18 SUMMARY, CONCLUSIONS & RECOMMENDATIONS

18.1 OVERVIEW

The aim of the EIA for the proposed Roggeveld Wind Farm is to provide information to inform decision-making that will contribute to environmentally sound and sustainable development. This report is submitted to the DEA to enable them to consider whether or not to grant environmental authorisation to the proposed development in terms of NEMA and if granted, to assist them in defining under what conditions the development should go ahead.

Through the EIA process which has included various stakeholder and specialist input, ERM has identified and assessed a number of issues relating to G7's proposed Wind Farm at Roggeveld. This Chapter provides an overview of the EIA findings and makes recommendations regarding key mitigation measures for the preferred and Final Layout (Site Layout Alternative 2) (*Figure 18.1*).

The Final Layout has been informed by the environmental sensitivity of the site based on the findings of the specialist studies undertaken during the EIA process, and best available wind resources. *Figures 4.4* to *4.7* show the Site Layout Alternatives 1 and 2, and illustrate how the site layout has been changed based on specialist feedback and input received during the specialist mitigation workshop.

The Final Layout (Alternative 2), used as the basis of this EIA, has been based on the best available information but may require some minor alterations once geotechnical investigations have been completed. Any revisions to the design should respect high sensitivity zones as per this EIR . The Final Layout and any micro-siting requirements, and final road alignments, borrow pits, etc. will require field checks by specialists, see recommendations below. Specialists have recommended mitigation measures, including pre-construction monitoring requirements, which may lead to further changes in the turbine layout and required mitigation measures. G7 have stated a willingness to relocate 22 turbines from the 1.5km and 2.5km buffers respectively of the Verreaux and Martial Eagle nests identified It is ERM's recommendation that pre-construction monitoring should inform the final turbine layout and any necessary mitigation. Any significant changes to the Final Layout resulting from the pre-construction monitoring or any other technical feasibility studies would be submitted to DEA before construction commences with an indication of the extent of change and any implications on the resultant environmental impacts.

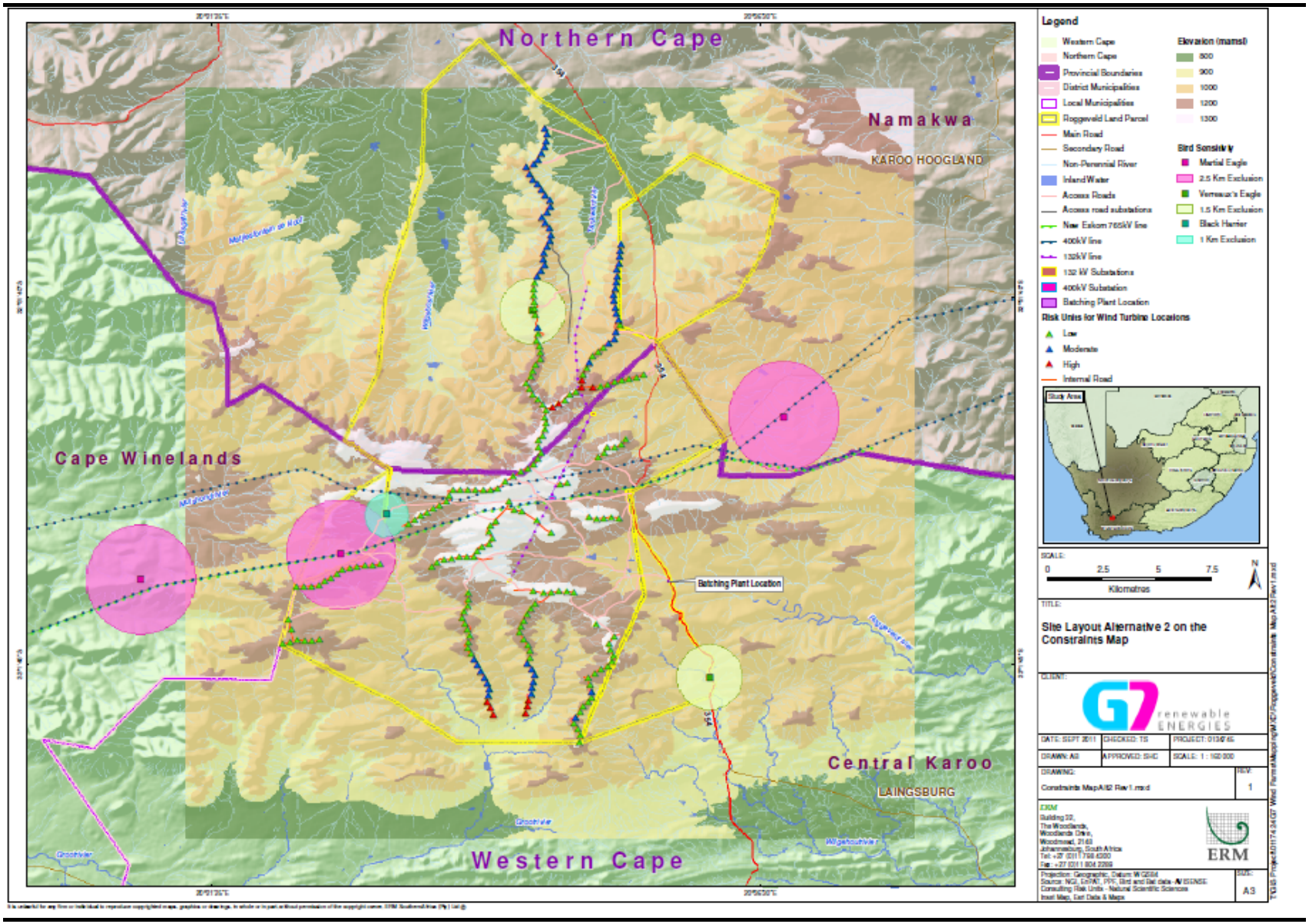
G7 has established the viability of the proposed wind farm during their feasibility assessment and the Roggeveld site has been selected as a priority site for a wind farm. G7 is also of the opinion that the Roggeveld site is

