

PROPOSED PROJECT BLUE WIND ENERGY FACILITY
IN THE NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

Produced for:
WWK Development (Pty) Ltd



Produced by:

MetroGIS (Pty) Ltd.
PO Box 384, La Montagne, 0184
Tel: (012) 349 2884/5 Fax: (012) 349 2880
E-mail: lourens@metrogis.co.za Web: www.metrogis.co.za



On behalf of:

Savannah Environmental (Pty) Ltd.
PO Box 148, Sunninghill, 2157
Tel: (011) 234 6621 Fax: 086 684 0547
E-mail: info@savannahSA.co.za Web: www.savannahSA.com



- October 2011 -

CONTENTS

1.	INTRODUCTION	2
2.	SCOPE OF WORK	4
3.	METHODOLOGY	4
4.	THE AFFECTED ENVIRONMENT	5
5.	POTENTIAL VISUAL EXPOSURE	11
6.	ANTICIPATED ISSUES RELATED TO VISUAL IMPACT	13
7.	CONCLUSIONS AND RECOMMENDATIONS	13
8.	REFERENCES/DATA SOURCES	16

MAPS

- Map 1:** Shaded relief map (indicating the location of the proposed facility and the topography and elevation above sea level) of the study area.
- Map 2:** Land cover / land use map of the study area.
- Map 3:** Potential visual exposure of the proposed facility.

FIGURES

- Figure 1:** Illustration of the main components of a wind turbine.
- Figure 2:** The R355 approaching Kleinsee with 220kV power lines crossing the road (in the vicinity of the Gromis Substation).
- Figure 3:** Typical visual quality of vegetation and topography within the study area (north of Kelinzee).
- Figure 4:** Visual quality of the receiving environment east of Kleinsee (overlooking the Buffels River valley in the middle distance).
- Figure 5:** Outskirts of the town of Kleinsee (from the R355).
- Figure 6:** Typical visual quality of the mining areas (to the south of Kleinsee).

MetroGIS (Pty) Ltd, specialising in visual assessment and Geographic Information Systems, undertook this visual assessment in collaboration with V&L Landscape Architects CC.

Lourens du Plessis, the lead practitioner undertaking the assessment, has been involved in the application of Geographical Information Systems (GIS) in Environmental Planning and Management since 1990.

The team undertaking the visual assessment has extensive practical knowledge in spatial analysis, environmental modeling and digital mapping, and applies this knowledge in various scientific fields and disciplines. The expertise of these practitioners is often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

The visual assessment team 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.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the visual impact assessment for the Proposed Project Blue Wind Energy Facility in the Northern Cape Province. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

1. INTRODUCTION

WWK Development (Pty) Ltd (WWK) is proposing the establishment of a commercial Wind Energy Facility (WEF) and associated infrastructure on a site north of Kleinsee, within the Nama Khoi Local Municipality of the Northern Cape Province. The site is located within a De Beers mining area.

A WEF 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 considered to be an environmentally friendly electricity generation option.

The effectiveness of the WEF, or amount of power generated by the facility, is dependent on the number of wind turbines erected in the area as well as the careful placement of the turbines in relation to the topography and each other in order to optimise the use of the wind resource.

WWK intends to construct up to 75 wind turbines over an area of approximately 33km² in extent. The facility will ultimately have a generating capacity of approximately 150MW.

The project will be undertaken in phases. Phase 1 will have a generating capacity of 20MW, phases 2 and 3, to be undertaken at a later stage will bring the capacity up to 150MW.

A locality map indicating the position and layout of the proposed WEF site, as well as the proposed phasing, is shown on **Map 1**.

The overall aim of the design and layout of the facility is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts.

The identified site is regarded as favourable due to the wind resource and proximity to a suitable electricity connection point. In addition, some parts of the site and surrounds are already disturbed due to mining activity.

The proposed site for the wind energy facility has been determined in consultation with the affected landowner (i.e. De Beers), and has taken cognisance of the current and proposed mining plans for the area.

