PROPOSED BOULDERS WIND FARM, WESTERN CAPE PROVINCE

VISUAL ASSESSMENT – INPUT FOR SCOPING REPORT

Produced for:

Vredenburg Windfarm (Pty) Ltd

On behalf of:

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CONTENTS

FIGURES

MAPS

Tables

Lourens du Plessis (t/a LOGIS) is a *Professional Geographical Information Sciences (GISc) Practitioner* registered with The South African Geomatics Council (previously PLATO), and specialises in Environmental GIS and Visual Impact Assessments (VIA).

Lourens has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990. He has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His 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 2017 he worked for SMEC South Africa (Pty) Ltd as a technical specialist until he went independent and began trading as LOGIS in March 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 book 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.

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To whom it may concern

DECLARATION OF INDEPENDENCE

I, Lourens Martinus du Plessis (t/a LOGIS), hereby confirm my independence as a specialist and declare that I don't have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal relating to the proposed Boulders Wind Farm project.

I further declare that I was appointed as a Visual Impact Assessment (VIA) specialist by Savannah Environmental (Pty) Ltd and will not, other than fair remuneration for work performed, benefit from the outcome of the project decision-making.

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Lourens Martinus du Plessis

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1. INTRODUCTION

Vredenburg Windfarm (Pty) Ltd is proposing the establishment of a Wind Farm (WF) to generate approximately 140 Megawatts (MW) (contracted capacity) of renewable energy on ten properties near Vredenburg in the Saldanha Bay Local Municipal Area in the Western Cape. The project is collectively referred to as the **Boulders Wind Farm** and is situated adjacent to (predominantly north of) the existing, operational West Coast 1 WEF.

See **Map 1** for the locality of the proposed site.

A WF generates electricity by means of wind turbines that harness the wind of the area as a renewable source of energy. Wind energy generation, or wind farming as it is commonly referred to, is generally considered to be an environmentally friendly electricity generation option.

In order to optimise the use of the wind resource and the amount of power generated by the facility, the number of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography must be considered.

Vredenburg Windfarm (Pty) Ltd intends to construct up to 45 wind turbine generators (WTG) on the properties listed below:

- Boebezaks Kraal 2/40
- Boebezaks Kraal 3/40
- Boebezaks Kraal 5/40
- Frans Vlei 3/22
- Schuitjies Klip 1/22
- Schuitjies Klip 3/22
- Davids Fontyn 7/18
- Davids Fontyn 9/18
- Het Schuyte 1/21
- Uitkomst Re/6/23

Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (placed at up to 120m above ground level) and three turbine blades attached to the hub. The overall height of the wind turbines are proposed to be up to 165m in extent. Variations of the above dimensions may occur, depending on the preferred supplier or commercial availability of wind turbines at the time of construction.

A formal layout of the facility has not been finalised yet, but additional infrastructure may include the following:

- Cabling between the components;
- Internal access roads to each turbine;
- A workshop area for control, maintenance and storage;
- A Substation to facilitate the connection between the facility and the grid; and
- A 132kV transmission line.

The construction phase of the WF is dependent on the number of turbines ultimately erected and is estimated at one week per turbine. The lifespan of the facility is approximated at 20 to 25 years.

2. SCOPE OF WORK

The scope of the work includes a scoping level visual assessment of the issues related to the visual impact.

The study area for the visual assessment encompasses a geographical area of 507km² (the terrestrial extent of the maps displayed in this report) and includes a 10km buffer zone (area of potential visual influence) from the boundaries of the proposed farms identified for the wind farm development. It includes the towns of Vredenburg, Paternoster, Britannia Bay, Stompneus Bay and St. Helena Bay, sections of the R27, R45 and R399 arterial roads as well as a number of secondary (local) roads.

3. METHODOLOGY

The study was undertaken using Geographic 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 5m interval contours from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

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

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

This report (scoping report) sets out to identify the possible visual impacts related to the proposed Boulders Wind Farm from a desktop level.

