km radius of the WEF may experience a **very high** visual impact. The magnitude of visual impact on sensitive visual receptors subsequently subsides with distance to; **high** within a 5-10km radius (where/if sensitive receptors are present) and **moderate** within a 10-20km radius (where/if sensitive receptors are present). Receptors beyond 20km are expected to have a **low** potential visual impact.

Specific objections

Where specific objections were raised against the construction and operation of the WEF (see **Section 6.4**) the 10 – 20km radius category includes a potentially **high** classification, due to the expressed sensitivity or aversion of the landowners to wind turbine structures. This aversion to wind energy infrastructure was explicitly communicated to the VIA specialists during a site visit to the potentially affected properties. The author cannot disregard these objections and cannot speculate as to the legitimacy thereof or motivation therefor i.e. it is accepted at face value and is therefore addressed in this report.

Likely areas of potential visual impact and potentially affected sensitive visual receptors located within the study area are displayed on **Map 6**. **Map 7** includes a larger scale visual impact index map, focusing on the RPGR as a specific objector to the proposed Merino Wind Farm.

Magnitude of the potential visual impact

< 5km

The WEF may have a visual impact of **very high** magnitude on the following observers (within a 5km radius):

Residents of/visitors to:

- Damplaas
- Vogelstruisfontein
- Schalkhanna
- Rondawel

Note:

The location of Vogelstruisfontein, Schalkhanna and Rondawel on farms earmarked for the proposed Angora and Merino WEFs reduces the probability of this impact occurring i.e. it is assumed that the landowners are supportive of the WEF developments on the affected properties.

Observers travelling along the:

- N1 national road
- Rondawel to Hutchinson secondary road

5 – 10km

The WEF may have a visual impact of **high** magnitude on the following observers:

Residents of/visitors to:

- Excelsior
- Westdene

- Gedundefontein
- Baardmansfontein
- Bultfontein
- Roggefontein
- Nieuwefontein
- De Novo

The WEF may have a **very high** visual impact on the following **objecting landowners** located between a 5 – 10km radius of the wind turbine structures:

Residents of/visitors to:

- Bloemhof (Bloemhof Karoo Farmstay located in the RPGR)
- Selected north-facing viewpoints within the northern parts of the RPGR

Observers travelling along the:

- Game viewing tracks within the northern parts of the RPGR[8]

10 – 20km

The WEF may have a visual impact of **moderate** magnitude impact on the following observers located between a **10 – 20km radius** of the wind turbine structures:

Residents of/visitors to:

- Alexandria
- Klipkraal
- Witsloot
- Patrysfontein
- Jandelangesfontein
- Taaiboslaagte
- Rooiwal
- Bethel
- South Merino
- Rietwal
- Eselsfontein
- De Hoop
- Ouplaas
- Taaibosfontein
- Poortjie
- Graafwaterdam
- Disselkuil
- Vleiplaas

The WEF may have a **high** visual impact on the following **objecting landowners** located between a 10 – 20km radius of the wind turbine structures:

Residents of/visitors to:

- De Brak (homestead located within the RPGR)
- Selected north-facing viewpoints within the central to southern parts of the RPGR

Observers travelling along the:

[8] No roads or additional receptors sites were provided by the RPGR management.

