SUURPLAAT
WIND MONITORING MASTS

VISUAL IMPACT ASSESSMENT AS PART OF A BASIC ASSESSMENT PROCESS

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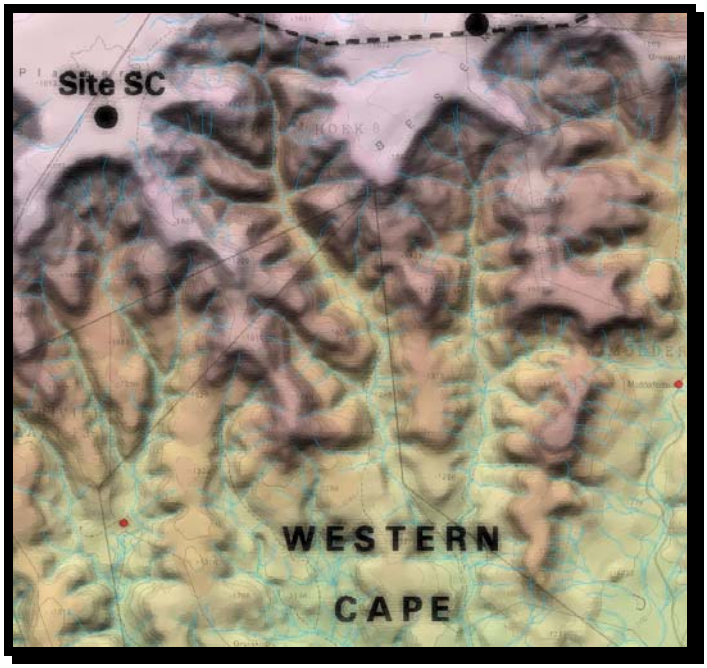
INVESTEC



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- June 2009 -

CONTENTS

Lourens du Plessis from MetroGIS (Pty) Ltd undertook the visual impact assessment in his capacity as a visual assessment and Geographic Information Systems specialist. 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 modelling and digital mapping, and applies this knowledge in various scientific fields and disciplines. His GIS expertise are often utilised in Environmental Impact Assessments, State of the Environment Reports and Environmental Management Plans.

Savannah Environmental (Pty) Ltd appointed MetroGIS (Pty) Ltd as an independent specialist consultant to undertake the Visual Impact Assessment and neither the author, nor MetroGIS will benefit from the outcome of the project decision-making.

1. INTRODUCTION

Investec proposes the construction of six wind monitoring masts on the farms Hartebeeste Fontein 146 (Site SA), Hartebeeste Fontein 147 (Sites SB and SE), Sterboom Hoek 8 (Site SC), Vinkekuil 144 (Site SD) and Dwars Rivier 7 (Site SF). Sites SA, SB, SD and SE are located in the Northern Cape Province and Sites SC and SF are located in the Western Cape Province. The study area for the Suurplaat wind monitoring masts is located approximately 33km south-east of Sutherland and 41km north of the N1 national road (near Laingsburg) at the closest.

The positions of the proposed wind-monitoring masts are shown on **Figure 1** below. A mast will be a steel lattice structure that is 80m in height and 0.5m wide. The mast will be anchored to the ground, in addition to its concrete foundation, with approximately 12 guy wires on three sides of the mast. **Figure 2** shows an assembled mast before it has been painted according the to specifications as required by the Civil Aviation Authority (CAA). These specifications dictate that the mast needs to be painted white and red in alternating segments each one seventh of the total height. The top and bottom segments need to be painted red. The operational phase (period of utilisation) of the wind-monitoring masts are approximated at 12 months.

