

Annex I

Visual Impact Specialist Report

Proposed Renewable Energy Facilities
At the Roggeveld Site
By G7 Renewable Energies (Pty)
Draft Visual Impact Assessment

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EXECUTIVE SUMMARY

This Visual Impact Assessment (VIA) for the **Roggeveld** site is based on the visual baseline study carried out in the area in October 2010. Initial recommended mitigations were included in the baseline study.

The Roggeveld site has a number of visual constraints, including visually sensitive mountain ridges of the Klein Roggeveld mountains, and the proximity to the R354 arterial road. The wind turbines would create a distinct feature in the open, sparsely vegetated and mountainous Karoo landscape, and would be visible for a considerable distance. The proposed substations, with transformers, together with the various operations and management (O&M) buildings, being smaller in scale, and located on lower slopes, would be less visually significant.

Given the topography and nature of the landscape at the Roggeveld site, and its surrounding context, it is anticipated that the wind turbines would have a high visual impact before mitigation. The visual impact could be reduced to medium-high by applying visual mitigation measures. This involves removing or re-locating the wind turbines off the peaks, such as Tafelkop, Karookop, Spitskop and a number of other peaks, as well as having a minimum visual setback distance from the R354 of 2.5km, or preferably 3km. There is little opportunity for visual screening or further mitigation other than to reduce the number of turbines.

The potential visual impact of the substation transformers, connecting power lines and O&M buildings would be lower, the ratings being medium before mitigation and medium to low after mitigation. This is partly owing to the area already being visually disturbed by an existing Eskom power line.

The visual effect of the proposed wind farm on the mountain skyline and expansive Karoo landscape is a concern, as the area has natural, scenic and tourism value.

The cumulative impacts are a further concern, as similar large wind farms are proposed near Sutherland to the northeast, and at Witberg and Konstabel to the south, within a 30km radius.

It is clear therefore that Roggeveld, and other similar wind farms, cannot be seen in isolation, but need to be seen in a regional context, as cumulative impacts and trade-offs will need to be considered, especially in the light of the larger alternative energy debate. Unfortunately no regional plans for wind energy exist at present in the province, or in the country, that would guide the spatial location of wind farms.

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SECTION 1: INTRODUCTION

1.1 SCOPE OF THE STUDY

The scope of work for the Roggeveld visual impact assessment includes the following:

- 1) A description of the approach and methodology used in the visual assessment.
- 2) A description of the proposed renewable energy facilities at the Roggeveld site.
- 3) A description of the existing visual characteristics of the site, together with their visual significance.
- 4) Identification of the area from which the proposed facilities will potentially be visible (or viewshed).
- 5) Identification of visual issues that may need to be taken into account in the planning and implementation of the proposed facilities.
- 6) Mitigation measures for the siting and layout of the proposed energy facilities at the Roggeveld site.

1.2 LIMITATIONS AND ASSUMPTIONS

The layout of the energy facilities and related infrastructure are indicative at this stage, and are subject to change in the detailed design phase. No detailed information about building finishes and colours, as well as lighting were available during the visual assessment, and assumptions had to be made regarding these elements. It was indicated that the turbine navigation lights would be fitted with reflectors, and would therefore not be visible from below. Similarly, no information on the size and nature of the construction camp and equipment, or the location of borrow pits was available.

1.3 LOCATION OF THE ROGGEVELD SITE

The site location is indicated on Fig. 1. The Roggeveld site is located adjacent to the R354 arterial road, about 20km north of Matjiesfontein and 45km south of Sutherland, on the boundary between the Western and Northern Cape Provinces.