- Game viewing tracks within the central to southern parts of the RPGR

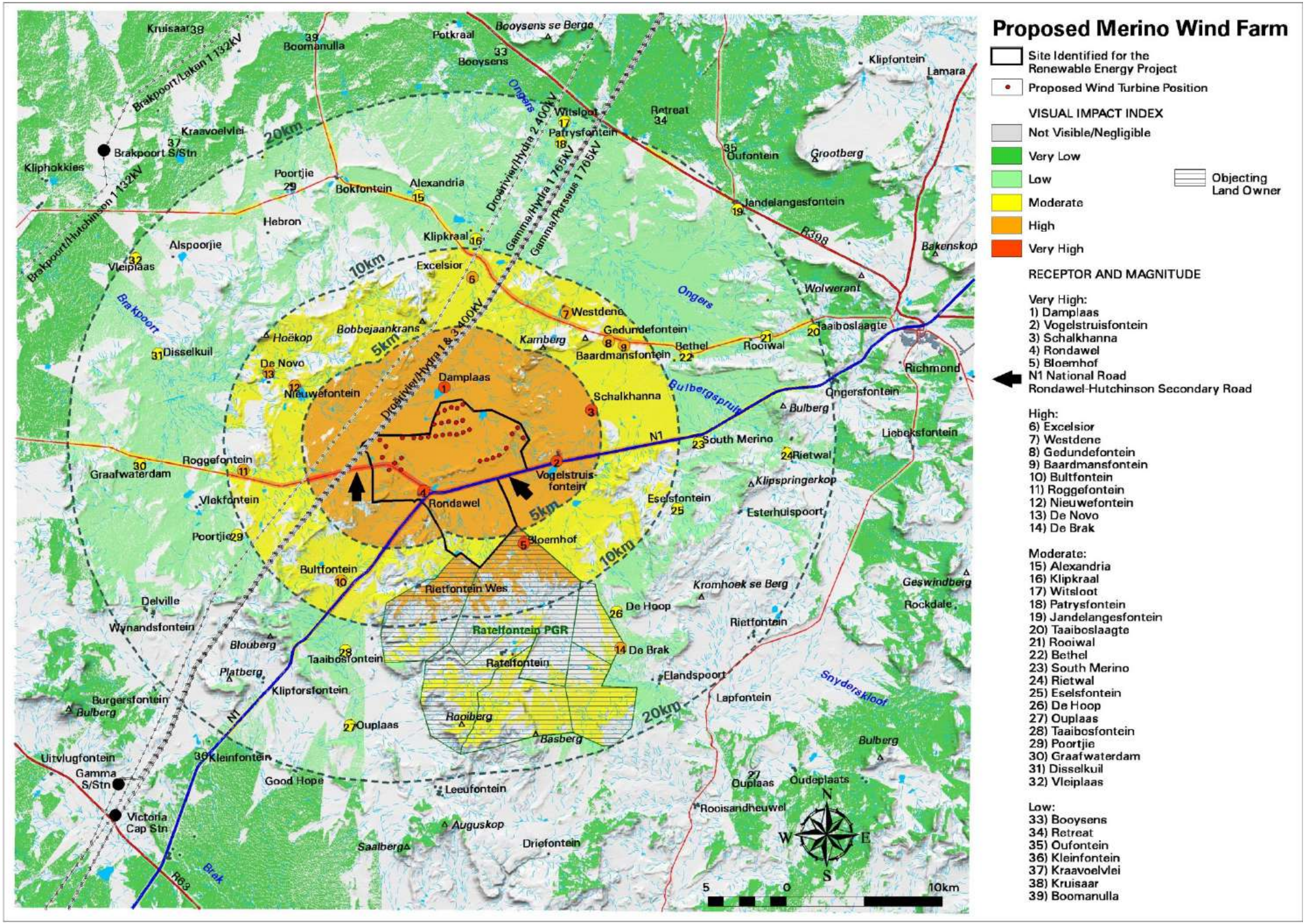
> 20km

The WEF may have a visual impact of **lower** magnitude on the following observers located beyond a 20km radius of the proposed WEF:

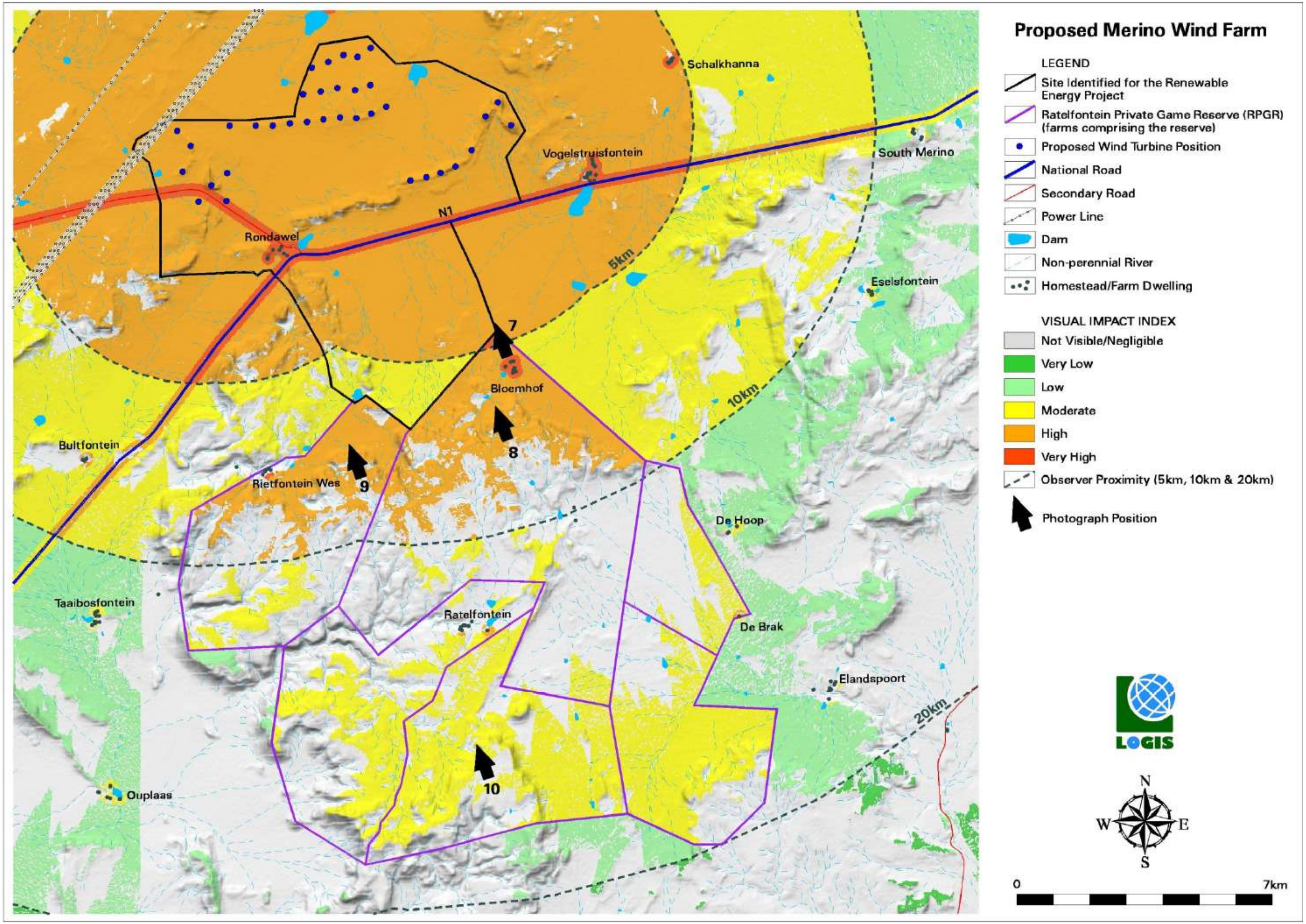
- Booysens
- Retreat
- Oufontein
- Kleinfontein
- Kraanvoëlvlei
- Kruisaar
- Boomanulla

Note:

Where any of the above-mentioned homesteads are derelict or deserted, the visual impact will be non-existent, until such time as it is inhabited again.



Map 6: Visual impact index and potentially affected sensitive visual receptors.



Map 7: Visual impact index and potentially affected sensitive visual receptors (**objecting** land owners).

7. PHOTO SIMULATIONS

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Merino WEF within the receiving environment. The purpose of the photo simulation exercise is to support/verify the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions (i.e. it is not an artist's impression).

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout.

The photograph positions (for the **general** receptor sites 1 - 6) are indicated on **Figure 10** below and should be referenced with the photo simulation being viewed in order to place the observer in spatial context. The photograph positions for the RPGR (**specific objector** receptor sites 7 - 10) are indicated on visual impact index map (**Map 7**) above.

The simulated views show the placement of the wind turbines during the long-term operation phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken.