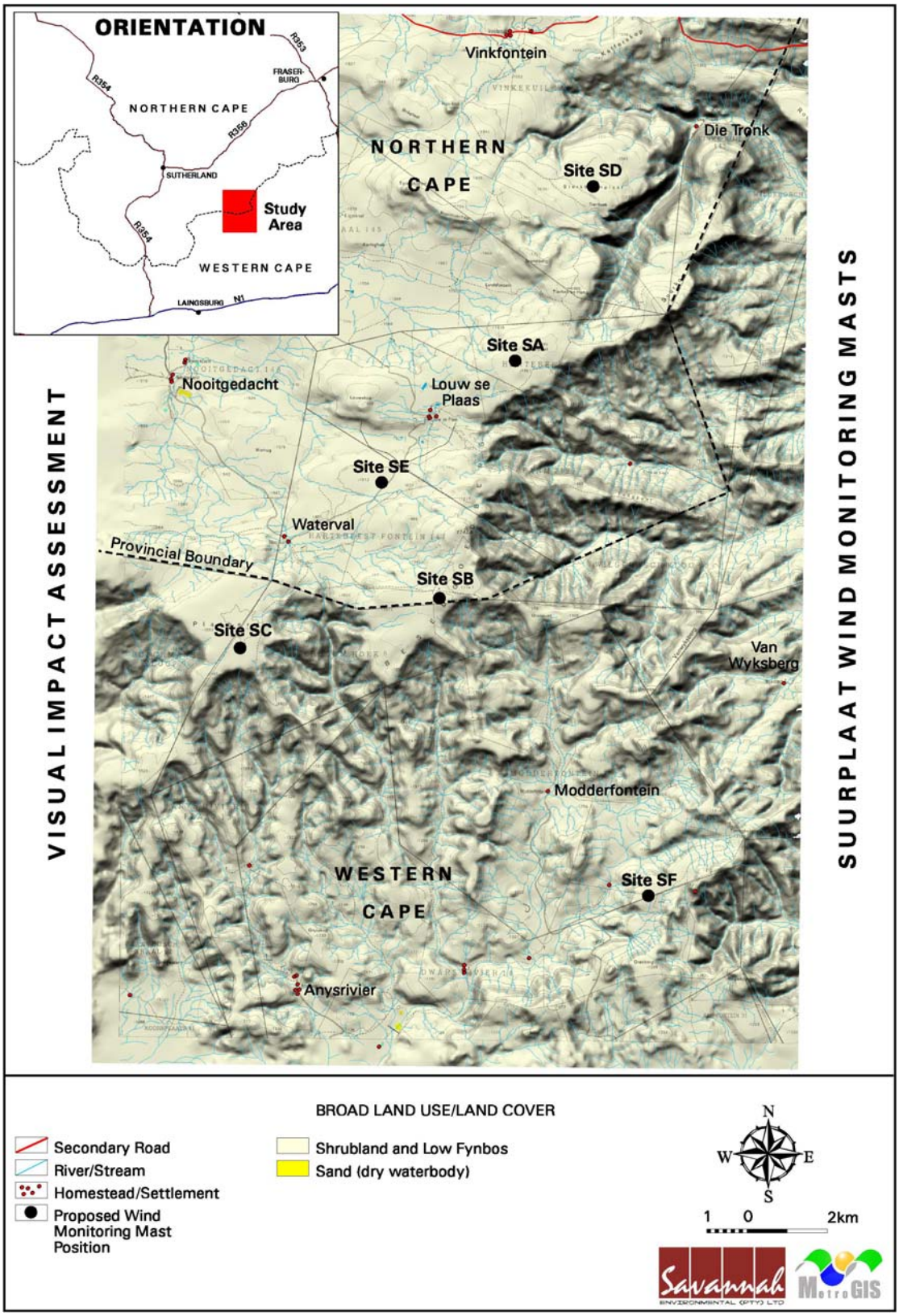

Figure 1: Map indicating the proposed location of the Suurplaat wind monitoring masts and broad land use patterns

Figure 2: Photograph of a wind monitoring mast (Note: the mast is not painted as per CAA specifications)

This report sets out to identify and quantify the possible visual impacts related to the proposed wind-monitoring infrastructure mentioned above, as well as offer potential mitigation measures, where required.

2. SCOPE OF WORK

The study area for the Suurplaat wind monitoring masts covers a 463km^2 geographical area that is located within a remote section of the Great Karoo.

The scope of work includes the determination of the potential visual impacts in terms of nature, extent, duration, magnitude, probability and significance of the construction and operation of the proposed infrastructure. In this regard specific issues related to the visual impact were identified during a site visit to the affected environment. Issues related to the proposed wind monitoring masts include:

- The potential visual exposure and proximity of the proposed masts to observers travelling along secondary roads within the study area.
- The potential visual exposure and proximity of the proposed masts to areas of high viewer incidence (i.e. homesteads and settlements).

3. METHODOLOGY FOR THE ASSESSMENT OF THE VISUAL IMPACT

3.1. General

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 structures. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours, supplied by the Surveyor General.