4. THE AFFECTED ENVIRONMENT

The project is proposed on portions of a number of different farms with a combined surface area of approximately 51km^2. The final surface area (development footprint) to be utilised for the facility will be smaller, and will depend on the type of turbine selected, the final site layout and the placement of wind turbines and ancillary infrastructure. The site is located approximately 6km north of Vredenburg (at the closest) and immediately adjacent to the West Coast 1 WEF. Access to the site is provided by the Vredenburg to Stompneus Bay secondary road that traverses the proposed development site.

Topography, vegetation and hydrology

The study area is located on land that ranges in elevation from sea level at the coast to approximately 270m above sea level at the top of the hills. The dominant topographical unit or terrain type of the study area is *moderately undulating plains* to the west and *plains* to the east. A number of rolling hills

occur within the area, with the *Patrysberg*, adjacent to the R399 being the largest of these. Other smaller hills include the *Klipheuwel* and the *Kasteelberg*.

The farms comprising the proposed WF lie within four vegetation types namely; *Langebaan Dune Strandveld*, *Saldanha Limestone Strandveld*, *Saldanha Granite Strandveld,* and *Saldanha Flats Strandveld*. These vegetation types are all considered to be *endangered* except for the *Langebaan Dune Strandveld* which has a conservation status of v*ulnerable*. It should be noted, however, that the farms have all been heavily transformed by agricultural activities.

Land cover within the study area is dominated by *low shrubland and fynbos* and *cultivated land / agricultural fields.*

The most prominent terrestrial hydrological feature is the Berg River mouth (at Port Owen/Veldrif) that is situated in the north-eastern corner of the study area. A number of smaller drainage systems, wetlands and man-made dams are evident within the central study area. Refer to **Maps 1** and **2** for the topography and land cover maps of the study area.

Land use and settlement patterns

The study area has a rural character with very few built structures outside of the previously mentioned town boundaries. Exceptions occur at the West Coast 1 WEF, where 47 wind turbines are operational and clearly noticeable.

Wheat and maize farming dominate the general land-use character of this relatively arid region with a rainfall of less than 500mm per annum.

The region has a population density of approximately 65 people per km^2 with the highest concentrations occurring in the towns of Vredenburg and Port Owen. A number of smaller towns occur along the Atlantic seaboard. These towns (Paternoster, Britannia Bay, Stompneus Bay, St. Helena Bay, etc.) are popular tourist destinations due to their close proximity to the ocean and their distinct West Coast character.

There are a number of farm residences (farmsteads) scattered throughout the study area. Some of these in closer proximity to the proposed WF include:

- Klein Waterklip
- Heuningklip
- Waterklip
- Die Krans
- Nieuwe Rust
- Sandfontein
- Koeltebaai
- Trekoskraal
- Besterskraal
- Noodhulp
- Pelgrimsrust
- Uitkomst
- Rooiheuwel
- Langklip
- Skuitjiesklip
- Swartrug
- Morkelsdam
- Rondekop
- Korhaanvlei
- Koringhuis

- Uitvlugt
- Blaauwberg
- Langklip
- Droëdasvlei
- Soutsakfontein
- Katzenberg
- Droëvlei
- Klipheuwel
- Boebezakskraal
- Kaalberg
- Fransvlei
- Klippiesvlei
- Skuitjies