definitely viable for wind powered electricity generation, based on the results of wind measurements to date.

The potential impacts associated with the development are summarised below and should be considered both in the context of the project rationale and the discussion of cumulative impacts in the previous chapter. The decision on whether to issue an environmental authorisation for the proposed wind farm must consider both the potential negative impacts on the environment while at the same time recognising the need to encourage renewable energy in South Africa in order to move toward more sustainable energy practices and meet targets set by the government of sourcing 10,000 GWh from renewable energy projects by 2013 (1).

(1) National Energy Regulator of South Africa **South Africa Renewable Energy Feed-In Tariff** (2009) NERSA Publications.

Figure 188.1 Final Layout (Site Layout Alternative 2)



18.2 SUMMARY OF IMPACTS IDENTIFIED AND ASSESSED

18.2.1 Comparative assessment of Alternative 1 and 2

Below is a comparative assessment table for the layouts identified as feasible alternatives, followed by a short discussion.

Table 18.1 Comparative assessment of layout alternative 1 and 2

Aspect	Site Layout Alternative 1	Site Layout Alternative 2
Number of turbines	250 turbines	228 turbines
Electricity generation capacity	750MW output for a 3 MW turbine	684MW output with a resultant reduction in output of 66MW compared to Site Layout Alternative 1
Flora and Fauna	Turbines are located on CBA along drainage channels. This affects flora and faunal habitats.	Offsets recommended as a mitigation measure.
Birds	Turbines located in close proximity to Martial and Verreaux Eagle nests.	Turbines excluded from nest buffer areas for both eagle nests resulting in the exclusion of 22 turbines.
Bats	Turbines located in high risk areas for bat migration	Turbine numbers and location to be revisited after pre construction monitoring has been undertaken
Soils, Surface and Groundwater	Construction, soil compaction and erosion associated with 250 turbine installations	Reduced impact on soil as 228 turbines proposed under this alternative
Visual	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.	Minor mitigation measures to be implemented which does not result in a change to the significance post mitigation
Noise Impact	Turbines located on the boundary of the site	Additional property acquired which meant that turbines were not located on the boundary of the site
Cultural Heritage	Turbine would be in a broader cultural landscape but with no significant impact	Micro siting of turbines where necessary to avoid identified heritage resources

In the above table, each of the attributes for the site alternatives has been given a "green" or "red" colour. Green indicates that the attribute is favourable in relation to that particular alternative in relation to the other and red indicates that it is not favourable.

The table clearly shows that avoidance of areas based on specialist input has resulted in more favourable attributes relating to Site Layout Alternative 2 when compared to Site Alternative 1. Although **Site Layout Alternative 2** has resulted in a decreased electricity generation capacity for the project, the positive trade-off is the reduction in the environmental impacts in the table above, through avoidance as the first step in mitigating potential impacts and this is therefore the **preferred layout alternative**.