Each turbine will have a capacity of up to 3MW and will consist of a concrete foundation, a steel tower and nacelle (with a maximum hub height of 120m), and a rotor (up to 125m diameter, consisting of 3 blades of up to 60m in length). The rotational power generated by the turbine blades is transmitted to the generator housed within the nacelle via a gearbox and drive train. Refer to **Figure 1**.

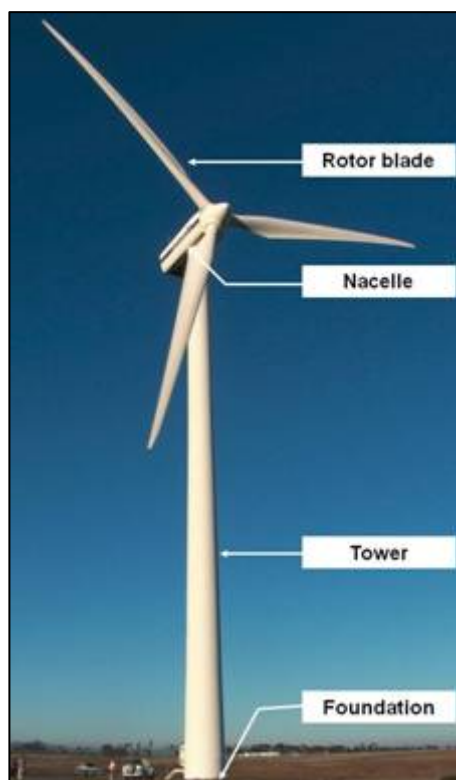


Figure 1: Illustration of the main components of a wind turbine¹

Ancillary infrastructure will include the following:

- Concrete foundations to support the turbines;
- Cabling between the turbines to be lain underground where practical, which will connect to an on-site substation;
- A 33/66 kV substation located within the wind energy facility. A high-voltage (HV) yard footprint of approximately 80m x 90m is proposed;
- An overhead power line (66/132kV) feeding into Eskom's electricity grid at the Gromis Substation, located to the immediate east of the site;

¹ Illustration courtesy of Savannah Environmental.

- Internal access roads (approximately 6 m in width) linking the wind turbines and other infrastructure on the site. Existing roads will be used as far as possible;
- An office / workshop building for maintenance and storage.

It is expected, from a visual impact perspective, that the wind turbines would constitute the highest potential visual impact of the WEF.

Complete turbine erection and commissioning is typically one tower per week. A facility consisting of 75 turbines will therefore take approximately 1,5 years to construct and commission and will require a small workforce comprising low, semi skilled and highly skilled staff. The operational phase is estimated at approximately 20 years. Each turbine is designed to operate continuously and with low maintenance.

2. SCOPE OF WORK

The project is proposed on the following farm portions:

- Klein Zee Re/193;
- Predikant Vlei 1/190;
- Predikant Vlei 3/190;
- Predikant Vlei 4/190;
- Dikgat 2/195;
- Dikgat 4/195;
- Dikgat 5/195;
- Dikgat 7/195;
- Dikgat 9/195; and
- Dreyers Pan Re/192.

The scope of work for the proposed facility includes a scoping level visual assessment of the issues related to the visual impact. The scoping phase is the process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment.

The main purpose is to focus the impact assessment on a manageable number of important questions on which decision-making is expected to focus and to ensure that only key issues and reasonable alternatives are examined.

The study area for the visual assessment encompasses a geographical area of approximately 2040km² (the extent of the maps displayed below) and includes a minimum 20km buffer zone from the proposed development area.

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 20m interval contours supplied by the Surveyor General.

The procedure utilised to identify issues related to the visual impact includes the following activities:

- The creation of a detailed digital terrain model (DTM) of the potentially affected environment.

- The sourcing of relevant spatial data. This includes 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 development area 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 facility.

6. THE AFFECTED ENVIRONMENT

Regionally, the proposed WEF site is located less than 5km north of Kleinsee. The properties lie along the coastline with the proposed WEF located less than 5km from the shore.

The study area occurs on land that ranges in elevation from 0m a.s.l. (along the coast) to about 575m a.s.l. (at the top of hills in the north). The non-perennial, westward flowing Buffels and Kwaganap Rivers (and their tributaries) are the main hydrological features within the study area. The Buffels River bypasses the site to the south and the Kwaganap to the north.