It is imperative that the natural vegetation be restored to its original (current) status for these simulated views to ultimately be realistic. The additional infrastructure (e.g. the proposed substation, access roads, etc.) associated with the facility is not included in the photo simulations.

The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility.

The photo simulations are displayed as "before" and "after" views of the affected landscape.

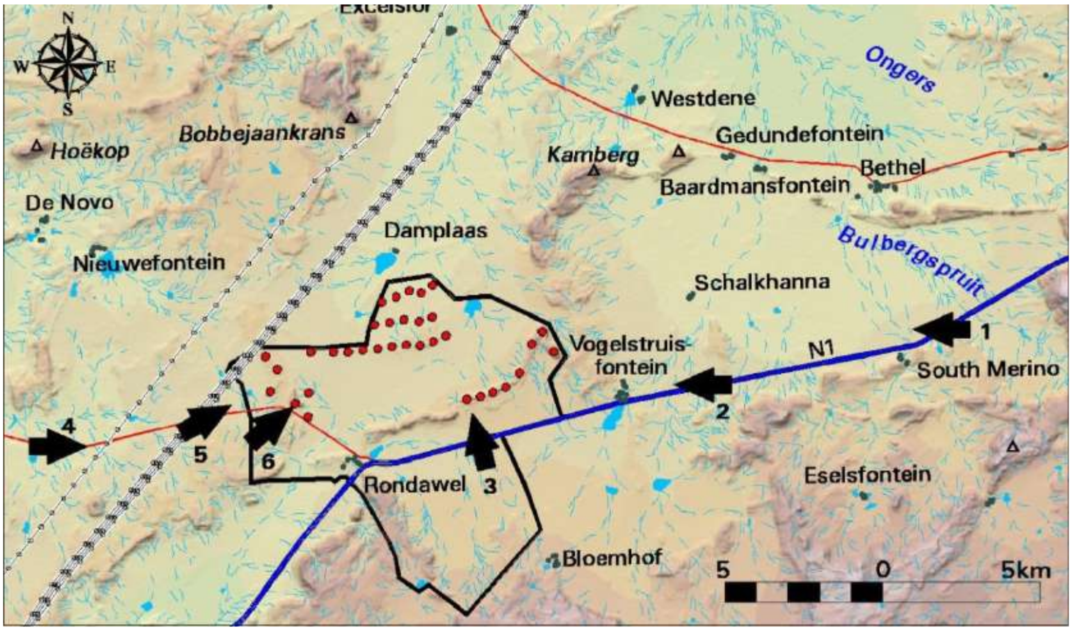


Figure 11: Photograph positions.

7.1. Viewpoint 1: before construction (**Figure 12:** Photo simulation 1 - before).

7.2. Viewpoint 1: after construction (Figure 13: Photo simulation 1 - after). *The closest wind turbine is 12.2km from this point*.

7.3. Viewpoint 2: before construction (Figure 14: Photo simulation 2 - before).

7.4. Viewpoint 2: after construction (**Figure 15:** Photo simulation 2 - after). *The closest wind turbine is 4.5km from this point.*

7.5. Viewpoint 3: before construction (Figure 16: Photo simulation 3 - before).

7.6. Viewpoint 3: after construction (**Figure 17:** Photo simulation 3 - after). *The closest wind turbine is 1.4km from this point.*

7.7. **Viewpoint 4: before construction (Figure 18:** Photo simulation 4 - before).

7.8. Viewpoint 4: after construction (**Figure 19:** Photo simulation 4 - after). *The closest wind turbine is 7.3km from this point.*

7.9. Viewpoint 5: before construction (Figure 20: Photo simulation 5 - before).

7.10. Viewpoint 5: after construction (**Figure 21:** Photo simulation 5 - after). *The closest wind turbine is 2.3km from this point.*

7.11. Viewpoint 6: before construction (Figure 22: Photo simulation 6 - before).

7.12. Viewpoint 6: after construction (Figure 23: Photo simulation 6 - after). *The closest wind turbine is 300m from this point*

7.13. Viewpoint 7: before construction (Figure 24: Photo simulation 7 - before).

7.14. Viewpoint 7: after construction (Figure 25: Photo simulation 7 - after). *The closest wind turbine is 5.6km from this point*

7.15. Viewpoint 8: before construction (Figure 26: Photo simulation 8 - before).

7.16. Viewpoint 8: after construction (Figure 27: Photo simulation 8 - after). *The closest wind turbine is 7km from this point*

7.17. Viewpoint 9: before construction (Figure 28: Photo simulation 9 - before).

7.18. Viewpoint 9: after construction (Figure 29: Photo simulation 9 - after). *The closest wind turbine is 7.9km from this point*

7.19. Viewpoint 10: before construction (Figure 30: Photo simulation 10 - before).

7.20. Viewpoint 10: after construction (Figure 31: Photo simulation 10 - after). *The closest wind turbine is 16km from this point*

Visibility of wind turbines in photographs vs. field observations

It is the authors' judgment, based on many years of VIA experience, that photographs and photo-simulations of wind turbine structures consistently under-represent the degree of visibility and object scale observed in the field. This is especially true for photographs of wind energy facilities taken from longer distances, where the turbines are barely visible on a photograph, but clearly visible in the field. Scottish Natural Heritage (2006) suggests that the camera's inability to replicate the full contrast range visible to the human eye is a "key limitation of photographs in replicating the human experience."

For this reason the author has compiled a number of enlarged (zoomed) snap-shots of the previous photo-simulations, that will provide a more accurate representation (especially in term of the scale) of what the views would look like in real life.

Figure 32: Photo simulation 1. *The closest wind turbine is 12.2km from this point*.