A site visit was undertaken to source information regarding land use, vegetation cover, topography and general visual quality of the affected environment. It further served the purpose of verifying the results of the spatial analyses and to identify other possible mitigating/aggravating circumstances related to the potential visual impact.

The results of the spatial analysis and other relevant orientation data are displayed on a number of supplementary maps, which will be referred to in the text.

3.2. Potential visual exposure

The visibility or visual exposure of any structure or activity is the point of departure for the visual impact assessment. It stands to reason that if the proposed infrastructure, or evidence thereof, weren't visible, no impact would occur.

Viewshed analyses of the proposed masts, based on a 20m contour interval digital terrain model of the study area, indicate the potential visual exposure. These visibility analyses were undertaken at an offset of 80m above average ground level (i.e. the proposed maximum height of the mast) in order to simulate a worst-case scenario. The viewshed analyses do not include the visual absorption capacity of the vegetation for the study area, as the remaining natural vegetation cover, predominantly *shrubland* and *low fynbos*, is not expected to influence the results of the analyses significantly.

Figure 3 below indicates the potential cumulative visual exposure of the six proposed masts by indicating the frequency of exposure (i.e. the number of masts visible). It becomes apparent that the masts will be quite exposed, both jointly and individually, due to their elevated locations along the escarpment. The masts will be visible, at various distances from a number of homesteads and the secondary road traversing north of the study area. The maximum number of

masts theoretically visible (i.e. the highest frequency of exposure) is five, due to the location of Site SF below the escarpment.