SECTION 2: APPROACH AND METHODOLOGY

The methodology used for the VIA included the following steps:

- Preparation of a visual baseline report based on a field trip during October 2010, and information provided by ERM;
- Mapping of the energy facilities, including distance circles and critical viewpoints, particularly those relating to intersections of major roads, arterial and scenic routes, as well as settlements and farmsteads;
- Determination of the viewshed, using a digital terrain model (DTM) to determine the area that would be visually affected;

- Preparation of photomontages using panoramic photographs to determine the degree of visibility of the proposed energy facilities;
- Assessment of potential visual impacts, using quantitative criteria, such as visibility and exposure, as well as qualitative criteria such as compatibility and effect on landscape integrity.
- Finally, significance of visual impacts is assessed based on extent, magnitude, duration and probability of the impacts occurring, both before and after mitigation.

SECTION 3: DESCRIPTION OF THE PROJECT IN TERMS OF VISUAL CONSIDERATIONS

Key aspects of the proposed energy facilities that have visual implications are summarised in Table 1 below. The proposed facility would require an electrical substation, operations and maintenance buildings, and grid connections, which link the sites to the Eskom power lines.

The large scale of the wind turbines means that these will have the greatest visual significance in the landscape. An indication of the size and nature of the turbines is given in Fig. 2. The turbines will have a hub height of 100m, with a rotor diameter of 117m. Each turbine has an electrical transformer beside it.

The layout for the wind turbines is indicated on Figures 3 and 4. The substation, which includes large transformers and connections to the grid, also have visual implications, particularly when located close to arterial roads.

Table 1 : Description of Energy Facilities at the Roggeveld Site

Facility	Footprint	Height	Comments
Total area of the site	374.7 km ²	n/a	
Area covered by turbines	62.5 ha		Includes hardstanding.
No. of wind turbines	250 x 3MW	n/a	±320m spacing.
Size of wind turbine	Base to tower 20 x 20m Foundation 5 x 5m	Hub ht. 100m Rotor diam. 117m	Light grey painted steel tapered tubular tower.
Electrical transformer	6m ² (2x3m) each turbine	2.5m	Green painted steel mini container.
Hardstanding	2500m ²	n/a	At each turbine; gravel surface
Internal access roads	unavailable	n/a	12m wide, gravel surface + side drains
Electrical substation	1 main 400kV station 200 x 40m (8000m ²) 6 smaller 132kV stations	Single storey buildings. Transformers variable ht.	Plastered and painted masonry buildings. Transformers next to substation buildings.
Electrical pylons of connecting transmission line	Approx. 12km	Ht. unknown	Additional pylons between turbines and substation.
Operations and maintenance buildings (O&M building)	960m ² site area (40 x 24m)	Single storey	Steel portal frame structures and container storage.
Parking area for O&M bldg.	250m ² (12.5 x 20m)	n/a	Included in O&M site area
Wind measuring mast	1 mast	80m	Painted steel tower lattice
Security fencing	n/a	2m	Galv. weldmesh around substation and O&M buildings only.
Security Lighting Navigation lights	n/a 2 on each turbine nacelle	5m 100m	Painted steel lighting mast Flashing red light (to CAA requirements) fitted with reflectors to screen lights when seen from below.
<i>Construction Phase:</i>			
Lay down area	3 000m ² (150x20m)	n/a	Temporary gravel hard standing
Construction camp	5 000m ²	Single storey	Temporary prefab structures
Borrow pits	40 x 250m	10m deep	Site to be determined - could be from existing sources in the area.
Depth of excavation	Turbine foundations Cable trenches	Approx. 3m Approx. 1.5m	

SECTION 4: DESCRIPTION OF THE AFFECTED ENVIRONMENT

A description of the Roggeveld site is summarised in Table 2 below, including visual/scenic significance, along with visual opportunities and constraints in relation to the siting of energy facilities. Viewpoints and viewsheds are indicated on Figure 4, and photographic panoramas are given in Figures 5 and 6.