This draft EIA report provides a description of the EIA process followed to date including the public participation process that has been undertaken and

which will continue through to the submission of the Final Impact Assessment Report to the Department of Environmental Affairs for decision-making.

The potential impacts associated with the development are summarised below and should be considered both in the context of the project rationale and the discussion of cumulative impacts in the previous chapter.

18.2.2 Bio-physical and Socio-economic Construction Phase Impacts

The key negative potential impacts during the construction phase involve potential impacts on flora and fauna (including birds, bats, mammals, reptiles and amphibians), noise, visual and tourism activities. These impacts together with proposed mitigatory measures are summarised in *Table 18.1*.

The construction phase is envisaged to span 24 months per 200MW and would involve an intensive period of site clearance for the infrastructure such as the laydown areas, storage areas, substation, roads, buildings and turbine foundations. This may require blasting along the ridge, but the extent of blasting required can only be established after further geotechnical studies have been undertaken and once the actual amount of rock excavation is established. The quality of rock excavated will in turn determine the amount of crushed stone that may need to be quarried from borrow pits for mixing into the concrete.

In summary, the key potential **positive impacts during construction** involve benefits to the local economy and potential paleontological discoveries should a find be recorded by a palaeontologist during excavation. The benefits to the local economy associated with the construction phase of the project warrants a residual moderate positive significance rating associated with the benefits from employment as well as local procurement. The civil and other construction, specialised industrial machinery and building construction sectors would benefit predominantly but also hospitality and service industries, such as accommodation, catering, cleaning, transport, vehicle servicing and security services.

The key potential **negative impacts during construction** relates to visual, bats, birds, fauna and flora.

Table 18.2 Summary of pre-mitigation and residual impacts of the bio-physical and socio-economic environment during construction

Environmental Aspect	Section	Impact	Pre-mitigation Significance	Residual Impact Significance
Flora and Fauna	7.1	Destruction & Loss of Vegetation	MODERATE-HIGH (-)	MODERATE MINOR(-)
	7.2	Protected Plant Species	MODERATE-HIGH (-)	MODERATE MINOR(-)
	7.2	Faunal impacts – Construction Disturbance	MODERATE (-)	MODERATE (-)
Birds	8.1	Habitat loss	MODERATE-HIGH	MODERATE (-)
	8.1	Disturbance	MODERATE-HIGH	MODERATE (-)
Bats	9.1	Habitat loss, destruction, disturbance and displacement	MODERATE (-VE)	MINOR (-VE)
Soils, Surface and Groundwater	10.1	Loss of topsoil, compaction and erosion	MODERATE (-VE)	MINOR (-VE)
	10.2	Impact on surface and groundwater	MINOR (-VE)	MINOR (-VE) (
Noise Impact	11.1	Construction noise	MODERATE (-VE)	MODERATE-MINOR (-VE)
Visual	12.2	Visual impact on fixed receptors	MODERATE(-VE)	MODERATE (-VE)
Cultural Heritage	13.1	Disturbance or damage to paleontological resources	MODERATE (-VE)	MODERATE-MAJOR (+VE)
	13.1	Disturbance or damage to archaeological resources	MINOR (-VE)	MINOR (-VE)
	13.1	Disturbance or damage to cultural heritage resources	MODERATE (-VE)	MINOR (-VE)
	13.1	Disturbance or damage to buried graves	MODERATE (-VE)	MINOR (-VE)
Socio-economic	14.1	Benefits to the local economy	MODERATE positive	MODERATE positive
	14.2	Increased social ills	MODERATE Negative	MINOR (-VE)
	14.3	Disruption to agricultural activities	MODERATE Negative	MINOR Negative
		Loss of agricultural land	MINOR Negative	MINOR Negative
	14.4	Tourism activities	MINOR Negative	NEGLIGIBLE Negative
	14.5	Property prices and desirability of property	MINOR (-VE)	MINOR (-VE)
		Sense of place	MINOR Negative	NEGLIGIBLE Negative
		Road infrastructure	MODERATE Negative	MINOR Positive
Other Impacts	15.1	Dust	MINOR (-VE)	MINOR (-VE)
	15.2	Traffic	MODERATE(-VE)	MINOR (-VE)
	15.3	Waste and effluent	MINOR (-VE)	MINOR (-VE)
	15.4	Health and safety	MINOR (-VE)	NEGLIGIBLE

18.2.3 Bio-physical and Socio-economic Operational Phase Impacts

The key residual negative potential impacts anticipated during the operation of the proposed development involve impacts on birds, bats, visual and cultural heritage.