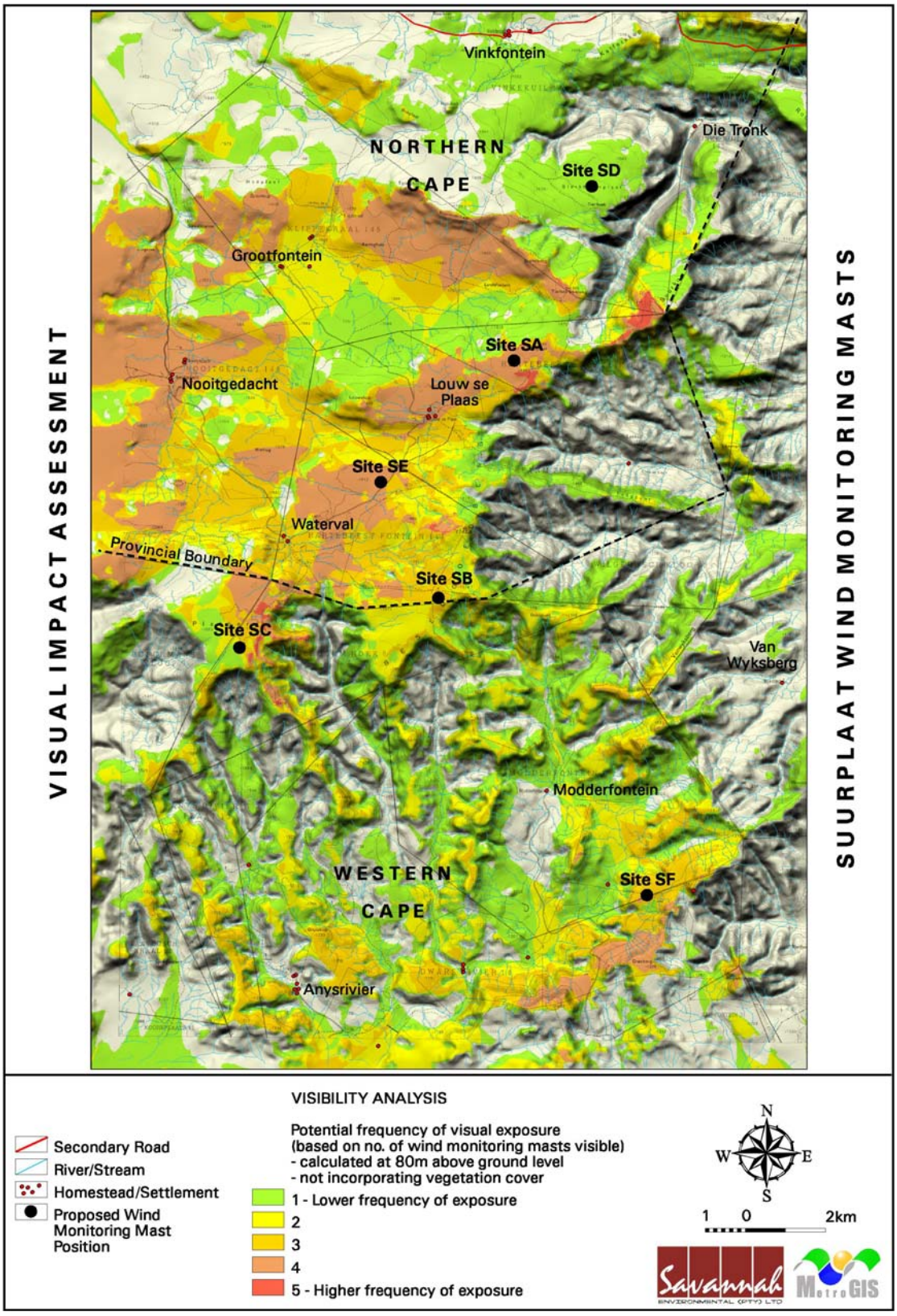

Figure 3: Potential visual exposure of the proposed wind monitoring masts

3.3. Visual distance / observer proximity to the wind monitoring masts

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 design would create a significant contrast with the natural environment surrounding the mast positions. The structure is however not as bulky, even for its 80m height, as is the case with other masts (e.g. telecommunication masts or power line towers) that are much lower.

The proximity radii for the proposed masts are indicated on **Figure 4** in order to indicate the scale and viewing distance of the structure and to determine the prominence of the structure in relation to its environment.

The proximity radii chosen for the masts, based on their dimensions, are:

- 0 - 250m. Short distance view where the masts could potentially dominate the frame of vision and constitute a very high visual prominence.

- 250 - 500m. Short to medium distance view where the masts could potentially be easily and comfortably visible and constitute a high visual prominence.

- 500 - 1000m. Medium distance view where the masts would become part of the visual environment, but could still be visible and recognisable. This zone constitutes a medium visual prominence.

- 1000 - 2000m. Medium to long distance view of the masts where it will become increasingly difficult to view or recognise the structures. This zone constitutes a medium to low visual prominence.

- Greater than 2000m. Long distance view of the mast where the structures would more than likely not be visible or recognisable. This zone constitutes a low to negligible visual prominence.

Almost all of the sites are locate beyond 2km from major settlements/homesteads (i.e. Louw se Plaas and Waterval) and none of the sites are located close to the secondary road to the north of the study area.