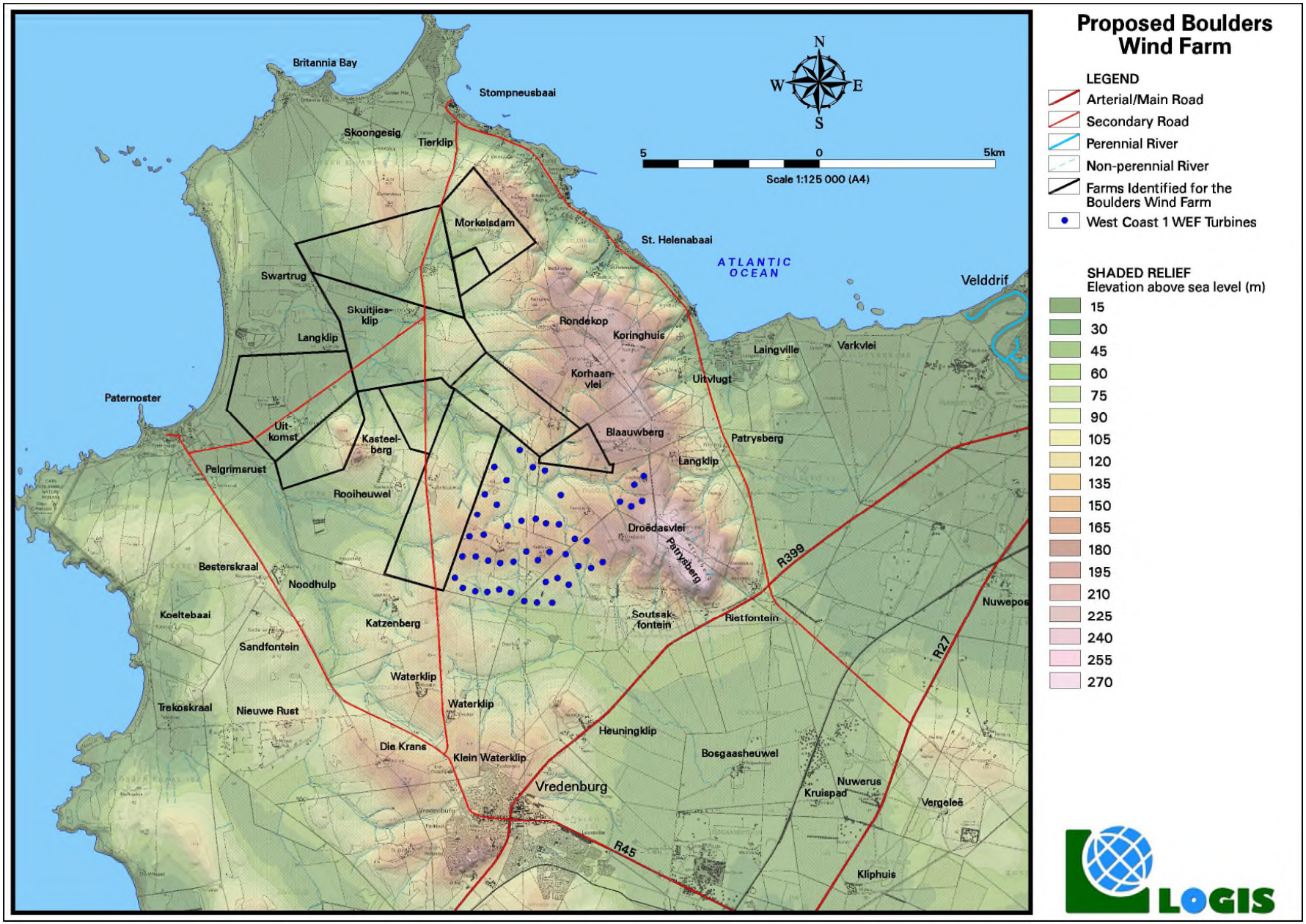
Formal conservation areas in the region include the Cape Columbine Nature Reserve to the west of Paternoster and the Paternoster Rock Island Reserve to the north. Both reserves are located at distances exceeding 10km from the proposed Boulders Wind Farm project site.

Figure 1: West Coast 1 wind turbines as seen from the Vredenburg to Stompneus Bay secondary road.