Figure 33: Photo simulation 2. *The closest wind turbine is 4.5km from this point.*

Figure 34: Photo simulation 3. *The closest wind turbine is 1.4km from this point.*

Figure 35: Photo simulation 4. *The closest wind turbine is 7.3km from this point.*

Figure 36: Photo simulation 5. *The closest wind turbine is 2.3km from this point.*

Figure 37: Photo simulation 6. *The closest wind turbine is 300m from this point.*

Figure 38: Photo simulation 7. *The closest wind turbine is 5.6km from this point.*

Figure 39: Photo simulation 8. *The closest wind turbine is 7km from this point.*

Figure 40: Photo simulation 9. *The closest wind turbine is 7.9km from this point.*

Figure 41: Photo simulation 10. *The closest wind turbine is 16km from this point.*

8. VISUAL IMPACT ASSESSMENT

8.1. 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 infrastructure) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent** - long distance (very low = 1), medium to longer distance (low = 2), short distance (medium = 3) and very short distance (high = 4)[9].
- **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)[10].
- **Probability** – very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5).
- **Status** (positive, negative or neutral).

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[9] Long distance = > 20km. Medium to longer distance = 10 – 20km. Short distance = 5 – 10km. Very short distance = < 5km (refer to Section 6.3. Visual distance/observer proximity to the WEF).

[10] 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.

- **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)
- 30-60 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)

8.2. Visual impact assessment

The primary visual impacts of the proposed WEF are assessed as follows:

8.2.1. Construction impacts

8.2.1.1. Potential visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF and ancillary infrastructure

During construction, there may be a noticeable increase in heavy vehicles utilising the roads to the development 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 **moderate** (significance rating = 56), temporary visual impact, that may be mitigated to **moderate** (significance rating = 36).

Table 2: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of construction activities on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Short term **(2)**	Short term **(2)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	Moderate **(56)**	Moderate **(36)**
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 in all areas outside of the development footprint, but within the project site. Construction: ➢ Ensure that vegetation is not unnecessarily removed during the construction period. ➢ Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) where possible. ➢ Restrict the activities and movement of construction workers and vehicles to the immediate construction site 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 approved 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 that rehabilitation works are carried out as required.

8.2.2. Operational impacts

8.2.2.1. Potential visual impact on sensitive visual receptors (residents and visitors) located within a 5km radius of the wind turbine structures

The operation of the Merino Wind Farm is expected to have a **high** visual impact (significance rating = 72) on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. This includes:

- Damplaas

It is unclear whether this homestead is occupied as a residence, or whether it is utilised as a storage facility. The project proponent needs to engage with the property owner and confirm this.

The following WEF properties are provisionally included, due to their assumed support for WEF developments (either the proposed Merino or Angora WEFs). The homestead's names are listed below.

- Vogelstruisfontein (Angora WEF)
- Schalkhanna (Angora WEF)
- Rondawel (Merino WEF)

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 3: Visual impact on observers (residents and visitors) in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers (residents at homesteads and visitors/tourists) in close proximity (i.e. within 5km) to the wind turbine structures

	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(72)**	High **(72)**
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 practice management measures can be implemented.	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.2. Potential visual impact on sensitive visual receptors (observers travelling along roads) located within a 5km radius of the wind turbine structures

The operation of the Merino Wind Farm is expected to have a **high** visual impact (significance rating = 72) on observers traveling along public roads within a 5km radius of the wind turbine structures. This includes observers travelling along the:

- N1 national road
- Rondawel-Hutchinson secondary road

The eight wind turbines located on the Bakonskop ridge is expected to contribute the most to the visual impact, especially when viewed from the N1 national road. Unless the project proponent is willing to remove, or relocate these turbine positions, the impact is expected to remain high.

Other than the above recommendation, 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 travelling along roads in close proximity to the proposed wind turbine structures.

Nature of Impact: Visual impact on observers travelling along the roads in close proximity (i.e. within 5km) to the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**

Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(72)**	High **(72)**
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 practice management measures can be implemented.	
Generic best practise mitigation/management measures: Planning: ➢ Retain/re-establish and maintain natural vegetation in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.3. Potential visual impact on sensitive visual receptors within the region (5 – 10km radius)

The Merino Wind Farm could have a **moderate** visual impact (significance rating = 60) on residents of (or visitors to) homesteads within a 5 - 10km radius of the wind turbine structures. This significance rating is based on the **Impact rating methodology** as discussed in **Section 8.1.** It should be noted that this rating value is marginal between **moderate** and **high**, and that some receptors, depending on their aversion to wind energy facilities (especially those located closer to 5km (e.g. 5.5km) from the turbine structures), may experience visual impacts of higher significance.

Residents of/visitors to:

- Excelsior
- Westdene
- Gedundefontein
- Baardmansfontein
- Bultfontein
- Roggefontein
- Nieuwefontein
- De Novo

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 wind turbine structures within the region (5 – 10km).

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 5 – 10km radius of the wind turbine structures

	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	Moderate **(60)**	Moderate **(60)**
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 in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.4. Potential visual impact on objecting sensitive visual receptors within the region (5 – 10km radius)

The WEF may have a **high** (significance rating = 85) visual impact on the following **objecting landowners** located between a 5 – 10km radius of the wind turbine structures:

Residents of/visitors to:

- Bloemhof (Bloemhof Karoo Farmstay located in the RPGR)
- Selected north-facing viewpoints within the northern parts of the RPGR

Observers travelling along the:

- Game viewing tracks within the northern parts of the RPGR

Table 6: Visual impact on **objecting** sensitive visual receptors within the region (5 – 10km).

Nature of Impact: Visual impact on objecting sensitive visual receptors (RPGR) within a 5 – 10km radius of the wind turbine structures		
	Without mitigation	***With mitigation***
Extent	Short distance **(3)**	Short distance **(3)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Definite **(5)**	Definite **(5)**
Significance	High **(85)**	High **(85)**
Status (positive,	Negative	Negative

neutral or 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 in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.5. Potential visual impact on sensitive visual receptors within the region (10 – 20km radius)

The Merino Wind Farm could have a **moderate** visual impact (significance rating = 36) on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.

Residents of/visitors to:

- Alexandria
- Klipkraal
- Witsloot
- Patrysfontein
- Jandelangesfontein
- Taaiboslaagte
- Rooiwal
- Bethel
- South Merino
- Rietwal
- Eselsfontein
- De Hoop
- De Brak
- Ouplaas
- Taaibosfontein
- Poortjie
- Graafwaterdam
- Disselkuil
- Vleiplaas

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 7: Visual impact of the proposed wind turbine structures within the region (10 – 20km).