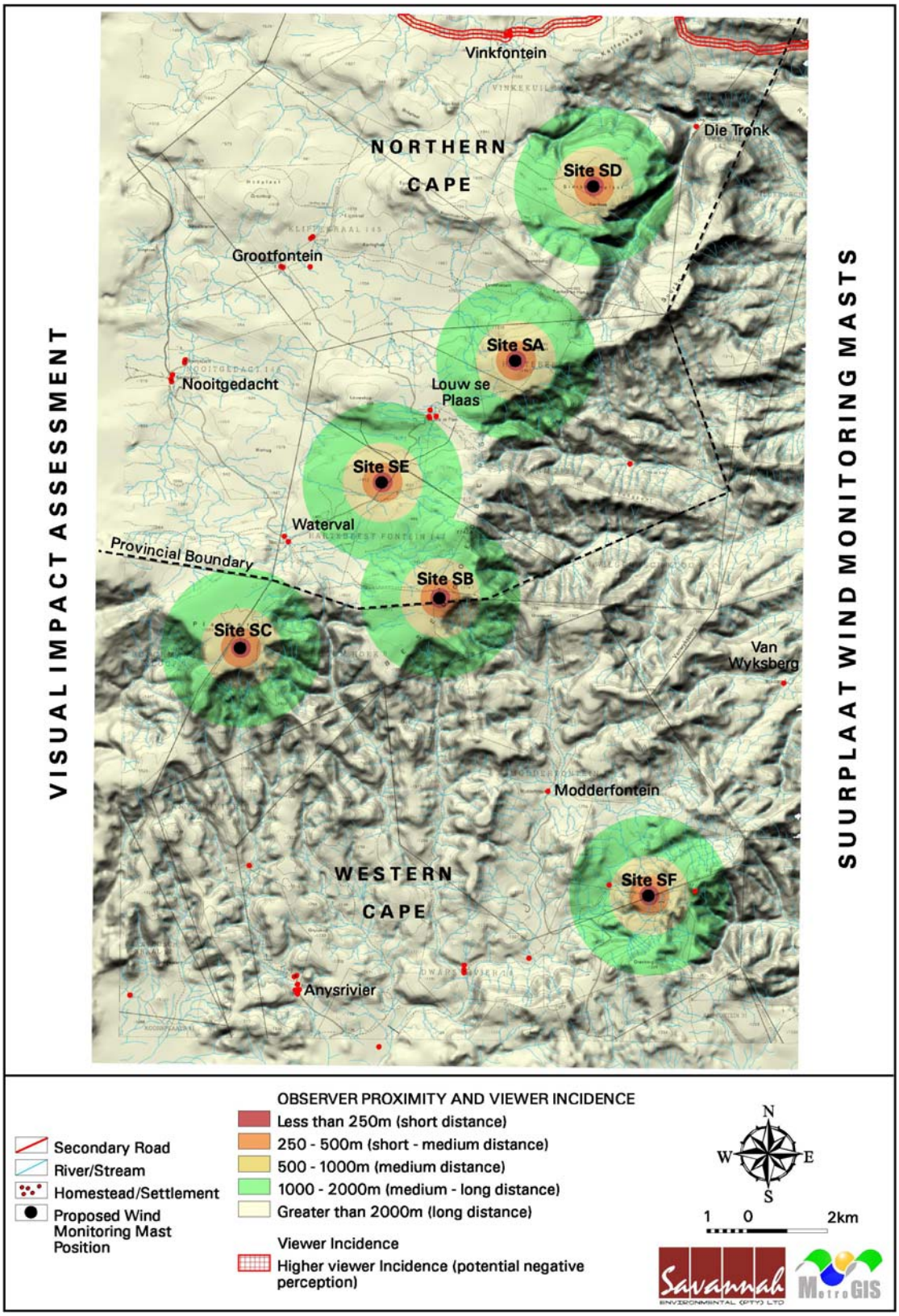

Figure 4: Observer proximity to the proposed wind monitoring masts and areas of higher viewer incidence (discussed under the next heading)

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

3.4. 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 potential visual sensitivity towards the proposed mast. 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.

Two areas of higher viewer incidence and potentially negative perception of the proposed masts were identified for the study area. The first area includes the settlements/homesteads identified within the study area. Residents of this zone are seen as potential sensitive visual receptors upon which the construction of the masts could have a negative visual impact. See **Figure 4** for the location of these areas.

The second area includes a 100m buffer zone along the only major road within the study area. This zone represents the area with the highest potential sightings of the masts (by people travelling along this road). The road buffer zone is shown on **Figure 4**.

The rest of the study area, excluding the abovementioned zones, is greatly devoid of random observers or sensitive visual receptors. This zone consists predominantly of natural vacant land or grazing land with a low to insignificant occurrence of observers.

3.5. Visual absorption capacity of the natural vegetation

It is has become apparent from site inspections that the visual absorption capacity of the natural vegetation (*shrubland* and *low fynbos*) would not influence the outcome of the visual impact assessment significantly. The vegetation types in question have a relatively low growth form and are on average less than 2m high.

3.6. Visual impact index

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

4. REGIONAL OVERVIEW

4.1. Description of the affected environment

The study area is predominantly described as a natural area (area not altered by development or agriculture) with sheep farming as the dominant land use within the region. The population density of this remote region, often referred to as the Moordenaars Karoo, is less than one person per km^2.

The dominant topographical unit or terrain type of the study area is described as *mountains of the great escarpment*. Five of the proposed mast positions are

located on top of the escarpment and one (Site SF) is located at the base of the escarpment. The elevation of the study area ranges from 1000m above sea level to 1700m, an incredible 700m difference in altitude. See **Figure 5** below.

Very few man-made structures occur in close proximity of the proposed site positions, which are all located within natural areas.

The study area has a natural to rural character with only a few farming homesteads occurring within the study area. The natural vegetation type is *shrubland* and *low fynbos*. This vegetation type is intact for virtually the entire study area.