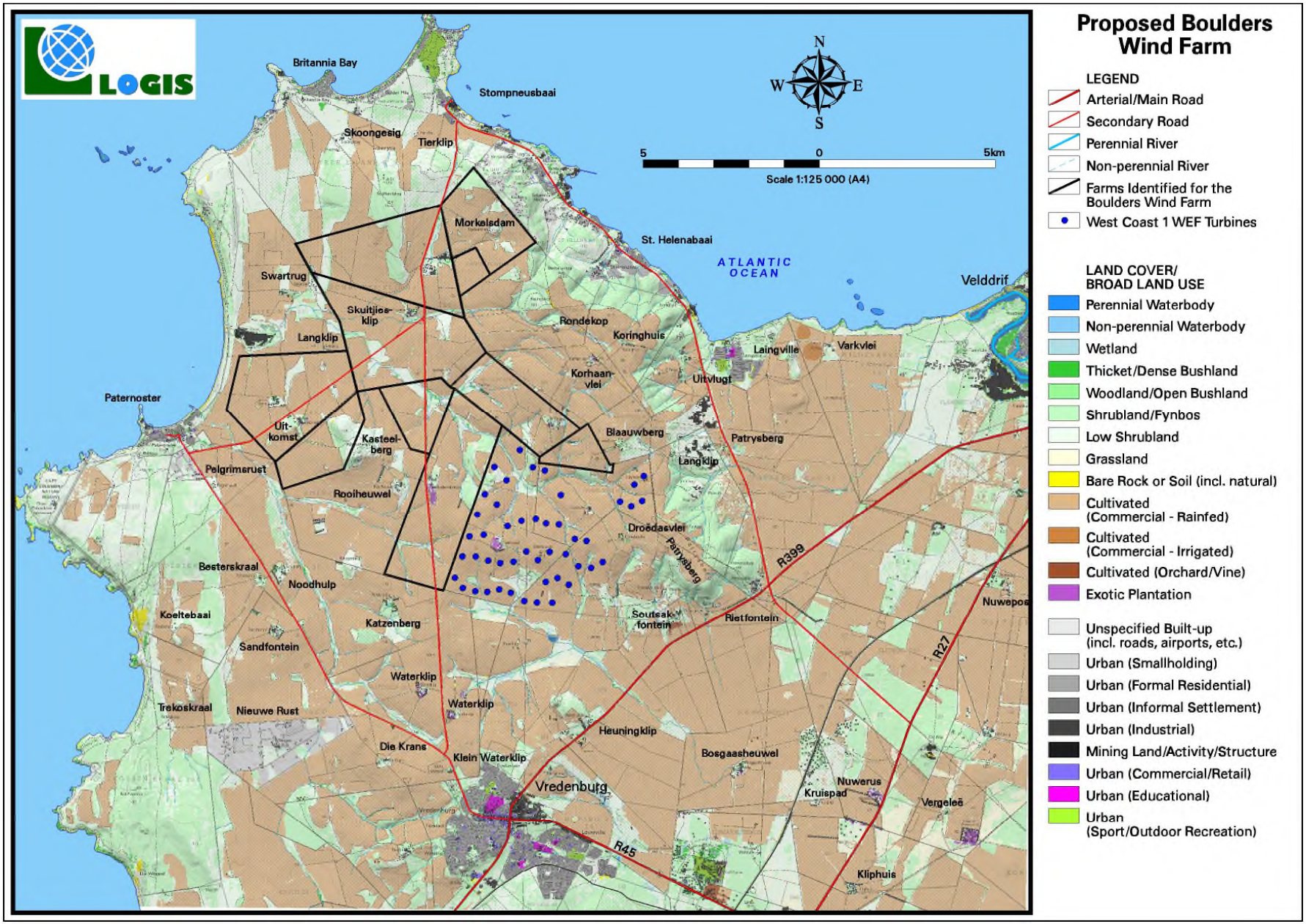
Figure 2: Patrysberg as seen from the R399 arterial road.

Figure 3: Photograph depicting the rural land-use character of the area surrounding the proposed WF.

Sources: DEA (ENPAT Western Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2013-14 (DEA).



Map 1: Shaded relief map of the study area.



Map 2: Land cover and broad land use patterns.

5. VISUAL EXPOSURE/VISIBILITY

The result of the preliminary viewshed analyses for the proposed facility is shown on the map below (**Map 3**). The initial viewshed analyses were undertaken from 45 vantage points within the proposed development area at an offset of 120m above ground level (the hub-height of the wind turbines). This was done in order to determine the general visual exposure (visibility) of the area under investigation, simulating the maximum height of the proposed structures associated with the facility.

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

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

The viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed WF, therefore signifying a worst-case scenario.

Results

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 Boulders Wind Farm, whilst lower lying areas such as valleys is shielded, or not as exposed.

It is expected that the wind turbines will be exposed to observers travelling along the arterial (R399) and secondary roads within the study area, as well as from Paternoster, Kalkoond and farm residences (homesteads) within the region.

