UYEKRAAL WIND ENERGY FACILITY

VISUAL ASSESSMENT - INPUT FOR SCOPING REPORT

Produced for:

Creative-Renewable-Energy-Solutions (Pty) Ltd (Crenersol)

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: karen@savannahSA.co.za Web: www.savannahSA.com

- November 2010 -

CONTENTS

MAPS

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 Uyekraal Wind Energy Facility. Neither the author, MetroGIS or V&L Landscape Architects will benefit from the outcome of the project decision-making.

1. INTRODUCTION

Creative-Renewable-Energy-Solutions (Pty) Ltd (Crenersol) is proposing the establishment of a Wind Energy Facility (WEF) about 10 km southeast of Vredenburg. This area lies within the West Coast District of the Western Cape.

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 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.

Crenersol intends to construct up to 22 wind turbines over an identified area of approximately 541 ha. The proposed facility would have a generating capacity of approximately 66 MW.

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

- A substation,
- A 132kV power line linking to the transmission grid at Eskom's existing Blouwater substation,
- Access roads and
- Maintenance / control buildings.

Each turbine is expected to consist of a concrete foundation, a steel tower, a hub and three blades attached to the hub. The height of the turbines, including the rotor blades, is estimated to be 170m.

The construction phase of the WEF is dependent on the number of turbines erected and is estimated at one week per turbine. The lifespan of the facility is approximated at 20 to 30 years.

2. SCOPE OF WORK

The scope of work for the WEF project 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 2584km² (the extent of the maps displayed below) and includes a minimum 20km buffer zone from the proposed development area.

The broader study area includes towns and built up areas, farms and homesteads, a number of mining and industrial land uses and an air force base. Other industrial infrastructure includes several transmission and distribution power lines as well as a number of distribution substations.

Arterial roads that traverse the area include the R399 to the west of the site, the R45 just north of the site and the R27 to the immediate east of the site, running in a north south direction. A number of secondary roads form links between these arterials.

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 WEF.

4. ANTICIPATED ISSUES RELATED TO VISUAL IMPACT

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

- The visibility of the facility to, and potential visual impact on, observers travelling along the arterial and secondary roads within the study area.
- The visibility of the WEF to, and visual impact on built-up centres and populated places (i.e. the towns of Vredenburg, Langebaan and Saldanha.
- The visibility of the WEF to, and visual impact on farmsteads and homesteads within the study area.
- The visibility of the WEF to, and visual impact on protected and conservation areas and their buffer zones. Protected areas situated within close proximity of the site include the West Coast National Park (located approximately 8km away) and its associated viewshed protection zone (located immediately to the south), the Langebaan Lagoon Ramsar Site (located approximately 10km away) and the Benede Bergrivier Conservancy (located approximately 14km away). These areas all form part of the greater West Coast Biosphere Reserve (i.e. they lie within the core, buffer or transition zones).
- The potential impact of the facility on the visual character or sense of place of the region, with specific reference to the tourist routes (R45, R399 and R27) and tourist destinations (i.e. Langebaan and the lagoon).
- The potential visual impact of the construction of ancillary infrastructure (i.e. the substation at the facility, associated power lines, internal access roads etc.) on observers in close proximity of the facility.
- The visual absorption capacity of the natural vegetation (if applicable).
- Potential cumulative visual impacts.
- 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. This only occurs when the sky is clear, and when the 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, a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.
- 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.

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.

5. THE AFFECTED ENVIRONMENT

The proposed area for the development of the Wind Energy Facility includes Portion 4 of the Farm Langeberg 187 and Portion 1 of the Farm Uyekraal 189.

The proposed development site encompasses a surface area of approximately 541 ha. The final surface area to be utilised for the WEF may be smaller, depending on the final site layout and the placement of the wind turbines and ancillary infrastructure.

Regionally, these farms are located some about 10km southeast of Vredenburg, 10km east of Saldanha and 10km north of Langebaan, within the Western Cape Province. The site is located on the coastal plain, near to the natural port of Saldanha Bay, as well as the Langebaan Lagoon.

The dominant topographical unit or terrain type is primarily *plains* in the central study area and *moderately undulating plains* in the north west and in the south.

The Berg River flows through the broader region for a short distance in the far north east. Refer to **Map 1**.

With its typical mediterranean climate, the study area receives less than 350mm of rainfall per annum.