Table 2 : Landscape Description of the Roggeveld Site

<i>Location</i>	The site is located on a series of farms to the west of the R354 Main Road which connects Matjiesfontein in the south with Sutherland on the plateau to the north. The boundary between the Western and Northern Cape Provinces runs through the site.
<i>Geology</i>	The area is formed by shales, sandstones, mudstone and coal of the Beaufort and Ecca Series of the broader Karoo System of rocks.
<i>Physical Landscape</i>	The area is characterised by flat plains interspersed with hills and mountains, the dry riverbeds being indicative of the fairly arid landscape. The topography is dominated by the Klein Roggeveld Mountains with peaks ranging from 1300 to 1500 metres height.
<i>Vegetation Cover and Land Use</i>	The northern area of the site is described as a <i>Rainshadow Valley Karoo Bioregion</i> , belonging to the Succulent Karoo Biome, and the more mountainous southern portion as <i>Mountain Shale Renosterveld</i> , being part of the Fynbos Biome. In both cases the vegetation is low and therefore visually exposed, except for the thickets along the dry riverbeds. Gums and poplars typically occur around the few scattered farmsteads. Farming is mainly with sheep, used for both wool and meat.
<i>Visual Significance</i>	The R354 Main Road from Matjiesfontein to Sutherland is an important tourist route, which has scenic value in places. The proposed wind turbines, located on the mountain ridges, would be visible from the R354 and from a number of surrounding farms.
<i>Opportunities and Constraints</i>	The mountainous terrain results in much of the surrounding area, particularly to the south, being in a view-shadow, where the proposed turbines would not be visible. There are no known nature reserves in the area. Some potentially historic, but derelict farm buildings occur in the north near Wilgebos. Other sites and buildings of heritage value are being reported on separately.

SECTION 5: IDENTIFICATION OF APPLICABLE POLICIES, LEGISLATION, STANDARDS AND GUIDELINES

At the national level the following legislation could apply to visual assessments:

The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA. (Act No. 107 of 1998).

The Protected Areas Act (PAA) (Act 57 of 2003, Section 17), intended to, inter alia, protect natural landscapes.

The National Heritage Resources Act (NHRA) (Act No. 25 of 1999) and the associated provincial regulations provide legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

At the provincial level, the Provincial Government of the Western Cape's Department of Environment and Planning (DEA&DP) is the principal authority involved in the Environmental Impact Assessment (EIA) process. The Department of Environmental Affairs (DEA) is the authorizing agency in terms of the NEMA regulations. The regulations require a full scoping and EIA Report for electricity generation projects of this size.

In terms of a report by the Provincial Government of the Western Cape on the "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes" (B. Oberholzer, 2005), a full 'Level 4' visual assessment is required.

No formal guidelines have been published for the wind energy industry to assist in the design and assessment of wind energy development at the local scale. However, a draft report has been prepared by the Provincial Government of the Western Cape and CNdV Africa (2006) called "A Strategic Initiative to Introduce Commercial and Land Based Wind Energy Development to the Western Cape".

This 2006 Report provides a broad guiding framework for the location of wind energy development in both urban and rural areas, based on the sensitivity and capacity of landscape types and the scale of the project. The Report indicates that, in the rural context, where most commercial wind farms will be located, large scale 'open' landscapes and/or 'disturbed' rural landscapes are preferred for the siting of wind farms.

The Report further states the following in the Executive Summary:

A. Commercial Wind Energy development should be **excluded** from:

- Areas of high aesthetic landscape value, particularly national parks and provincial nature reserves and other wilderness areas.
- Areas where technical and safety considerations apply.

B. Wind energy should be **encouraged**:

- At strategic locations identified in a Regional Wind Plan (RWP) to be prepared by the relevant planning authority.
- Where they are well located in terms of visual impact, technical and safety criteria and landscape, environmental and planning criteria.
- In large concentrated wind farms rather than small dispersed locations where the distance between large wind farms is at least 30km, and ideally exceeding 50km.
- In appropriate urban and industrial “brownfield” sites.
- Where visual disturbance to the landscape has already occurred (e.g. power transmission lines).
- At the local scale where individual turbines (not exceeding 50m in total height) could provide power to small users.