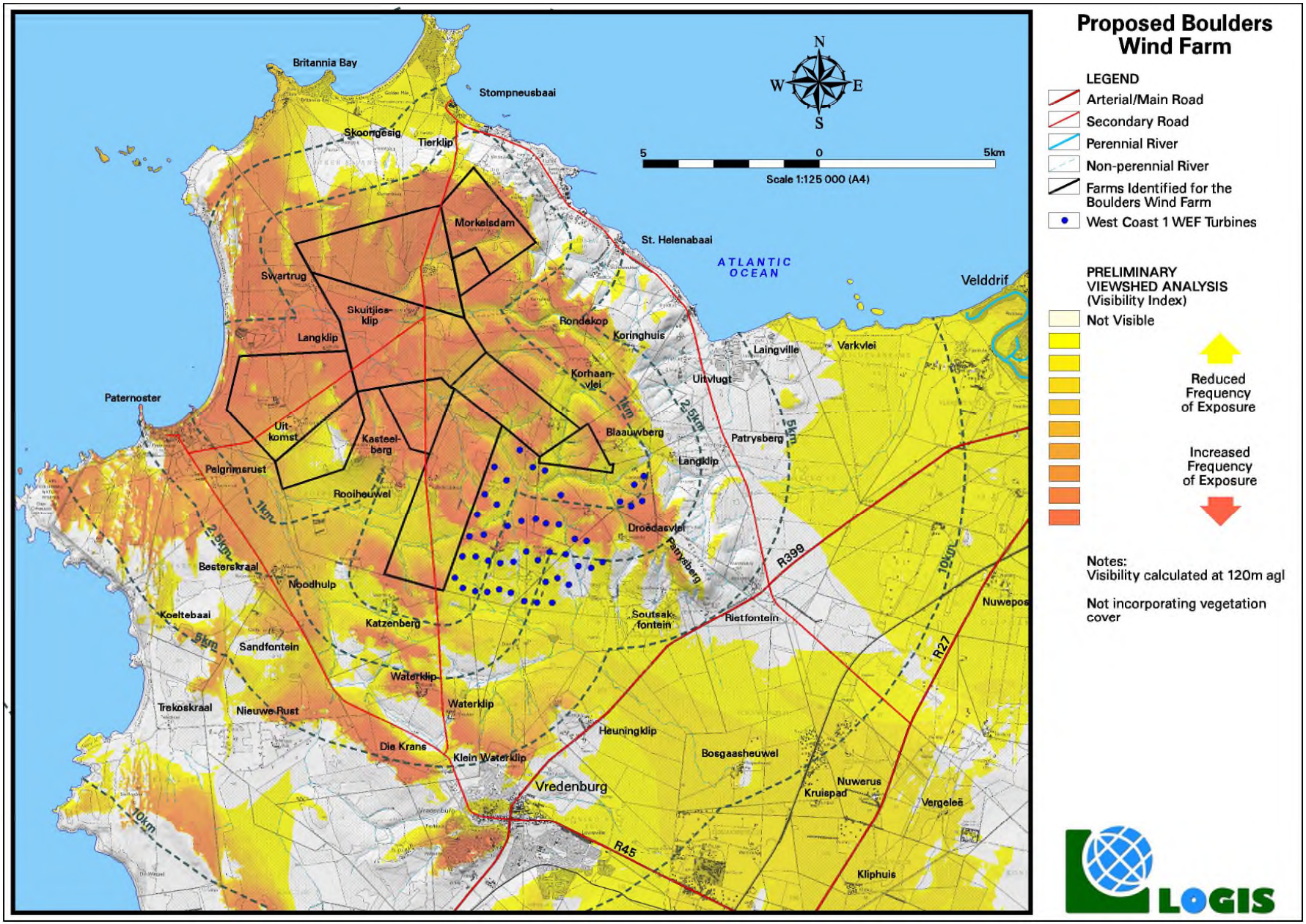
Towns, homesteads and roads expected to be visually influenced include:

- Kalkoond
- Paternoster
- Pelgrimsrust
- Kaalberg
- Morkelsdam
- Swartrug
- Uitkomst
- Besterskraal
- Noodhulp
- Sandfontein
- Nieuwe Rust
- Waterklip
- Droëvlei
- Skuitjiesklip
- Langklip
- Klipheuwel
- Fransvlei
- Droëdasvlei
- Klippiesvlei
- Langklip

- Korhaanvlei
- Rondekop
- Rooiheuwel
- Boebezakskraal
- Katzenberg
- Skuitjies
- Blauwberg
- R399 Arterial Road
- Paternoster-Stompneus Bay Road
- Vredenburg-Paternoster Road
- Vredenburg-Stompneus Bay Road

Conclusion

It is envisaged that the structures, where visible from shorter distances (e.g. less than 5km), may constitute a high visual prominence, potentially resulting in a high visual impact.