Nature of Impact: Visual impact on observers travelling along the roads and residents at homesteads within a 10 – 20km radius of the wind turbine structures		
	Without mitigation	**_With mitigation_**
Extent	Medium to longer distance **(2)**	Medium to longer distance **(2)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Moderate **(6)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(36)**	Moderate **(36)**
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 in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.2.2.6. Shadow flicker

Shadow flicker only occurs when the sky is clear, and when the turbine rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "*most shadow impact is associated with 3-4 times the height of the object*". Based on this research, an 1,000m buffer along the edge of the outer most turbines is identified as the zone within which there is a risk of shadow flicker occurring.

There are no places of residence within the 1,000m buffer and the significance of shadow flicker is therefore anticipated to be **low** to **negligible**.

Table 8: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.

Nature of Impact: Visual impact of shadow flicker on sensitive visual receptors in close proximity to the proposed WEF.		
	Without mitigation	**_With mitigation_**
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
Status (positive, neutral or negative)	Negative	Negative

Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	N.A. due to the low probability of occurrence	
Generic best practise mitigation/management measures: N.A.		
Residual impacts: N.A.		

8.2.2.7. Lighting impacts

Potential visual impact of operational, safety and security lighting of the facility at night.

The area immediately surrounding the proposed facility has a relatively low incidence of receptors and light sources, so light trespass and glare from the security and after-hours operational lighting for the facility will have some significance for visual receptors in close proximity.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. This is especially true due to the strobing effect of the lights, a function specifically designed to attract the observer's attention. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts have traditionally been very low other than to restrict the number of lights to turbines that delineate the outer perimeter of the facility.

Figure 42: Aircraft warning lights fitted to the wind turbine hubs (Source: http://www.pinchercreekecho.com/2015/04/29/md-of-pincher-creek-takes-on-wind-turbine-lights.)

Some ground-breaking new technology in the development of strobing lights that only activate when an aircraft is detected nearby may aid in restricting light pollution at night and should be investigated and implemented by the project proponent, if available and permissible by the CAA. This new technology is referred to as *needs-based night lights,* which deactivates the wind turbine's night lights when there is no flying object within the airspace of the WEF. The system relies on the active detection of aircraft by radar sensors, which relays a switch-on signal to the central wind farm control to activate the obstacle lights. See diagram in **Figure 43** below.[11]

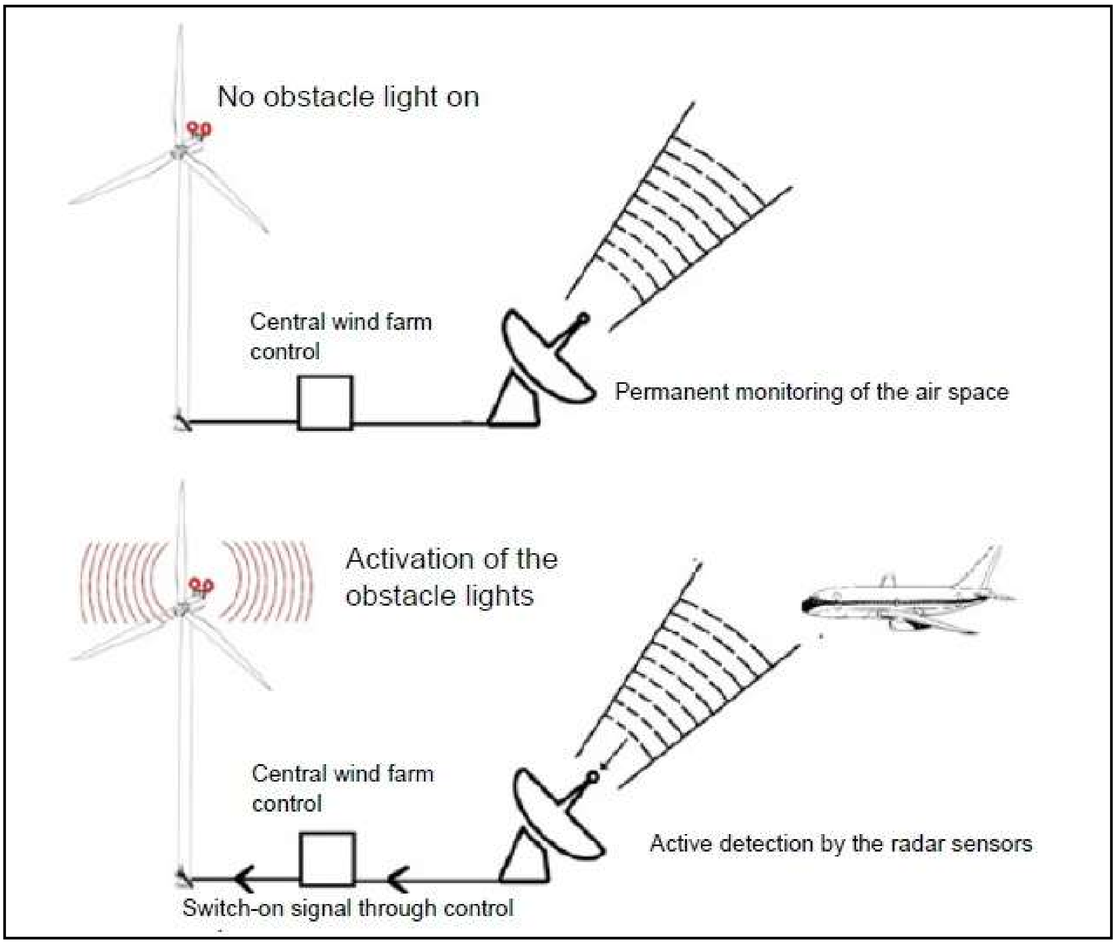

Figure 43: Diagram of the functional principle of the needs-based night lights.

Last is the potential lighting impact known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contributes to the increase in sky glow.

This anticipated lighting impact is likely to be of **high** significance (rating = 64), and may be mitigated to **moderate** (rating = 48) especially within a 5km radius (and potentially up to a 10km radius) of the wind turbine structures.