Operational impacts of the wind farm relate primarily to the existence of 228 turbines on the ridge and the presence of the turbines and their turning blades on birds and bats.

There is an international drive amongst countries towards increasing their share of renewable energy generation due to concerns such as climate change resulting from carbon emissions and the continued exploitation of non renewable resources. To this end the SA Government has set a 10 year target of 10 000 GWh renewable energy contribution to final energy consumption by 2013. This amounts to about 4% (1667 MW) of SA's total estimated electricity demand.

In line with this target in the Western Cape, provincial government has also made a commitment to improving sustainability by setting a goal of generating 15 percent of all energy from renewable resources by 2014, and the proposed development would likewise positively contribute to this target. Therefore, especially given the scale of the proposed Wind Farm development, it is also important to place it in the context of the regional and national requirements for CO_2 emissions reduction and increased production of renewable energy.

The impacts associated with the operational phase of the proposed Roggeveld Wind Farm are summarised in *Table 18.3,* together with the residual impact significance.

Table 18.3 Summary of residual bio-physical and social residual impacts during the operational phase of the project

Environmental Aspect	Section	Impact	Pre-mitigation Significance	Residual Impact Significance
Flora and Fauna	7.1	Erosion Potential	MODERATE-HIGH (-)	MINOR (-)
	7.2	Alien Plant Invasion	MODERATE (-)	MINOR (-)
	7.2	Hunting and Collecting of Fauna & Flora	MODERATE (-)	MINOR (-)
	7.2	Loss of landscape connectivity for fauna	MINOR (-)	MINOR (-)
		Maintenance impact on vegetation	MODERATE MINOR(-)	MINOR (-)
		Impact on Critical Biodiversity Areas	MODERATE-HIGH (-)	MODERATE (-)
Birds	8.1	Displacement	MODERATE (-)	MODERATE MINOR(-)
	8.2	Mortality	MODERATE (-)	MODERATE MINOR(-)
Bats	9.1	Habitat loss – Destruction, disturbance and displacement	MODERATE (-VE)	MINOR (-VE)
	9.2	Collision of bats with turbines	MODERATE (-VE)	MINOR (-VE)
	9.3	Barotrauma	MAJOR (-VE)	MODERATE (-VE)
Soils, surface and groundwater	10.1	Loss of topsoil, compaction and erosion	MINOR (-VE)	MINOR (-VE)
	10.2	Impact on surface and groundwater	MINOR (-VE)	MINOR (-VE)
Noise Impact	11.2	Wind turbine noise during operation (at the boundary)	MODERATE (-VE)	MODERATE-MINOR (-VE)
Visual Impact	12.2	Visual impact on fixed receptors (wind turbines)	MAJOR (-VE)	MAJOR (-VE)
	12.2	Visual impact on fixed receptors (substation complex)	MODERATE (-VE)	MODERATE-MINOR (-VE)
	12.2	Visual impact on fixed receptors (at night)	MODERATE (-VE)	MODERATE-MINOR (-VE)
	12.3	Visual impact on temporary receptors (day time)	MODERATE (-VE)	MODERATE (-VE)
	12.3	Visual impact on temporary receptors (night time)	MODERATE (-VE)	MODERATE-MINOR (-VE)
Cultural Heritage	13.2	Cultural heritage visual or sense of place	MODERATE (-VE)	MODERATE (-VE)
Socio-economic	14.1	Benefits to the local economy	MODERATE positive	MODERATE positive
	14.2	Social Ills	MINOR Negative	MINOR Negative
	14.3	Disruption to agricultural land	MINOR Negative	NEGLIGIBLE Negative
		Loss of agricultural land	MINOR Negative	MINOR Negative
	14.4	Tourism activities for local traders	MINOR Positive	MODERATE (+VE)
	14.4	Impact on tourism activities of lifestyle farmers and reserves	MINOR Negative	NEGLIGIBLE Negative