Map 3: Map indicating the potential (preliminary) visual exposure of the proposed facility.

6. ANTICIPATED ISSUES RELATED TO THE VISUAL IMPACT

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

- The visibility of the facility from, and potential visual impact on observers travelling along the arterial (R27, R45 and R399) and secondary (local) roads within the study area.

- The visibility of the facility from, and potential visual impact on built-up centres and populated places (i.e. the towns of Vredenburg, Paternoster, Britannia Bay, Stompneus Bay, St Helena Bay, Laingville and Velddrif) 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 pastoral landscape and small coastal towns (tourist attractions).

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

- The potential visual impact of lighting of the facility in terms of light glare, light trespass and sky glow.

- The potential visual impact of shadow flicker.

- The potential cumulative visual impact of the proposed WF and associated infrastructure in context of the authorised West Coast 1 WEF.

- Potential visual impacts associated with the construction phase.

It is envisaged that the issues listed above may constitute a visual impact at a local and/or regional scale.

Table 1: Impact table summarising the potential primary visual impacts associated with the Boulders Wind farm.

Impact

Visual impact of the wind farm on observers in close proximity to the proposed wind turbine structures. Potential sensitive visual receptors include:

- Observers travelling along roads
- Residents of towns and homesteads
- Visitors at holiday destinations

Issue	Nature of Impact	Extent of Impact	No-Go Areas
The viewing of the wind turbine structures	The potential negative experience of viewing wind turbine structures	Observers situated within a 0-5km radius of the wind turbine structures	No turbines must be located on or near Kasteelberg

Description of expected significance of impact

Extent: Local
Duration: Long term
Magnitude: very high
Probability: Highly probable
Significance: High
Status (positive, neutral or negative): Negative
Reversibility: Recoverable
Irreplaceable loss of resources: No
Can impacts be mitigated: No

Gaps in knowledge & recommendations for further study

A layout of the wind turbine positions and turbine dimensions are required for further analysis.

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

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

Additional activities:

- Identify potential cumulative visual impacts
- Undertake a site visit
- Create photo-simulations of the proposed structures
- Recommend mitigation measures and/or infrastructure placement alternatives

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

7. CONCLUSION AND RECOMMENDATIONS

The construction and operation of the proposed Boulders Wind Farm may have a visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 5km radius of the facility.

Visual receptors include people travelling along roads and residing in towns and tourists visiting holiday destinations in the region.

The area potentially affected by the proposed development is generally seen as having a high tourism value and tourism potential based on the presence of well-known holiday towns (i.e. Paternoster, Britannia Bay, Stompneus Bay and St. Helena Bay) and tourist access routes (i.e. the R27, R45 and R399).

Furthermore, the pastoral landscape is considered to have a pleasing sense of place based on the aesthetic quality of the receiving environment.

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

Specific spatial criteria need to be applied to the visual exposure of the proposed facility in order to successfully determine visual impact and ultimately the significance of the visual impact. In addition, photo simulations of critical viewpoints should be undertaken where required, in order to aid in the visualisation of the envisaged visual impact.

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

- **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 a 5m contour interval digital terrain model of the study area.

The first step in determining the significance of 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 must be 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 attention on areas were the perceived visual impact of the facility will be the highest and where the perception of affected observers will be negative.

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

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

This is the capacity of the receiving environment to absorb the potential visual impact of the proposed 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 discernable 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 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 layout 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 the VIA report.

- **Site visit and photo simulations**

Photographs from strategic viewpoints will be used to simulate a realistic post construction view of the WF. This will aid in visualising the perceived visual impact of the proposed WF and place it in spatial context.

8. REFERENCES/DATA SOURCES

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