Table 9: Impact table summarising the significance of visual impact of lighting at night on visual receptors in closer proximity (5km and potentially up to 10km) to the proposed WEF.

Nature of Impact: Visual impact of lighting at night on sensitive visual receptors.

[11] Source: Nordex Energy GmbH, 2019

	No mitigation	***Mitigation considered***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	High **(8)**
Probability	Highly probable **(4)**	Probable **(3)**
Significance	High **(64)**	Moderate **(48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning & operation:

- Implement needs-based night lighting if considered acceptable by the CAA.
- Limit aircraft warning lights to the turbines on the perimeter according to CAA requirements, thereby reducing the overall impact.
- Shield the sources of light by physical barriers (walls, vegetation, or the structure itself).
- Limit mounting heights of lighting fixtures, or alternatively use foot-lights or bollard level lights.
- Make use of minimum lumen or wattage in fixtures.
- Make use of down-lighters, or shielded fixtures.
- Make use of Low Pressure Sodium lighting or other types of low impact lighting.
- Make use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.2.2.8. Ancillary infrastructure

On-site ancillary infrastructure associated with the WEF includes a 33/132kV substation and collector substation, BESS, underground 33kV cabling between the wind turbines, internal access roads, workshop and office and staff accommodation. No dedicated viewshed analyses have been generated for the ancillary infrastructure, as the range of visual exposure will fall within (and be overshadowed by) that of the turbines.

The anticipated visual impact resulting from this infrastructure is likely to be of **low** significance both before and after mitigation.

Table 10: Visual impact of the ancillary infrastructure.

Nature of Impact:
Visual impact of the ancillary infrastructure on observers in close proximity to the structures.

	Without mitigation	***With mitigation***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(2)**
Significance	Low **(24)**	Low **(24)**
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 in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the infrastructure. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.3. Visual impact assessment: secondary impacts

8.3.1. The potential impact 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.), play 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 rural, undeveloped character and a natural appearance. These generally undeveloped landscapes are considered to have a high visual quality.

The significance of the visual impacts on the sense of place within the **region** (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of **low** significance.

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 11: The potential impact on the sense of place of the region.

Nature of Impact: The potential impact on the sense of place of the region.		
	Without mitigation	***With mitigation***
Extent	Long distance **(1)**	Long distance **(1)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
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 in all areas outside of the development footprint/servitude, but within the project site. Operations: ➢ Maintain the general appearance of the facility as a whole. Decommissioning: ➢ Remove infrastructure not required for the post-decommissioning use. ➢ Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.		
Residual impacts: The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.		

8.3.2. The potential cumulative visual impact of wind farms on the visual quality of the landscape

The cumulative visual impact of the proposed Merino, Angora, Ishwati Emoyeni and Victoria West WEFs is expected to be **high**, especially the potential sequential cumulative visual impact on observers driving along the N1 national road and potentially along other arterial roads within the region.

The RPGR is located in between (adjacent to) the proposed Ishwati Emoyeni and Merino WEFs, potentially causing a **high** cumulative visual impact at locations (e.g. viewpoints and tracks) within the game farm that may be exposed to wind turbines from both these proposed WEFs.

Table 12: The potential cumulative visual impact of wind farms on the visual quality of the landscape.

Nature of Impact: The potential cumulative visual impact of wind farms on the visual quality of the landscape.		
	Overall impact of the proposed project considered in isolation	***Cumulative impact of the project and other projects in the area***
Extent	Very short distance **(4)**	Very short distance **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Very high **(10)**	Very high **(10)**
Probability	Highly probable **(4)**	Highly probable **(4)**
Significance	High **(72)**	High **(72)**
Status (positive, neutral or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	
Mitigation measures: N.A.		

Residual impacts:
The visual impact will be removed after decommissioning, provided the WEF infrastructure is removed and the area rehabilitated. Failing this, the visual impact will remain.

8.4. The potential to mitigate visual impacts

The primary visual impact, namely the appearance of the WEF (the wind turbines) is not possible to mitigate. The functional design of the turbines cannot be changed in order to reduce visual impacts.

Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's *Marking of Obstacles* expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*".

Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact.

The overall potential for mitigation is therefore generally low or non-existent. The following mitigation is, however possible:

- It is recommended that vegetation cover (i.e. either natural or cultivated) be maintained in all areas outside of the actual development footprint (but still within the project site), both during construction and operation of the proposed WEF. This will minimise visual impact as a result of cleared areas and areas denuded of vegetation.

- Existing roads should be utilised wherever possible. New roads should be planned taking due cognisance of the topography to limit cut and fill requirements. Construction/upgrade of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems.

- In terms of onsite ancillary buildings and structures, it is recommended that it be planned so that the clearing of vegetation is minimised. This implies consolidating this infrastructure as much as possible and making use of already disturbed areas rather than undisturbed sites wherever possible.

- Install aircraft warning lights that only activate when the presence of an aircraft is detected, **if permitted by the CAA**, and where deemed feasible.

- The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact.

- Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility. The correct specification and placement of lighting and light fixtures for the proposed WEF and ancillary infrastructure will go far to contain rather than spread the light. Mitigation measures include the following:

  - Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
  - Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
  - Making use of minimum lumen or wattage in fixtures;
  - Making use of down-lighters, or shielded fixtures;
  - Making use of Low Pressure Sodium lighting or other types of low impact lighting.
  - Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

- 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.
  - Reduce the construction period through careful logistical planning and productive implementation of resources.
  - Plan the placement of laydown areas 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 site 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 approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
  - Restrict construction activities to daylight hours 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 should be consulted to assist or give input into rehabilitation specifications.

- During operation, the maintenance of the turbines and ancillary structures and infrastructure must be undertaken to ensure that the facility does not degrade, therefore aggravating the 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 facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site must be removed and all disturbed areas appropriately rehabilitated. An ecologist must 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.

- Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate. There is also no mitigation to ameliorate the negative visual impacts on roads frequented by tourists and which provides access to tourist destinations within the region.