Agricultural land (mainly wheat) dominates the land-use character in the central and northern part of the study area, while conservation prevails in the far west, the south and the south east. Isolated patches also occur in the central and north eastern study area. The conservation or natural areas comprise of a mix of *Thicket, bushland, bush clumps and high fynbos* and *Shrubland and low fynbos.*

The site itself is used for cattle farming.

Besides the urban centres, other significant land uses are industry and mining, including the EXXARO Namaqua Sands smelter and the MITTAL Saldanha Steel smelter to the immediate west of the site. The Saldanha Oil & Gas terminals lie to the south of the site and several electrical transmission and distribution power lines and a number of distribution substations lie in close proximity (i.e. within 5km) of the proposed WEF. In addition, the Langebaanweg Airforce Base is located some 5km east of the site. Refer to **Map 2**.

In terms of long term planning, an Industrial Development Zone (IDZ) is planned about 3 km to the northwest of the wind farm area.

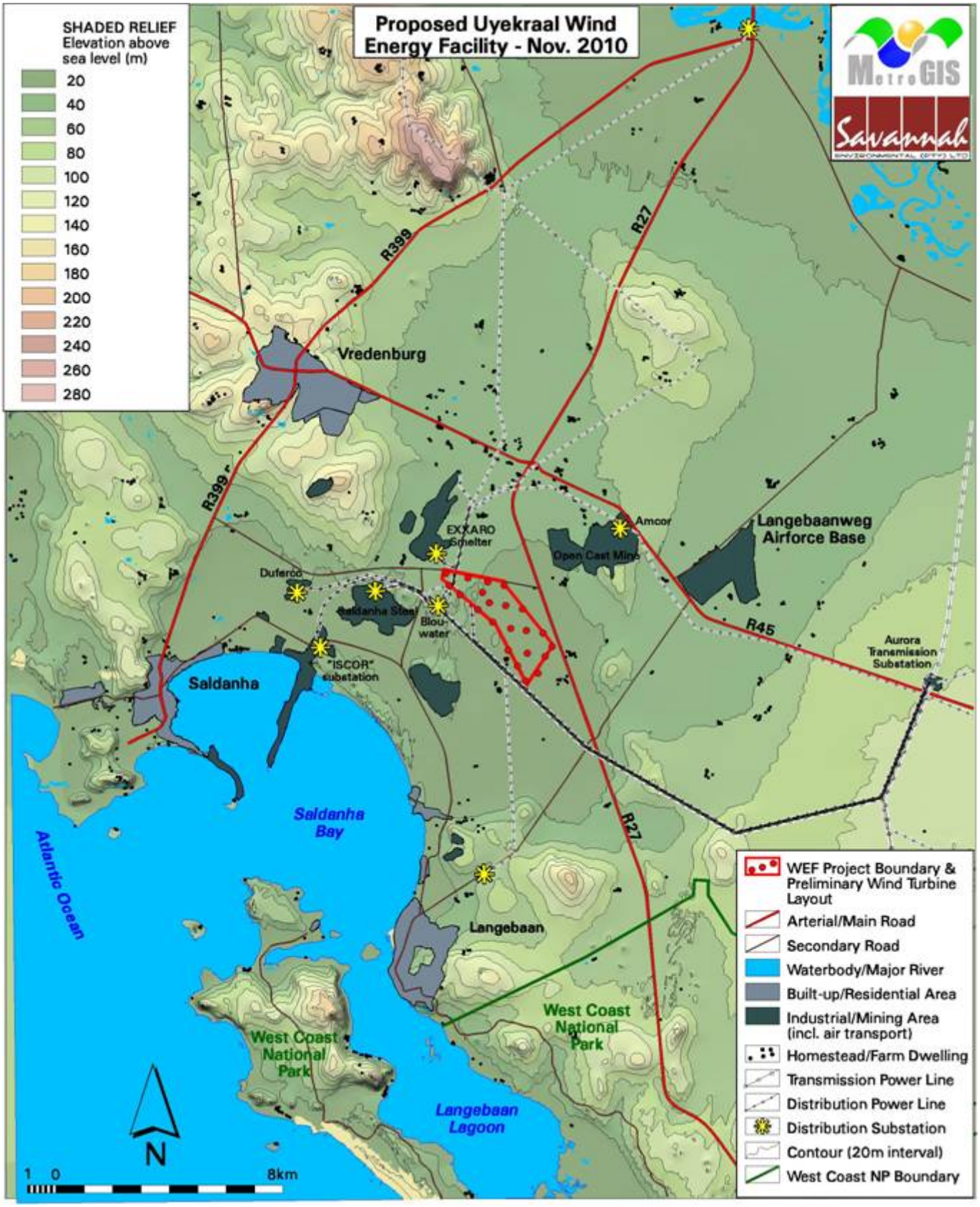
The towns of Vredenburg, Saldanha and Langebaan account for the highest population concentration within the region, which has an average of 44,7 people per km^2.