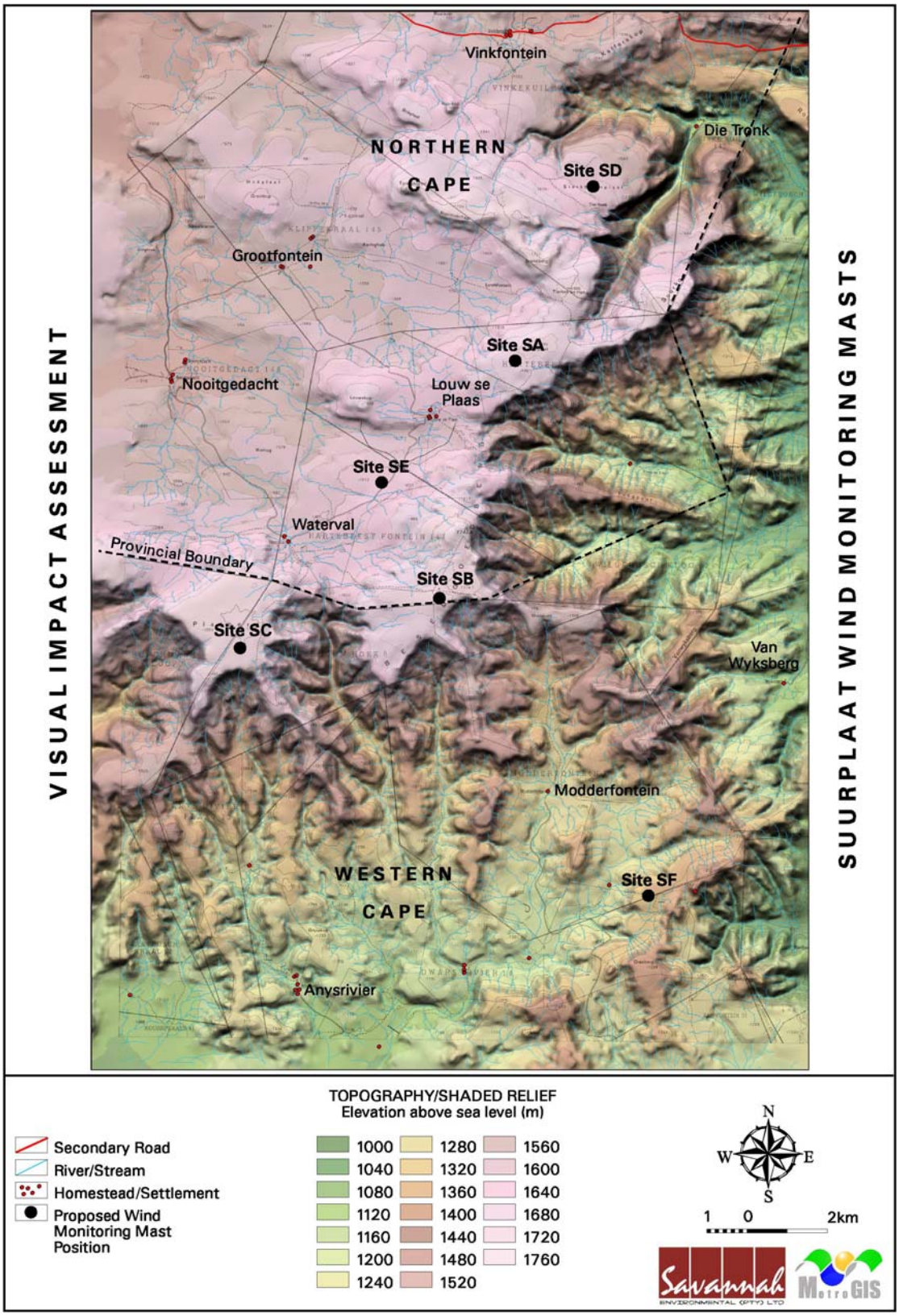

Figure 5: Shaded relief map indicating topography and elevation above sea level

5. RESULTS

5.1. Visual impact index

The visual impact index is a combined weighted index of the cumulative visual exposure, the observer proximity and the viewer incidence/perception of the proposed masts. The result of the combination of the above criteria gives an indication of the likely area of visual impact. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

The visual impact index for the six wind monitoring masts is shown on **Figure 6**.

The index indicates a large area with *very low* to *low* potential visual impact. *Medium* to *high* potential visual impacts appear to be located primarily within a 1km radius of the masts, with the Sites SA and SE having the largest areas of potentially *high* to *very high* visual impact. This is due to these masts's higher frequency of exposure (i.e. higher cumulative visual impact).

Very few homesteads will be significantly exposed to the masts with Louw se Plaas and Waterval (the settlements closest to the masts) indicated as potentially experiencing *low* visual impacts.