  Where sensitive visual receptors (as identified in **Section 6.6.**) are likely to be affected and where valid objections (as determined by the visual specialist) are raised by these receptors during the application process, it is recommended that the developer investigate the receptor's willingness (and the viability) of screening of visual impacts at the receptor site prior to construction commencing. This may entail the planting of natural vegetation, natural trees or the construction of screens in the pre-dominant direction of impact likely to be experienced by the principal receptor at the site. Ultimately, visual screening is most effective when placed at the receptor itself and should be considered in this context only.

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

Site/layout specific mitigation

The eight wind turbines perched on top of the Bakenskop ridge is expected to contribute the most to the visual impact of the WEF on observers travelling along the N1 national road, as well as on visitors to the RPGR. If the project proponent is willing to remove, or relocate (set back in line with the northern most turbines) these turbine positions, the impact of **visual encroachment** on this road and the RPGR is expected to be mitigated to a large degree. Three of these turbines are displayed in **Figure 44** below (also see **Figure 34**). The much less conspicuous northern wind turbines (referred to above) can be seen in the left-hand side of the image, indicating the level of potential impact mitigation that may be achieved.

Figure 44: Three of the eight wind turbines located on the Bakenskop ridge.

9. CONCLUSION AND RECOMMENDATIONS

The visual impact assessment (VIA) practitioner takes great care to ensure that all the spatial analyses and mapping is as accurate as possible. The intention is to quantify, using visibility analyses, proximity analyses and the identification of sensitive receptors, the potential visual impacts associated with the proposed

Merino Wind Farm. These processes are deemed to be transparent and scientifically defensible when interrogated.

However, visual impact is ultimately a subjective concept. The *subjects* in this case are the residents of, and visitors to the region. The author has attempted to accurately capture the location of these *subjects* (i.e. sensitive visual receptors and areas of likely visual impact) to the best of his ability, drawing on years of experience as a VIA practitioner. The VIA further adopts a risk averse approach in so far as to assume that the perception of most (if not all) of the sensitive visual receptors (bar the landowners of the properties earmarked for the development), would be predominantly negative towards the development of a WEF in the region.

There are likely to be supporters of the Merino Wind Farm (as renewable energy generation is a global priority) amongst the population of the larger region, but they are normally expected to be indifferent to the construction of the WEF and not as vocal in their support for the wind farm as potential detractors thereof. To the knowledge of the author, the only objection to the Merino Wind Farm (and WEFs within the general region) was from the RPGR.

It is expected that the construction and operation of the proposed Merino Wind Farm and its associated infrastructure, will have a high visual impact on the study area, especially within a 5km (and likely up to 10km) radius of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility. Tourists travelling through the region and residents of homesteads will likely experience visual impacts where the wind turbine structures are visible.

The combined visual impact or cumulative impact of up to five wind energy facilities (i.e. the authorised Umsinde Emoyeni, Ishwati Emoyeni and Victoria West WEFs, and the proposed Merino and Angora WEFs) is expected to increase the area of potential visual impact within the region. The intensity of visual impact (number of turbines visible) to exposed receptors, especially those located within a 5km (and likely up to 10km) radius of the proposed Merino Wind Farm, is expected to increase when considered in conjunction with the other authorised or proposed WEFs.

Overall, the significance of the visual impacts associated with the proposed Merino Wind Farm is expected to be high as a result of the undeveloped character of the landscape. The facility would be visible within an area that contains certain sensitive visual receptors who could consider visual exposure to this type of infrastructure to be intrusive. Visual receptors include people travelling along the public roads (e.g. the N1 national road), residents of rural homesteads and tourists passing through or holidaying (e.g. visitors to the RPGR) in the region.

Conventional mitigation (e.g. such as screening of the structures) of the potential visual impacts is highly unlikely to succeed due to the nature of the development and the receiving environment. A number of mitigation measures have been proposed (**Section 8.4**). The proposed mitigation measures will primarily be effective in terms of mitigating lighting and construction phase visual impacts, as well as the mitigation of the visual encroachment of wind turbine structures on the N1 national road and the RPGR. This latter mitigation would entail the relocation or removal of the eight identified wind turbines from the proposed layout as mentioned in the previous section.

It is recommended that the project proponent investigate the viability of relocating these wind turbines in light of the conclusions of the VIA. Failing this the Merino Wind Farm may not offer an ideal operating scenario from a visual impact perspective. See Impact Statement below.

Note: 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 facility, should it be authorised.

10. IMPACT STATEMENT

The findings of the Visual Impact Assessment undertaken for the proposed Merino Wind Farm is that the visual environment surrounding the site, especially within a 5km radius (and likely up to 10km), will be visually impacted upon for the anticipated operational lifespan of the facility (i.e. 20 - 25 years).

The following is a summary of impacts remaining:

- Construction phase activities may potentially result in a **moderate** temporary visual impact, both before and after mitigation.
- The operation of the Merino Wind Farm is expected to have a **high** visual impact on observers/visitors residing at homesteads within a 5km radius of the wind turbine structures. No mitigation of this impact is possible.
- The operation of the Merino Wind Farm is expected to have a **high** visual impact on observers traveling along the public roads (N1 and Hutchinson secondary road) within a 5km radius of the wind turbine structures. No mitigation of this impact is possible, except for the removal/relocation of the eight turbine positions from the Bakenskop ridge in order to ameliorate the visual impact to some degree.
- The operation of the Merino Wind Farm could have a **moderate** to **high** visual impact on sensitive visual receptors within the region (5 - 10km radius of the wind turbine structures). No mitigation of this impact is possible.
- The operation of the Merino Wind Farm could have a **high** visual impact on **objecting** land owners and visitors to the RPGR located within a 5 - 10km (and potentially up to a 20km) radius of the proposed wind turbine structures. No mitigation of this impact is possible, except for the removal/relocation of the eight turbine positions from the Bakenskop ridge in order to ameliorate the visual impact to some degree.
- The Merino Wind Farm could have a **moderate** visual impact on residents of (or visitors to) homesteads within a 10 - 20km radius of the wind turbine structures.
- There are no places of residence within a 1,000m buffer from the wind turbine structures. The significance of shadow flicker is therefore anticipated to be **low** to **negligible**.
- The anticipated night-time lighting impact is likely to be of **high** significance and may be mitigated to **moderate**, provided that *needs-based aircraft warning lights* (if permitted by the CAA and deemed feasible), is installed. If needs-based aircraft warning light are not installed the night-time lighting impact will remain high.