Table 3 below, from the 2006 Report, provides a list of regional criteria, including key criteria to be mapped at a local project level, for proposed wind farms. These criteria have, however, not been legislated, and only serve as guidelines. These criteria were used as a starting point for the Mitigation Guidelines in Section 10 of this report.

Criteria		Buffer	Notes
1	Urban Areas	800m	This distance adequately covers noise and flicker criteria at the local level.
2	Residential Areas (including rural dwellings)	* 400m	Threshold adequately covers noise and flicker criteria at the local level.
3	Transport Routes		
3a	National Roads	13km	Depends on scenic value of route. Can be reduced.
3b	Local Roads	* 500m	Review if high scenic value.
3c	Provincial Tourist Route	4km	Statutory scenic drives
3d	Local Tourist Route	2,5km	Assumption made for local importance. Can be reduced.
3e	Railway Lines	250m	No distinction drawn between passenger and goods lines. Also, rail corridors usually visually disturbed
4	Transmission Lines		
4a	Major Power Lines	250m	
4b	Cell Phone Masts + Communication Towers	* 500m	To be captured at local scale.
4c	Radio + Navigation Beacons	* 250m	Capture at local scale
5	Key Infrastructure/Airports		
5a	Airport with Primary Radar	25km	Should be eliminated at regional level.
5b	Local Airfield	2,5km	To be confirmed with agency.
5c	National Security Sites (e.g. Koeberg)	15km	To be discussed with agency concerned. Should be eliminated at regional level.
6	National Parks + Provincial Nature Reserves	2km	Should be eliminated at regional level.
7	Protected Areas		
7a	Mountain Catchments	* 500m	To be captured at local level.
7b	Protected Natural Environment	2km	Should be eliminated at regional level.
7c	Private Nature Reserves	* 500m	Could be negotiated at local level.
8	Coast & Rivers		
8a	Distance to Coastlines of Undisturbed Scenic Value	4km	Should be eliminated at regional level.
8b	Distance to Rivers	* 500m	Only perennial rivers mapped at regional level – site level to account for all hydrology and geohydrology.
8c	Distance to 1:100 Year Floodline	* 200m	To be mapped at local level.
9	Sensitive Areas (Avian)		
9a	Distance to Major Wetlands (Ramsar Sites)	2km	Should be eliminated at regional level.
9b	Distance to Local Wetlands	* 500m	Map at local level.
9c	Distance to Bird Habitats or Avian Flight Paths where known	1km *	Assumed specific breeding sites dealt with at EIA level.
10	Topographical		
10a	Slope and elevation	*	Key considerations at local level; see visual and site assessment criteria.
10b	Distance from Ridge Lines	*	Major ridgelines eliminated at regional level, local level to identify ridgelines / skyline issues.
11	Vegetation		
	Distance to Important Indigenous/ Remnant Vegetation	*	To be mapped at local scale.

Table 3 : List of regional criteria for wind farms

(* Key Criteria to be Mapped at Local Project Level.

Source: Provincial Government of the W. Cape and CNdV Africa, 2006

SECTION 6: SPECIFICATION OF RELEVANT VISUAL THRESHOLDS

As visual assessment involves both qualitative, as well as quantitative criteria, it is not easy to establish environmental thresholds for the proposed energy facilities at the various sites. It is therefore suggested that the criteria given in Table 3 above be used as a general guide.

SECTION 7: IDENTIFICATION OF KEY VISUAL ISSUES

The public participation process (PPP) to date has provided a number of visual issues (ERM, 2010). These have been incorporated with issues identified by the visual specialists, and are summarised below. The issues are not seen as impacts, but merely as concerns that will need to be addressed in the visual impact assessment.