The mast positions are either not exposed to the secondary road within the study area or is expected to have a *very low* visual impact at distances beyond 4km from the closest mast (Site SD).

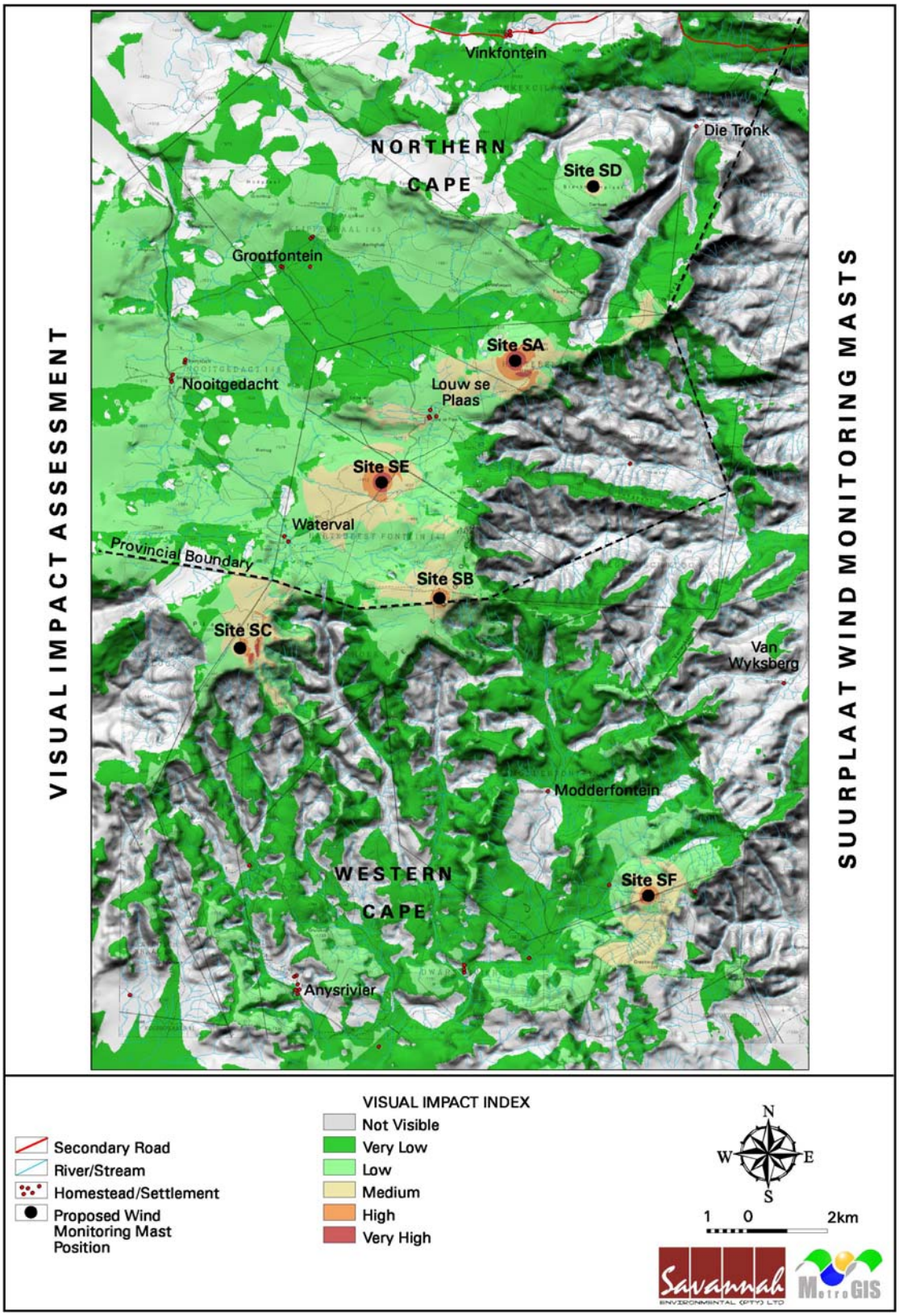

Figure 6: Visual impact index of the proposed wind monitoring masts

5.2. Visual impact assessment

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 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 roads) and includes a table quantifying the potential visual impact according to the following criteria:

- **Extent (E)** - local (high = 4), regional (medium = 3), national (low = 2) or international (very low = 1)
- **Duration (D)** - very short (0-1 yrs = 1), short (2-5 yrs = 2), medium (5-15 yrs = 3), long (>15 yrs = 4), and permanent (= 5)
- **Magnitude (M)** - low (= 0-4), medium/moderate (= 4-6), high (= 6-8) and very high (= 8-10)
- **Probability (P)** - very improbable (= 1), improbable (= 2), probable (= 3), highly probable (= 4) and definite (= 5)
- **Status** (positive, negative or neutral)
- **Significance (S)** - low, medium or high, where the significance is determined by combining the above criteria in the following formula: S = (E+D+M) P

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

- <30 points: Low (where the impact would not have a direct influence on the decision to develop in the area)
- 31-60 points: Medium (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)

Potential visual impact on users of secondary roads

Table 1: Impact table summarising the significance of visual impacts

Nature of Impact: Potential visual impact on users of roads	
Extent	Local **(4)**
Duration	Short term **(1)**
Magnitude	Low **(4)**
Probability	Improbable **(2)**
Significance	Low **(18)**
Status (positive or negative)	Negative
Reversibility	High
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the wind monitoring masts after one year.	
Cumulative impacts: No major cumulative visual impact is envisaged along this road.	
Residual impacts: N.A.	

The potential visual impact on areas of high viewer incidence (i.e. homesteads and settlements)

Table 2: Impact table summarising the significance of visual impacts

Nature of Impact: The potential visual impact on areas of high viewer incidence	
Extent	Local **(4)**
Duration	Short term **(1)**
Magnitude	Low **(4)**
Probability	Probable **(3)**
Significance	Low **(27)**
Status (positive or negative)	Negative
Reversibility	High
Irreplaceable loss of resources?	No
Can impacts be mitigated during operational phase?	No
Mitigation: Decommissioning: removal of the wind monitoring masts after one year.	
Cumulative impacts: Potential cumulative visual impact is possible where observers are exposed to more than two of the masts at once.	
Residual impacts: N.A.	

5.3. Lighting impact

The potential lighting impact associated with the wind monitoring masts pertains to the fitting of an aircraft warning light on top of each mast (as prescribed by the CAA). The light in question is a relatively toned-down red light that is not expected to cause significant visual impacts in terms of glare, light trespass or sky glow.

Additional illumination (i.e. by means of flood lights) of the wind monitoring masts is strongly inadvisable.

5.4. Mitigation measures

The potential for the mitigation of visual impacts of the wind monitoring masts during the operational phase is very low. The functional design and CAA requirements dictate the appearance of the masts and do not leave much room for deviation. The height of the masts (80m) also nullifies the effectiveness of attempting to shield the mast with vegetation cover or landscaped berms. The potential visual impacts are however completely reversed once the masts are removed after the utilisation period of 12 months.

The only way of reducing the potential cumulative visual impact of the masts is by constructing fewer masts or to locate the masts further away from each other.

6. CONCLUSION

The results of the visual impact assessment suggest that the overall visual impact of the proposed wind monitoring masts would be primarily *low* to *very low* for the largest part of the study area, with higher impacts potentially occurring closer to the mast structures. These areas are predominantly uninhabited with none or very few potential observers. The temporary (short term) operational phase of the wind monitoring masts and the high reversibility of the impacts after

decommissioning further mitigate the long term visual impacts of the proposed wind monitoring masts.

7. MANAGEMENT PLAN

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

Table 3: Management plan - Suurplaat wind monitoring masts

OBJECTIVE: The mitigation and possible negation of the additional visual impacts associated with the construction and operation of the Suurplaat wind monitoring masts.	
Project component/s	Suurplaat wind monitoring masts access roads and construction sites.
Potential Impact	The potential scarring of the landscape due to the creation of new access roads/tracks or the unnecessary removal of vegetation.
Activity/risk source	The viewing of the abovementioned visual scarring by observers in the vicinity of the masts or from roads.
Mitigation: Target/Objective	Minimal disturbance to vegetation cover in close vicinity to the proposed wind monitoring masts.

Mitigation: Action/control	Responsibility	Timeframe
Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.	Investec / contractors.	During construction.
Limit access to the mast sites (during both construction and operational phases) along existing access roads.	Investec / contractors.	Construction / operational phases

Performance Indicator	Vegetation cover that remains intact with no new access roads or erosion scarring in close proximity of the mast sites.
Monitoring	Monitoring of vegetation clearing during the construction phase.

8. REFERENCES

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

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