Environmental Aspect	Section	Impact	Pre-mitigation Significance	Residual Impact Significance
	14.5	Property prices and desirability of property	**MINOR (-VE)**	**MINOR (-VE)**
		Sense of place	**MODERATE Negative**	**MINOR Negative**
		Road infrastructure	**MINOR Negative**	**MINOR Positive**
Other Impact	15.1	Dust and emissions	**NEGLIGIBLE**	**NEGLIGIBLE**
	15.2	Traffic	**MINOR (-VE)**	**NEGLIGIBLE**
	15.3	Waste and effluent	**MINOR (-VE)**	**NEGLIGIBLE**
	15.4	Health and safety	**MINOR (-VE)**	**NEGLIGIBLE**
	15.5	Shadow flicker	**NEGLIGIBLE**	**NEGLIGIBLE**

18.2.4 General Concerns and/or Opposition against the proposed development

The Comments and Responses report provides a detailed record of all issues/ comments raised, together with responses from ERM and G7. The most significant general statements of concern/ opposition against the proposed development are summarised below in order to further aid the decision authority in its final decision.

Negative response from Organisations

The Department of Agriculture has indicated in writing that no subdivision of agricultural land will be allowed to accommodate the establishment of any wind farm. ERM believes that this is a policy issue which would need to be resolved as part of the rezoning process, which is separate from the EIA.

18.3 RECOMMENDATIONS

ERM's Recommendation as required by the environmental regulations is informed by the following key considerations. These should also inform the eventual decision by the DEA:

- Various iterations to the layout were undertaken to accommodate environmental sensitivities and although many impacts were significantly reduced as a result (notably noise, certain visual perspectives, flora and fauna, birds and bats) , not all negative impacts of the proposed Roggeveld Wind Farm can be mitigated and reduced to levels of minor significance.

- The implementation of the mitigation measures outlined in this report and included in the Environmental Management Plan, including additional pre-construction monitoring of **birds and bats**, would provide a basis for ensuring that the potential negative impacts associated with the establishment of the Roggeveld Wind Farm are mitigated where possible, and that enhancements of positive impacts are achieved where possible. This is particularly relevant in the case of reducing the impact on birds and bats to a level of moderate, which is premised on the implementation of such pre-construction monitoring and any additional mitigation that may be warranted arising from this.

- Uncertainties around **cumulative impacts** associated with similar developments in the vicinity of Roggeveld and the growth of the renewable energy sector requires strategic planning and cooperation on a provincial and national level with input from developers, organisations such as the Endangered Wildlife Trust, Bird Life South Africa and other stakeholders. However, this falls beyond the scope of this EIA as it is not certain yet which other wind farms or other developments in the vicinity will be approved or implemented. The proposed wind farm for the

Roggeveld site, could have cumulative impacts relating to visual, heritage, and bird and bats.

- Consideration needs to be given to whether or not the potential **positive local and national benefits** from the proposed development in terms of benefits to the local economy and tourism activities for local traders adequately compensate for the negative residual impacts (visual and heritage sense of place and potential impacts on birds and bats).

- The potential contribution of the proposed project to the overall national **renewable energy targets** represents a positive social benefit to society as a whole although this is difficult to quantify**.**

- G7 argues that the **environmental efficiency** of the proposed wind farm in terms of impacts per unit of electricity generated on land of similar environmental sensitivity is high (considering Roggeveld is a very high wind resource site, requiring less turbines to generate the same amount of electricity than elsewhere).

In the light of the above, ERM concludes that there are **no environmental fatal flaws** that should prevent the proposed wind farm from proceeding, and recommend that the project be granted environmental authorisation provided that ERM's recommended mitigation, monitoring and management measures are implemented and that G7 commits to ongoing monitoring of potential environmental and socio-economic impacts. Specifically and notwithstanding the above, a pre-construction bird and bat monitoring program as recommended in this EIR and EMP is conducted and any further mitigation measures identified and required therein are adhered to and implemented, including possible layout revisions, but respecting that the removal of further turbines should be regarded as an absolute last resort only if all other possible mitigation measures are exhausted due to the negative impact on the project feasibility. The above conclusion is based on the fact that the significance levels of the majority of the identified negative impacts can be reduced to acceptable levels by implementing the recommended mitigation measures.

ERM recommends that in its final decision, DEA needs to consider that the visual impact and impact on heritage sense of place as well as the impact on birds remain of moderate to moderate-major significance. This should then be weighed up against the benefits to the local economy and local traders involved in tourism activities as well as the government's commitments in terms of renewable energy targets. If promoting renewable/ alternative energy is an important consideration for the SA Government (also because of the associated benefits in terms of reduction in CO2 emissions) it may become important that some **trade offs and choices** would need to be made between promoting renewable energy versus the local and regional environmental and social impacts and benefits.