Table 4: Roggeveld Visual Issues

<i>Potential visual intrusion on sense of place</i>	The relatively large proposed wind farm of some 250 turbines would be located in rugged Karoo wilderness and rural farming terrain, the industrial energy facilities potentially having a significant effect on the existing landscape.
<i>Potential effect on landscape features and scenic resources</i>	The wind farm is located on mountain ridgelines of the Kleinroggeveldberge and will therefore be visible on the skyline for large distances in the surroundings. The sheer scale of the wind farm would probably have some effect on the scenic resources of the area.
<i>Potential effect on local inhabitants, visitors to the area and on tourism</i>	The proposed wind turbines would be visible to a number of scattered farmsteads, and also from the R354 arterial road between Matjiesfontein and Sutherland over a distance of almost 50km. Both of these destinations have tourism importance. The navigational lights on the turbines would also be potentially visible for a considerable distance at night.

<i>Potential effect of the scale of the project</i>	The scale of the proposed energy facilities, involving some 250 wind turbines, along with a number of electrical substations, would have visual implications for the surrounding area. These effects are assessed by means of visual simulations for the energy facilities.
<i>Potential effect of lights at night</i>	Security and navigational lights at night could have an effect on the 'dark skies' for which the Karoo is renowned. These could be particularly visible on the mountain skyline.
<i>Potential effect of construction and de-commissioning</i>	The scale of the project could have significant visual effects relating to the construction of access roads, haul roads, borrow pits, as well as the use of cranes and other heavy construction machinery. At the end of the life of the project, many of the foundations and roads may remain visible in the relatively arid landscape.

SECTION 8: ALTERNATIVES CONSIDERED IN THE IMPACT ASSESSMENT

A site selection process has previously been conducted by G7, involving some 14 sites, including Roggeveld. A range of criteria was used, which included visual parameters. (Coastal and Environmental Services, 2009).

Alternative layouts within the site have been developed, the current alternative being a response to the specialist baseline studies, and therefore being the preferred alternative. The layouts were provided by G7, and these may be subject to further refinement and micro-siting considerations.

SECTION 9: VISUAL ASSESSMENT CRITERIA

A series of both quantitative and qualitative criteria are used to determine potential visual impacts. These are rated to determine both the expected level and significance of the visual impacts.

(1) Viewpoints (Fig. 4, Table 5)

Viewpoints were selected based on prominent viewing positions in the area, where uninterrupted views of the proposed energy facilities could be obtained, including potentially sensitive viewpoints, (see Fig. 4). The proposed facilities would be potentially visible from the R354 arterial road, and a number of farmsteads.

(2) Visibility (Fig. 4)

Visibility tends to be determined by distance between the proposed energy facilities and the viewer. Given the size of the wind turbines, visibility tends to be significant up to distances of 5km. Distance radii are shown in Fig. 5 to assist in quantifying visibility of the proposed facilities.

Degrees of visibility in relation to distance tend to be as follows for the wind turbines, based on field observations and photographic panoramas, (see Table 5). Visibility is increased by the location of the turbines on a mountain skyline:

Highly visible:	Clearly noticeable within the observer's viewframe 0 to 5km
Moderately visible:	Recognisable feature within observer's viewframe 5 to 7.5km
Marginally visible:	Not particularly noticeable within observer's viewframe 7.5 to 10km
Hardly visible:	Practically not visible unless pointed out to observer 10 to 15km+

(3) Visual Exposure (Fig. 5)

Visual exposure is determined by the 'viewshed' or 'view catchment', being the geographic area within which the project would be visible. The viewshed boundary tends to follow ridgelines and high points in the landscape. Some areas within the view catchment area fall within a view shadow, and would therefore not be affected by the proposed energy facilities. The zone of visual influence tends to fade out beyond 5km distance.

(4) Visual Sensitivity

Visual sensitivity is determined by topographic features, steep slopes, protected areas, rivers, scenic routes or airfields. The Roggeveld site includes mountain ridgelines, steep mountain slopes and a regional arterial road.

(5) Landscape Integrity

Visual quality is enhanced by intactness of the landscape, and lack of other visual intrusions. The Roggeveld site currently has few visual intrusions, although existing Eskom power lines cross the site. The upper mountain slopes and ridges still have a wilderness character.