The terrain surrounding the proposed site is generally flat, sloping gently westwards towards the shore. The terrain type of the region is described as *slightly undulating plains*. Hilly terrain is evident in the north of the study area. These mountains mark the beginning of the escarpment which rises to the east. Refer to **Map 1**.

Land use is largely unspecified within the study area, and extensive surface based mining takes place along the coastline in the vicinity of, and north of Kleinsee.

The small town of Kleinsee represents the only populated place within the study area. Large parts of the region are mine-owned, and as a result, significant mining activities are evident, especially within a 7km band along the coast.

The region has a very low population density of 0,9 people per km².

Roads include the R355 arterial route (to Springbok) and a number of lower order secondary roads extending to the north and south from Kleinsee.

Other than the mining activity, industrial infrastructure within the region includes a network of distribution power lines leading into and from Kleinsee and the Gromis Transmission Substation.

The desert climate of the study area is dry, receiving between 28mm and 123mm of rainfall per annum. Land cover is primarily *shrubland* with localised areas of natural *exposed rock and sand* and *degraded land*. The vegetation type is *Strandveld of the West Coast*.



Figure 2: The R355 approaching Kleinsee with 220kV power lines crossing the road (in the vicinity of the Gromis Substation).



Figure 3: Typical visual quality of vegetation and topography within the study area (north of Kleinsee).



Figure 4: Visual quality of the receiving environment east of Kleinsee (overlooking the Buffels River valley in the middle distance).



Figure 5: Outskirts of the town of Kleinsee (from the R355).



Figure 6: Typical visual quality of the mining areas (to the south of Kleinsee).

The greater region beyond the study area is generally seen as having a high scenic value and high tourism value. It is well known for its scenic natural beauty (West Coast as a whole) and annual wild flower displays (Namaqualand)².

In addition to its function as a primary access route linking Kleinsee with the N7, the R355 is a scenic route, especially as it descends through the mountains of the escarpment (in the east, just beyond the study area). This road thus carries both commuters and tourists.

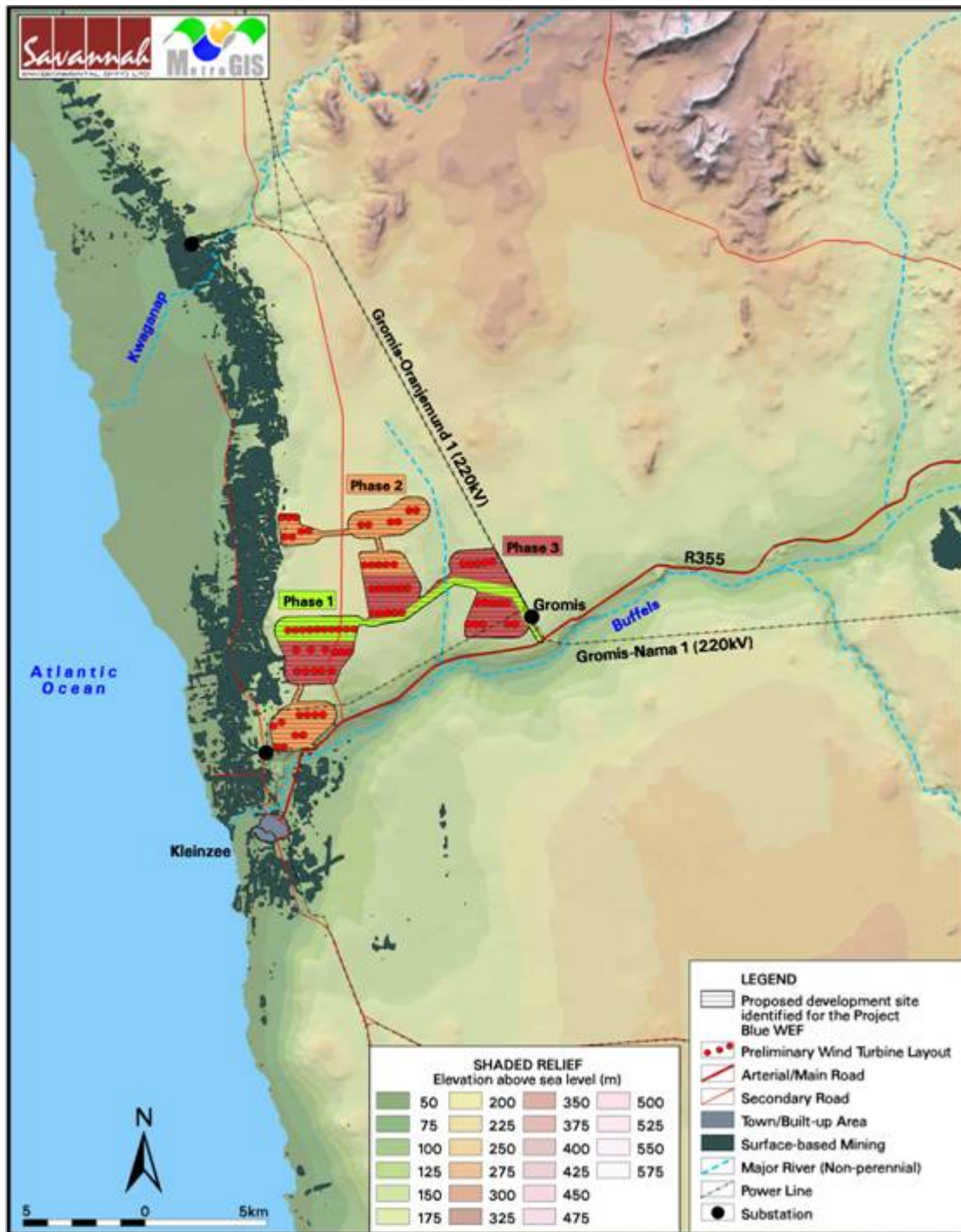
During the flower season, the secondary roads in the region are also utilised by tourists as scenic drives.