Outside of the urban and industrial areas, the region has a rural character, with scattered farmsteads and homesteads, especially in the north. Large areas have been given over to conservation, or remain in a natural state. The natural vegetation types are *coastal macchia* in the north east of the study area, *strandveld of west coast* surrounding the bay and the lagoon, and a strip of *coastal renoster-bush veld* between the two types, extending in a south easterly direction.

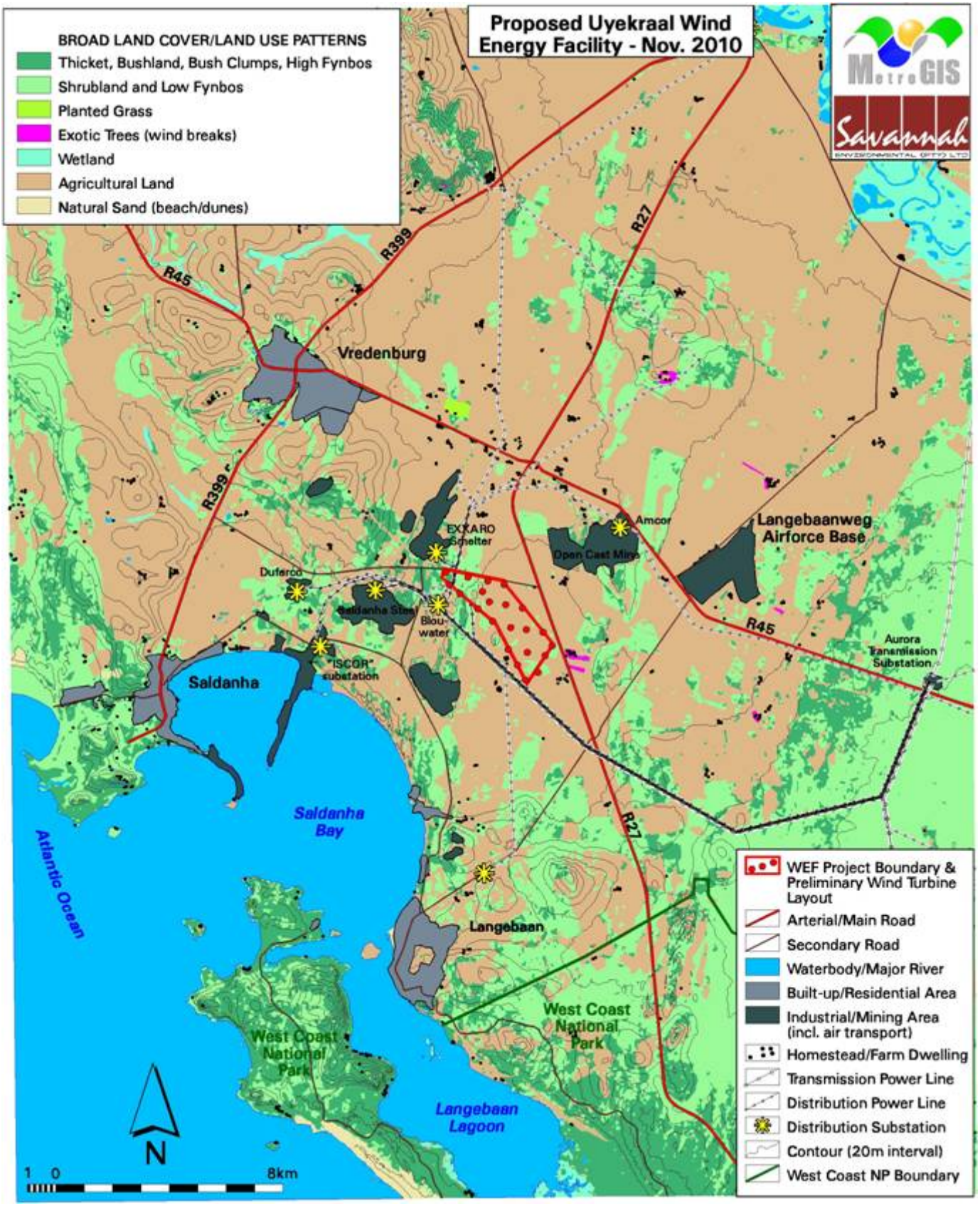
Formally protected areas in the region include the following:

- The West Coast National Park and its associated *viewshed protection zone*. The park itself is located about 8km to the south east of the proposed WEF, and the *viewshed protection zone* lies immediately to the south of the site, and in fact overlaps the far southern portion of the site.
- The Langebaan Lagoon Ramsar Site, located about 10km to the south west of the proposed WEF.
- The Benede Bergrivier Conservancy, located about 14km to the north east of the proposed WEF.