(6) Cultural Landscape

Besides natural attributes, landscapes have a cultural value, enhanced by the presence of historical settlements, old routes, graves and farmsteads. See detailed heritage impact assessment by ACO (2010).

(7) Visual Absorption Capacity

This is the potential to screen the project. Given the scale of the proposed facilities, their siting on a mountain skyline and the open nature of the landscape, there is little opportunity for screening.

(8) Cumulative Visual Impact

This is the accumulation of visual impacts in the area, particularly in relation to other existing or proposed wind energy farms and industrial-type facilities. Wind energy facilities are proposed at Sutherland (Komsberg), Witberg and Konstabel within a 30km radius.

The criteria above are considered in combination to give an indication of the potential visual impacts in Table 6.

Table 5 : Potential Visibility (see Figures 5 to 8)

View Pt	Location	Distance	Comments
VP1	R354 at Hillandale	6.42 km	Marginally visible in the distance.
VP2	R354 at road cutting	3.04 km	Clearly noticeable on the ridgeline in the middle distance.
VP3	R354 at Nuwerus	3.05 km	Clearly noticeable in the foreground.
VP4	R354 at Swartland	2.08 km	Highly visible in the foreground within the site.
VP5	R354 at Langhuis	6.91 km	Not visible because of view shadow.
VP6	Wilgebos Road	6.78 km	Clearly visible in the distance, but narrow view cone.
VP7	Wilgebos	3.93 km	Clearly visible on the ridgeline in the middle distance.
VP8	Klipbanksfontein	3.83 km	Clearly noticeable feature on the ridgeline in the middle distance.
VP9	Rietfontein	4.43 km	Partly visible in the middle distance.
VP10	road pass	2.03 km	Highly visible on the ridgeline.
VP11	ridge boundary	0.76 km	Highly visible in foreground.
VP12	Ou Mure	1.08 km	Highly visible in all directions.
VP13	Saaiplaas	6.43 km	Clearly visible in the distance.

Table 6 : Assessment Criteria and Potential Visual Impacts / Benefits

Criteria	Comments	Wind turbine impacts	Substations / O&M bldg. impacts
Visibility of facilities Distance from selected viewpoints	Views of wind turbines from the R354 tend to be the most significant (2 to 6km distant). Farmsteads range from 1 to 6km.	Medium-high	Medium-low (partly screened by ridges)
Visibility of lights at night	Depends on number of turbines with nav lights, and amount of security lighting. Indicated that navigation lights would have reflectors.	Medium-high (without reflectors)	Medium (without reflectors)
Visual exposure Zone of visual influence or view catchment	Extensive viewshed because of the location of the turbines on mountain ridgeline. Large viewshed.	High	Medium-low (smaller view catchments)
Visual sensitivity Effect on landscape features and scenic value	Exposed Karoo landscape and visually sensitive skyline. The turbines create a distinctive feature in the rugged Karoo landscape. Sparsely populated area.	High	Medium (smaller in scale)
Landscape integrity Effect on character of the area	Contrasts with rural / wilderness landscape. Existing power lines cross the site.	High	Medium-high
Cultural landscape Heritage value of the landscape	Historical farmsteads and a number of ruins occur within the viewshed.	Medium-high	Medium
Visual absorption capacity (VAC) Lack of concealment	Low potential of open landscape and exposed ridgeline to visually absorb wind turbines. Large number of turbines.	High	Medium (largely located in valleys)
Cumulative impacts Accumulation of impacts in the area	Additional wind energy farms being proposed within 30km radius.	High	Medium
Overall impact rating		High	Medium