Large tracts of land within the study area remain in an undisturbed and natural state with some areas maintaining a virtually pristine condition. This is due mainly to the low population density of the area and the relative remoteness and inaccessibility of the terrain.

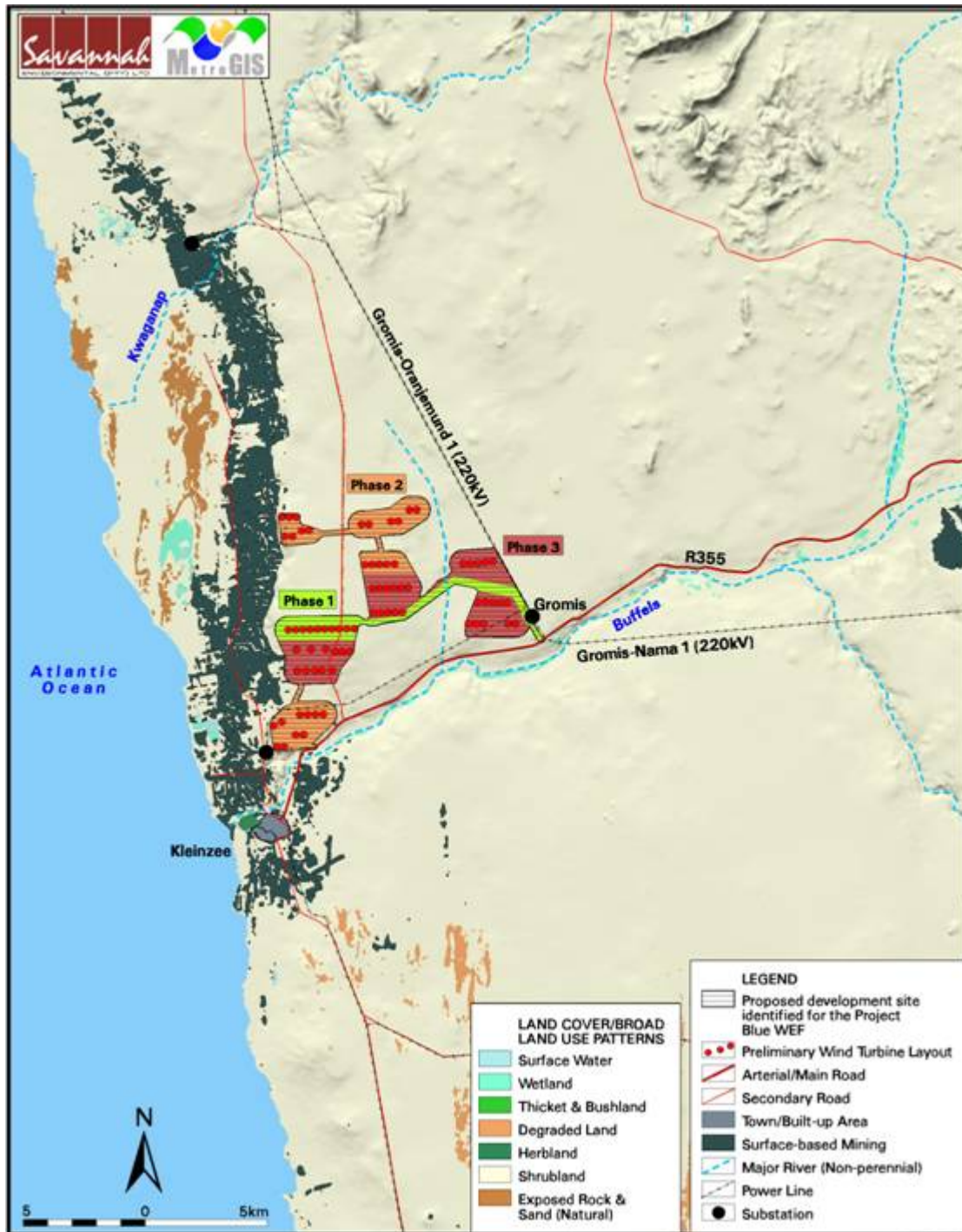
Within this scenic context, it is of relevance that the mining areas along the coastline are significantly disturbed and visually apparent due to the scale and nature of the surface based mining.