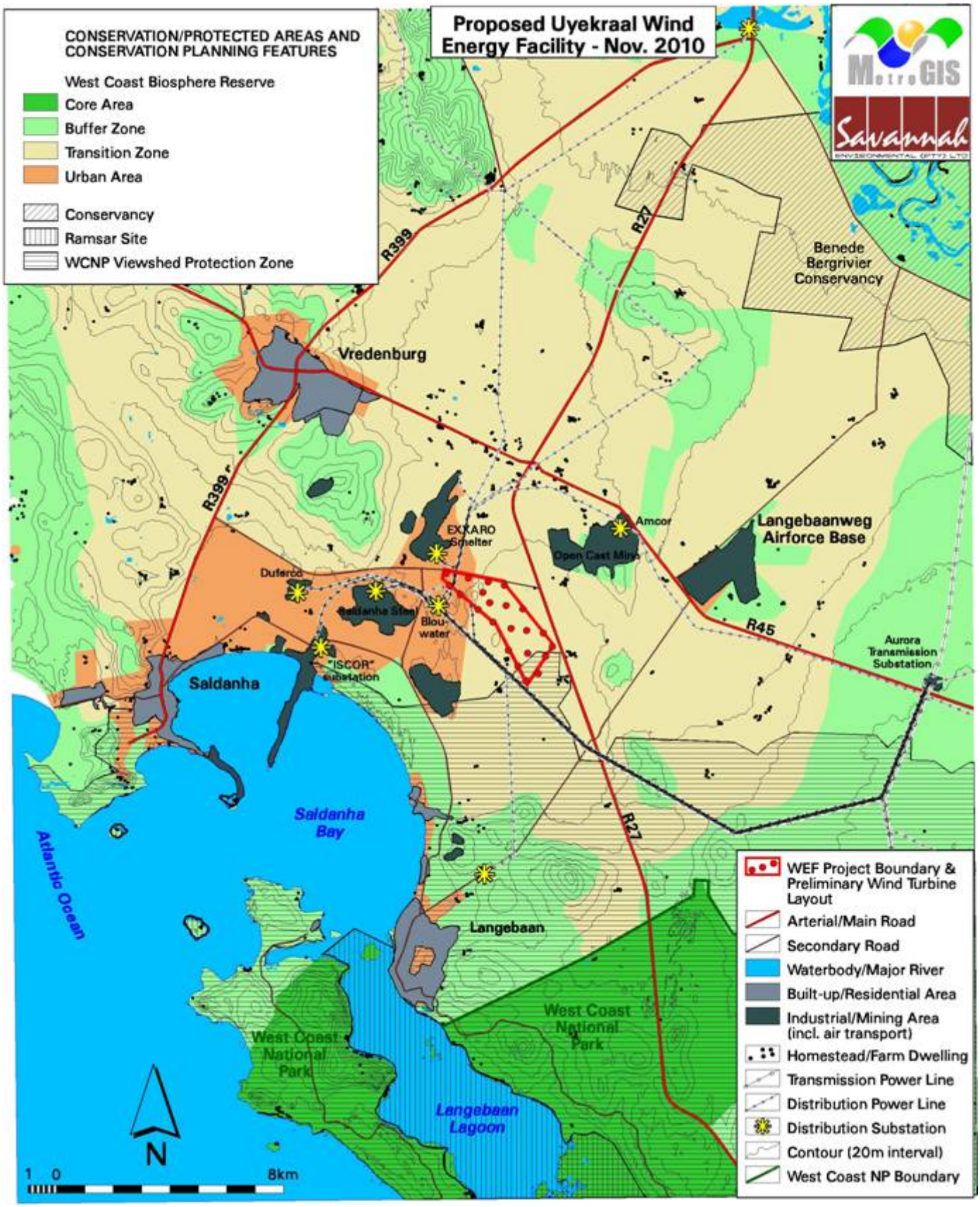
These areas all form part of the greater West Coast Biosphere Reserve (i.e. they lie within the core, buffer or transition zones). Refer to **Map 3**.