Table 7 : Synthesis of Visual Impacts / Benefits

Criteria	Comments	Wind Turbines	Substation/ O&M
Intensity or magnitude of impact Degree of visual impact.	See ratings in Table 6.	High	Medium
Spatial extent Degree of influence over a geographic area - local, district, regional or national.	Marginal visual effect beyond 5km.	Local to district scale.	Local
Duration Projected life-span of the proposed project.	Potentially longer than 15 years. (Projected to be ±25 years).	Long-term	Long-term
Probability Degree of possibility of the impact occurring.	Little or no opportunity to screen wind turbines.	Highly probable	Highly probable
Confidence Degree of confidence in predictions.	Based on available information and photo-montages.	High	High
Overall significance	Synthesis of criteria	High	Medium

SECTION 10: VISUAL MITIGATION MEASURES

The purpose of this section is to recommend practical management actions and alternatives to the project design, which will avoid, minimise, mitigate or compensate for potential negative impacts and enhance benefits. A number of mitigation guidelines were recommended in the earlier Baseline Study, and some of these have been incorporated into the current proposals.

Regional criteria for wind farms provided by the Provincial Government of the W. Cape and CNdV Africa (2006) were used as a starting point (see Table 8). These criteria are, however, not legislated and are general rather than place-specific. The criteria have therefore been compared with actual conditions at the Roggeveld site and mapping at the project level, with recommended buffers as indicated in the mitigations below.

10.1 ESSENTIAL MITIGATION MEASURES

The following are recommended as essential mitigation measures to reduce the visual impact ratings, based on criteria listed in Table 8 below:

- 1) No wind turbines should be located on the Tafelkop, Karookop, Spitskop (near Ou Mure), as well as other peaks, as these are prominent landscape features in the region. (Say 250m setback).
- 2) A minimum visual buffer zone of 2.5km (preferably 3km) for the wind turbines along the R354 Arterial Road. A number of turbines are closer than this in the current layout.
- 3) A visual buffer of 500m for the wind turbines from district roads and farmsteads.
- 4) A visual buffer of 500m for the substation and O&M buildings from the R354, local roads and farmsteads.
- 5) The substation and O&M buildings to be grouped together as far as possible.
- 6) The substation transformers, which have a high degree of visual intrusion, to be screened by the various buildings.
- 7) The design of the buildings to be compatible in scale and form with buildings of the surrounding area, preferably using the regional Karoo architectural style. All yards and storage areas to be enclosed by masonry walls.
- 8) Signage related to the enterprise to be discrete and confined to the entrance gates. No other corporate or advertising signage, particularly billboards, to be permitted.
- 9) The navigation lights on the wind turbines to be fitted with reflectors so that the lights are not visible from below.

Provided these mitigation measures are employed, the visual impact ratings could be reduced as indicated in Table 9 below.

10.2 CONSTRUCTION MITIGATION MEASURES

- 1) The construction camp, material stores and lay-down area should be located as far as possible out of sight of the R354, possibly in the vicinity of the proposed substation and O&M buildings.
- 2) The extent of the construction camp and stores should be limited in area to only that which is essential.
- 3) Disturbed areas rather than pristine or intact landscape areas should preferably be used for the construction camp.
- 4) Measures to control wastes and litter should be included in the contract specification documents.
- 5) Provision should be made for rehabilitation/ re-vegetation of areas damaged by construction activities.
- 6) Borrow pits for the construction (which have not been identified), would be subject to permits from the relevant authorities. Borrow pits on the site are to be rehabilitated and re-vegetated according to the botanist's recommendations.

10.3 OPERATIONAL MITIGATION MEASURES

- 1) The footprint of the operations and maintenance facilities, as well as parking and vehicular circulation, should be clearly defined, and not be allowed to spill over into other areas of the site.
- 2) The operations and maintenance areas should be screened by buildings, walls, hedges and/or tree planting, and should be kept in a tidy state to minimise further visual impact.