Sources: DEAT (ENPAT Northern Cape), NBI (Vegetation Map of South Africa, Lesotho and Swaziland) and NLC2000 (ARC/CSIR).

² Namaqualand stretches from the small town of Garies in the south to the Orange River to the north, its western border is the wild Atlantic coast, the remote town of Pofadder marks the eastern border (<http://www.discoverthecape.com/namaqualand/flower-route.html>)



Map 1: Shaded relief map (indicating the location of the proposed facility and the topography and elevation above sea level) of the study area.



Map 2: Land cover / land use map of the study area.

5. POTENTIAL VISUAL EXPOSURE

The result of the preliminary viewshed analyses for the proposed facility is shown on **Map 3**. The initial viewshed analysis was undertaken from 75 vantage points within the proposed development area (i.e. the positions of the proposed turbines) at offsets of 120m above average ground level (i.e. the approximate hub height of the proposed wind turbines).

This was done to determine the general visual exposure of the area under investigation, simulating the proposed structures associated with the facility. It must be noted that the viewshed analysis does not include the effect of vegetation cover or existing structures on the exposure of the proposed wind turbines, therefore signifying a worst-case scenario.

Map 3 indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible as well as proximity offsets from the proposed development area. The following is evident from the viewshed analyses:

- The proposed facility will have a core area of potential visual exposure on the WEF site itself, and within a 5km offset. Almost the entire area within 5km will be visually exposed to the WEF.

This core area includes the entire town of Kleinsee, the R355 and all the secondary roads leading north and south from Kleinsee.