- The anticipated visual impact resulting from ancillary infrastructure is likely to be of **low** significance both before and after mitigation.

- The significance of the visual impacts on the sense of place within the region (i.e. beyond a 20km radius of the development and within the greater region) is expected to be of **low** significance.

- The cumulative visual impact of the proposed Merino and Angora WEFs, and the authorised Ishwati Emoyeni, Umsinde Emoyeni and Victoria West WEFs is expected to be **high**, especially the potential sequential cumulative visual impact on observers driving along the N1 national road and potentially along other arterial roads within the region. The cumulative visual impact on the RPGR (located in between the authorised Ishwati Emoyeni and proposed Merino WEFs) is likely to be of **high** significance.

The anticipated visual impacts listed above (i.e. post mitigation impacts) range from **high** to **low** significance. Anticipated visual impacts on sensitive visual receptors in close proximity to the proposed facility remain high and are not possible to mitigate. Even though it is possible that the potential visual impacts may exceed acceptable levels within the context of the receiving environment, the proposed WEF development is not considered to be fatally flawed.

A fatal flaw occurs when:

- There is non-compliance with Acts, Ordinances, By-laws and adopted policies relating to visual pollution, scenic routes, special areas or proclaimed heritage sites.

- Non-compliance with conditions of existing Records of Decision.

- Impacts that may be evaluated to be of high significance and that are considered by the **majority** of stakeholders and decision-makers to be unacceptable.[12]

In terms of the proposed wind turbine layout, the project proponent needs to adhere to all relevant National, Provincial and Local Government regulations and ordinances, including all prescribed health and safety guidelines. If these are not adhered to, the layout may be deemed non-compliant, and may need to be revised in order to ensure compliance. The author is not aware of any non-compliance and the layout is deemed acceptable within this (legal) context.

It is likely that the WEF development will be met with (largely valid) concern and potential opposition from affected land owners and tour operators within the region. The fact that the visual impact is expected to be of high significance is undisputed. However, this report cannot categorically state that any of the above conditions were transgressed, nor can it (with the information available to the VIA practitioner) be empirically determined that the *statistical majority* of objecting stakeholders were exceeded. If evidence to the contrary surfaces during the progression of the development application, this statement may need to be revised.

11. MANAGEMENT PROGRAMME

[12] Source: Oberholzer, B. 2005

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

Refer to the tables overleaf.

Table 13: Management programme – Planning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the planning of the proposed Merino Wind Farm.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Primary visual impact of the facility due to the presence of the turbines and associated infrastructure as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 5km and potentially up to 10km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Consider removing, **or relocating (set back in line with the northern most turbines**) the eight turbines located on top of the Bakenskop ridge.	Project proponent/ design consultant/ Engineering, Procurement and Construction (EPC) contractor	Early in the planning phase.
Retain and maintain natural and / or cultivated vegetation in all areas outside of the development footprint, but within the project site.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Make use of existing roads wherever possible and plan the layout and construction of roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Plan all roads, ancillary buildings and ancillary infrastructure in such a way that clearing of vegetation is minimised. Consolidate infrastructure and make use of already disturbed sites rather than undisturbed areas.	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.
Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the WEF and the ancillary infrastructure. The following is recommended: o Install aircraft warning lights that only activate when an aircraft is detected (CAA regulations/conditions permitting, and where deemed feasible). o Limit aircraft warning lights for the proposed WEF to the turbines on the perimeter, thereby reducing the overall requirement (CAA regulations/conditions permitting). o Shield the sources of light by physical barriers (walls, vegetation, or the structure itself); o Limit mounting heights of fixtures, or use foot-lights or bollard lights; o Make use of minimum lumen or wattage in fixtures; o Making use of down-lighters or shielded	Project proponent/ design consultant/ EPC contractor	Early in the planning phase.

fixtures; ○ Make use of Low Pressure Sodium lighting or other low impact lighting. ○ Make use of motion detectors on security lighting, so allowing the site to remain in darkness until lighting is required for security or maintenance purposes.		

Performance Indicator	Minimal exposure (limited or no complaints from I&APs) of ancillary infrastructure and lighting at night to observers on or near the site (i.e. within 5-10km) and within the region.
Monitoring	Not applicable.

Table 14: Management programme – Construction.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed Merino Wind Farm.	
Project Component/s	Construction site and activities
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate construction work areas.

Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Project proponent/ EPC contractor	Early in the construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Project proponent/ EPC contractor	Early in the construction phase.
Plan the placement of laydown areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Project proponent/ EPC contractor	Early in and throughout the construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	Project proponent/ EPC 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/ EPC contractor	Throughout the construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Project proponent/ EPC contractor	Throughout the construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Project proponent/ EPC contractor	Throughout the construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Project proponent/ EPC contractor	Throughout and at the end of the construction phase.

Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.
Monitoring	Monitoring of vegetation clearing during construction (by contractor as part of the construction contract). Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).

Table 15: Management programme – Operation.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed Merino Wind Farm.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Visual impact of facility degradation (including operational wind turbines) and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the turbines, servitudes and the ancillary buildings.	Project proponent/ operator	Throughout the operation phase.
Maintain roads and servitudes 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	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis (by operator).	

Table 16: Management programme – Decommissioning.

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed Merino Wind Farm.		
Project Component/s	The WEF and ancillary infrastructure (i.e. turbines, access roads, substations and workshop).	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site.	
Mitigation: Target/Objective	Only the infrastructure required for post decommissioning use of the site retained and rehabilitated vegetation in all disturbed areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site. This may include the turbines, substations, ancillary buildings, masts etc.	Project proponent/ operator	During the decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted 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	Project proponent/ operator	Post decommissioning.

required.			

Performance Indicator	Vegetation cover on and in the vicinity of the site is intact (i.e. full cover as per natural vegetation within the environment) with no evidence of degradation or erosion.
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.

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