Map 1: Shaded relief map (indicating the location of the proposed WEF 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: Protected areas / conservation map of the study area.

6. POTENTIAL VISUAL EXPOSURE

The result of the preliminary viewshed analyses for the proposed WEF is shown on the map overleaf (**Map 4**). The initial viewshed analyses were undertaken from preliminary vantage points (with a maximum of 22) within the proposed development area at offsets of 100m above average ground level (i.e. the approximate hub height of the proposed wind turbines).

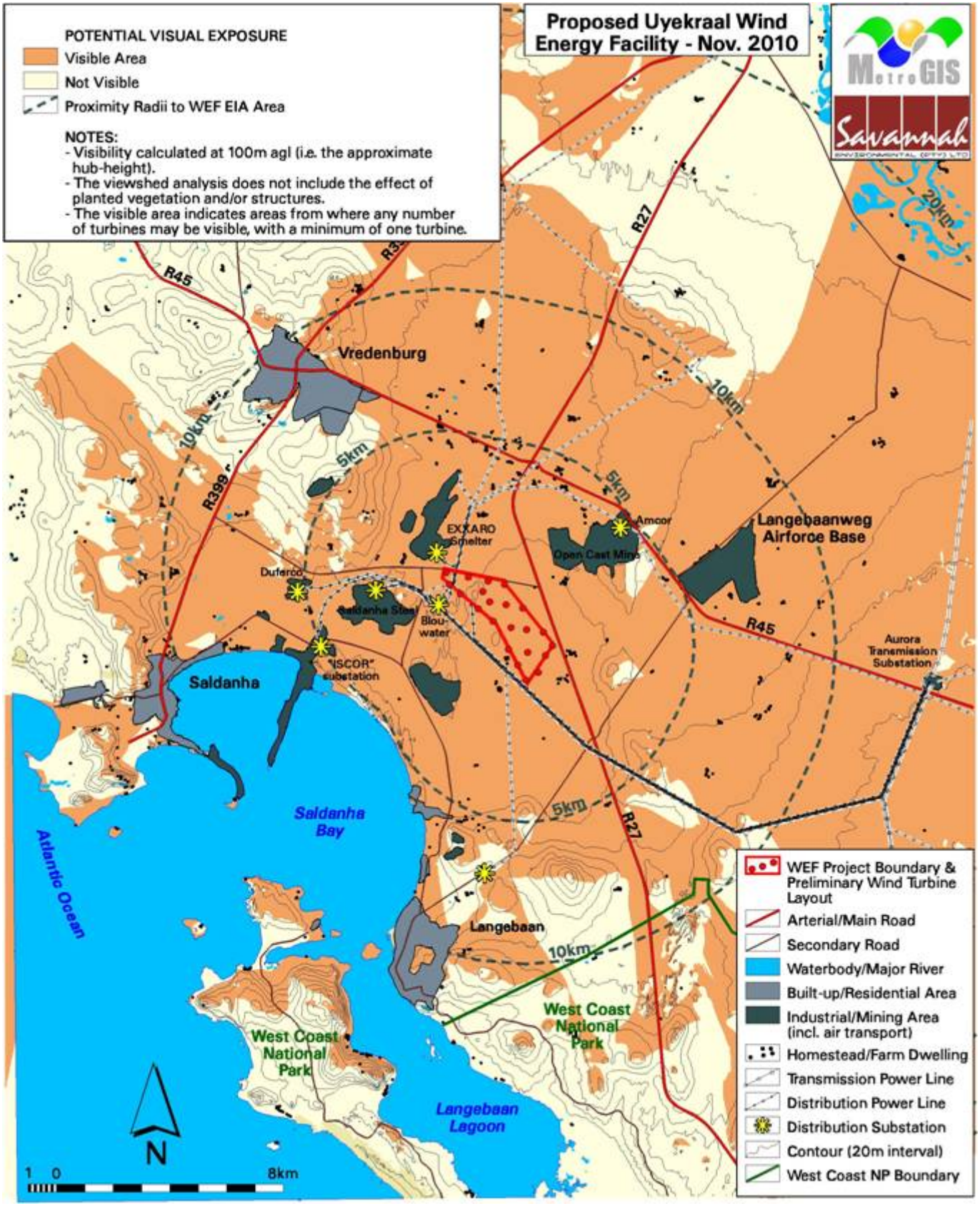
This was done in order to determine the general visual exposure of the area under investigation, simulating the proposed structures associated with the WEF. It must be noted that the viewshed analyses do not include the effect of vegetation cover or existing structures on the exposure of the proposed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

The viewshed analyses will be refined once a final layout of the wind energy facility is completed and will be regenerated per turbine position (and actual proposed turbine height) during the EIA phase of the project.