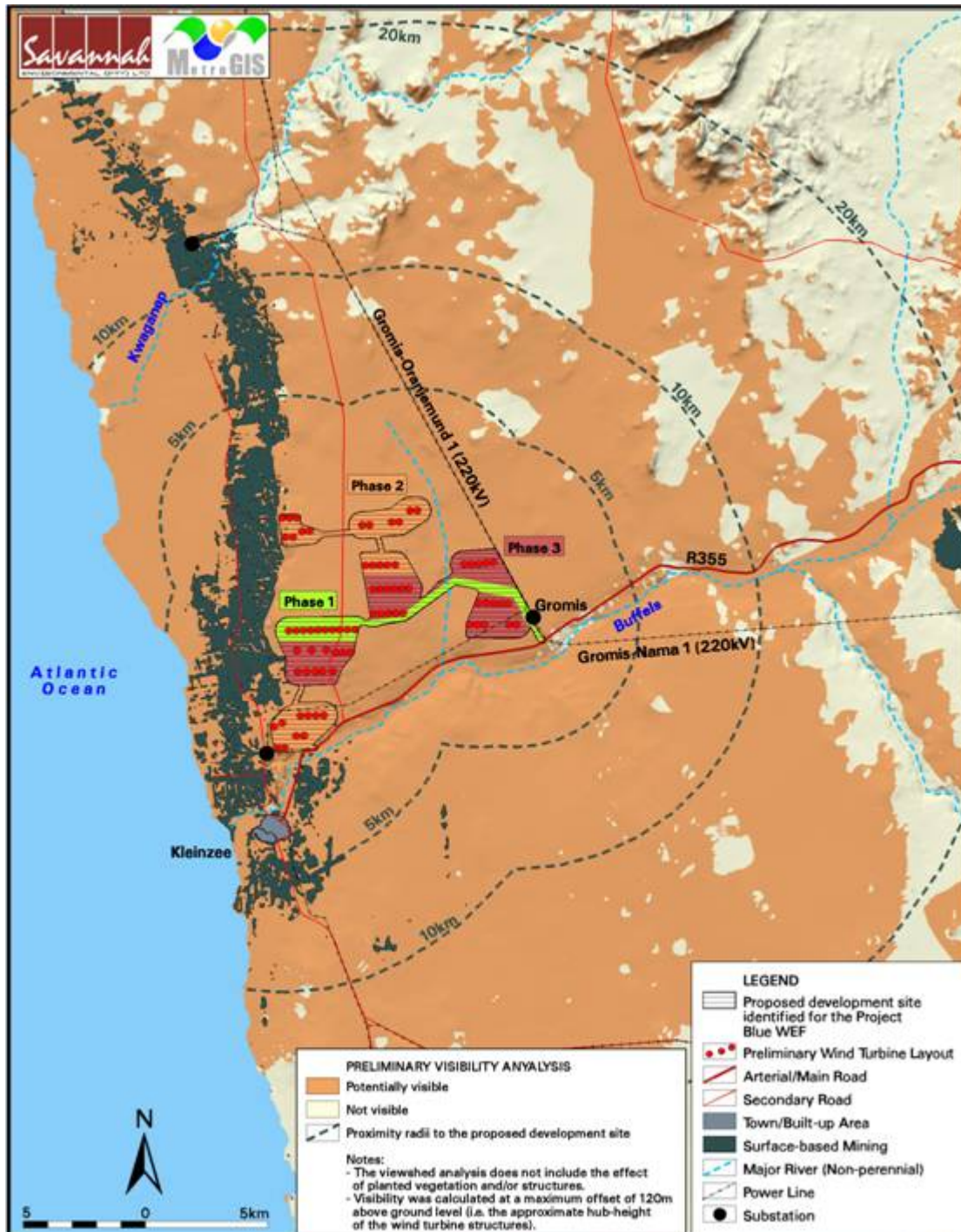
- Potential visual exposure remains high in the medium distance (i.e. between 5 and 10km). Some visually screened areas occurring as a result of local topography (i.e. local hills) to the east and north east of the site.

Receptors likely to be visually exposed include the users of the R355 and secondary roads.

- In the longer distance (i.e. between 10km and 20km), potential visual exposure is reduced, with significant visually protected areas evident in the north east, east and south east.

The visually exposed areas include limited sections of the R355, and the secondary roads running to the north and south along the coast.

It is envisaged that the turbine structures would be highly visible to limited numbers of observers (i.e. people travelling along roads and residing in Kleinsee) and would constitute a high visual prominence, especially within a 10km radius, potentially resulting in visual impact.



Map 3: Potential visual exposure of the proposed facility.
(Note: the visible area indicates areas from which any number of wind turbines (with a minimum of one turbine) may be visible.)

6. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

Anticipated issues related to the potential visual impact of the proposed Project Blue WEF include the following:

- The visibility of the facility to, and potential visual impact on, observers travelling along arterial (i.e. R355) and secondary roads in close proximity to the proposed WEF and within the region.
- The visibility of the facility to, and potential visual impact on, the town of Kleinsee in close proximity to the proposed WEF.
- The potential visual impact of the facility on the visual character of the landscape and sense of place of the region and the scenic Northern Cape.
- The potential visual impact of the facility on tourist access routes (i.e. the R355), scenic drives (i.e. secondary roads) and tourist destinations within the region.
- The potential visual impact of ancillary infrastructure (i.e. the substation, the overhead power line, the internal access roads and the office / workshop) on observers in close proximity to the facility and/ or associated infrastructure.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers in close proximity to the facility.
- Potential visual impacts associated with the construction phase on observers in close proximity to the facility and the power line.
- Potential cumulative visual impacts of the WEF and associated infrastructure.
- Potential residual visual impacts after the decommissioning of the facility.
- 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.

These anticipated visual impacts should be assessed in greater detail during the EIA phase of the project as this report is only focussed on defining the potential visual exposure of the proposed development and identifying the potential issues associated with the visibility of the development.

Of relevance is that the visual character of the study area has been impacted upon to some extent due to surface based mining and associated mining infrastructure. This existing visual context will be taken into consideration during the assessment of the anticipated visual impacts, which will follow in the EIA phase.

7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the proposed Project Blue WEF may have a visual impact on a very limited number of potentially sensitive visual receptors especially within (but not restricted to) a 10km radius of the facility.

Parts of the area potentially affected by the proposed development (i.e. that outside of the mining areas) is generally seen as having a high scenic and tourism value, based on the scenic West Coast environment and the annual Namaqualand Flower displays.

It is therefore recommended that the severity of the potential visual impact on sensitive receptors be assessed in further detail in the EIA. Additional spatial analyses must be undertaken in order to create a visual impact index that will further aid in determining potential 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 Phase of reporting for this proposed project. In this respect, the Plan of Study for EIA is as follows:

- **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 the turbine structures.

Proximity radii for the proposed development site 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.

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure). MetroGIS developed this methodology in the absence of any known and / or acceptable standards for South African wind energy facilities.

The proximity radii (calculated from the boundary lines of the farm selected for the facility) are as follows:

- 0 - 5km. Short distance view where the facility would dominate the frame of vision and constitute a very high visual prominence.
- 5 - 10km. Medium distance view where the structures would be easily and comfortably visible and constitute a high visual prominence.
- 10 - 20km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and recognisable. This zone constitutes a medium visual prominence.
- Greater than 20km. Long distance view of the facility where the facility could potentially still be visible, though not as easily recognisable. This zone constitutes a medium to low visual prominence for the facility.

- **Determine 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, then there would be no visual impact. If the visual perception of the structure is favourable to all the observers, then the visual impact would be positive.

It is therefore necessary to identify areas of high viewer incidence and to classify certain areas according to the observer's visual sensitivity towards the proposed facility 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, and purpose of sighting which would create a myriad of options.

- **Determine the Visual Absorption Capacity of the landscape**

This is the capacity of the receiving environment to absorb or screen 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.

The digital terrain model utilised in the calculation of the visual exposure of the facility does not incorporate the potential visual absorption capacity (VAC) of the region. It is therefore necessary to determine the VAC by means of the interpretation of the natural visual characteristics, supplemented with field observations.

- **Determine the Visual Impact Index**

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

The above exercise should be undertaken for the core wind energy facility as well as the ancillary infrastructure, as these structures (i.e. the substation, the overhead power line, the internal access roads, and the office / workshop) 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.

In addition, cumulative visual impact should be addressed, as well as suggested mitigation measures for all identified impacts (if any).

8. REFERENCES/DATA SOURCES

Chief Director of Surveys and Mapping, varying dates. *1:50 000 Topo-cadastral maps and digital data.*

CSIR/ARC, 2000. *National Land-cover Database 2000 (NLC 2000)*

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

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

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