Table 8 : Criteria for Visual Buffers at the Roggeveld Site

Criteria	PGWC Regional Level Mapping : Recommended Buffers (2006)	Local Project Level Mapping for the Roggeveld Site: Suggested Buffers
Urban Areas	800m	n/a
Residential Areas, including rural dwellings	400m	400m
National Roads	13km buffer. Depends on scenic value. Can be reduced.	n/a No national roads in the area.
Local Roads (district roads)	500m Review if high scenic value.	500m
Provincial Tourist Route	4km buffer. Statutory scenic drives.	n/a
Local Tourist Route	2.5km Assumption. Can be reduced.	2.5km The R354 is a regional tourist route.
Railway lines	250m	n/a
Local airfield	To be confirmed with agency.	An aerodrome is located near Sutherland about 35km to the northeast. A small local landing strip is located 15km to the south at Aasvoelbos.
National Parks, Provincial Nature Reserves	2km Should be eliminated at regional level.	2km. There are no National Parks or reserves in the immediate area.
Private Nature Reserves (Rietpoort game farm)	500m Could be negotiated at local level.	500m
Coastlines of Scenic Value	4km Should be eliminated at regional level.	n/a
Rivers	500m Perennial rivers at regional level. Hydrology to be determined at site level.	Hydrologist to determine site level buffers.
External farm boundaries	No indication	500m visual buffer. (in case of tourist facilities).

Table 9 : Significance of Visual Impacts before and after Mitigation

	Comments	Significance before mitigation	Significance after mitigation
Significance: wind turbines	Significance is increased by the large number of turbines, the open Karoo landscape, exposed mountain skyline and proximity of the N1 and rail line. Significance is decreased by remoteness of the site.	<u>High significance</u> (based on intensity/ magnitude in Table 7 above)	<u>Medium-high significance</u> With visual buffer along R354 and no turbines on peaks.
Significance: substation, O&M buildings	Significance is increased by need for connecting pylons. Significance is moderated by distance from N1 and rail line, existing power line and location on lower slopes.	<u>Medium significance</u>	<u>Medium-low significance</u> (Significance reduced if buildings grouped / transformers screened by buildings).
Significance: Lights at night	Significance is increased by the open landscape and high elevation on ridgeline. Significance is moderated by distance from N1.	<u>Medium-high significance</u>	<u>Medium-low significance</u> (Significance reduced if reflectors used for navigation and other lights).
Significance: Construction phase	Turbines manufactured off-site, but erection requires large equipment. Short duration of construction period would reduce significance. Borrow pits could increase significance.	<u>High significance, but short duration.</u>	<u>Medium-high significance, but short duration.</u>
Status		<u>Negative</u>	<u>Negative</u>

SECTION 11: RECOMMENDATIONS FOR MONITORING

This visual impact assessment has identified the need for mitigations in order to reduce potential visual impacts arising from the project. It is therefore recommended that final layouts of the energy facilities, as well as designs for the various buildings be reviewed by ERM and the visual specialists, before construction commences.

Any future additional infrastructure, such as buildings, lighting, masts, or other elements, which could visually intrude on the landscape, should first be reviewed by ERM, or their subconsultants, before being included in the EIA permit.

SECTION 12: CONCLUSION AND RECOMMENDATION

The visual assessment indicates that the potential visual impacts for the proposed wind turbines will be high before mitigation and medium-high after mitigation. The main mitigations are the removal of the proposed wind turbines from the Tafelkop, Karookop, Spitskop and other peaks. A visual buffer of 2.5km from the R254 was previously given in the Visual Baseline Study, and this should be seen as a minimum, but preferably 3km because of the increased size and number of turbines in the current layout. Given the nature of the site, with its high mountain ridge and the large size of the wind turbines, there is little opportunity for screening of the wind turbines.

The siting of the turbines is constrained by wind measurements and technical considerations. Further mitigation is therefore limited to reduction in the number of turbines, which is in turn related to project feasibility.

The potential visual impacts for the associated infrastructure, including substation, connecting power lines and operations and maintenance buildings would be medium before mitigation and medium-low after mitigation.

The cumulative impacts, as well as the lack of a regional plan to guide the spatial location of wind farms are a major concern.

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