Map 4 indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible as well as proximity radii from the proposed development area. The following is evident from the viewshed analyses:

- The proposed WEF would have a large core area of potential visual exposure within a 5km radius of the site. This is due to the tall wind turbine structures. This core area does not include any urban area, but a number of farmsteads and homesteads are evident. The main land use within this core area is industrial, and includes the EXXARO and MITTAL smelters and an open cast mine.
- Visual exposure would remain high in the medium distance (i.e. between 5 and 10km) due to the flat undulating nature of the topography. Of importance in this zone is the town of Vredenburg in the north west, Langebaan in the south, Saldanha in the west and the Langebaanweg Airforce Base in the east.
- In the longer distance (i.e. beyond 10km), visual exposure will be somewhat reduced along the coast (i.e. to the north west and to the south), whereas views from the east will remain clear and unobstructed. Land uses in the area beyond the 10km radius include mainly farmsteads, settlements and conservation areas.
- The facility will be visible for the entire length of the R45 running south east of Vredenburg as well as for the whole stretch of the R27 within 10km of the site. Substantial sections of the R399 will also be exposed to potential visual impact.
- Visual exposure of all secondary roads is high in the short and medium distance (i.e. up to 10km), reducing significantly beyond 10km.
- Sections of the West Coast Biosphere Reserve *core area* occur within 5km of the proposed WEF, and proposed turbines are located within the West Coast National Park *viewshed protection zone*.
- In the medium distance (i.e. between 5 and 10km), isolated sections of the West Coast Biosphere Reserve *buffer area* will be exposed to potential visual impact, as will the very northern most tip of the West Coast National Park (also representing the West Coast Biosphere Reserve *core area*). In the south, large areas comprising the West Coast National Park *viewshed protection zone* will be exposed to potential visual impact.

It is envisaged that the WEF structures would be easily and comfortably visible to observers (i.e. people travelling along roads, residing in towns and at homesteads or visiting the region), especially within a 0-10km radius of the WEF and would constitute a high visual prominence.



Map 4: Potential visual exposure of the proposed WEF.
(Note: the visible area indicates areas from which any number of wind turbines (with a minimum of one turbine) may be visible).

7. CONCLUSIONS AND RECOMMENDATIONS

The construction and operation of the Uyekraal Wind Energy Facility will in all likelihood have a negative visual impact on a number of potentially sensitive visual receptors especially within (but not restricted to) a 10km radius of the facility.

These sensitive receptors should be identified and the severity of the visual impact assessed within the EIA phase of the project. Photo simulations of critical viewpoints should be undertaken (as part of VIA), where required, in order to aid in the visualisation of the envisaged visual impact.

The area potentially affected by the proposed development is generally seen as having a high tourism value and potential despite the high incidence of heavy industry. Reports indicate that tourism is the second largest economic driver in the area (after industry). This is due to its location along the west coast seaboard, and specifically its close proximity to the tourist destination of Langebaan and the Langebaan Lagoon.

In addition, the broader study area contains a significant number of protected areas, which are significant both from a conservation and from a tourism perspective.

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. Specific spatial criteria need to be applied to the visual exposure of the proposed WEF in order to successfully determine the issues related to the visual impact and ultimately the significance of the visual impact. The Plan of Study for the EIA phase will include the following:

- **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 WEF) are as follows:

  - 0 - 5km. Short distance view where the WEF 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 comfortable 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 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, and purpose of sighting which would create a myriad of options.

- **Determine the Visual Absorption Capacity of the natural vegetation**

  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 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 natural vegetation of the region. It is therefore necessary to determine the VAC by means of the interpretation of the vegetation cover, supplemented with field observations.

- **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 (e.g. the substation and power lines) 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, as well as suggested mitigation measures.

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 Western Cape Province (ENPAT Western Cape).*

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

Scenic Landscape Architecture (2006). *Cullerin Range Wind Farm; Visual Impact Assessment.* Unpublished Report.