ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED KLEINZEE 300MW WIND ENERGY FARM, SOUTH OF KLEINSEE

NORTHERN CAPE PROVINCE (DEA Ref: 12/12/20/2212)

FINAL EIA REPORT
FOR SUBMISSION TO THE DEPARTMENT OF ENVIRONMENTAL AFFAIRS

MAY 2015

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PROJECT DETAILS

DEA Reference No. : 12/12/20/2212

Title : Environmental Impact Assessment Process
Final Environmental Assessment Report: Kleinzee 300MW Wind Farm south of Kleinsee in the Northern Cape Province

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Project Developer : Eskom Holdings SOC (State Owned Company) Limited

Submission date : May 2015

When used as a reference this report should be cited as: Savannah Environmental (2015) Final Environmental Management Plan: Kleinzee 300MW Wind Farm south of Kleinsee in the Northern Cape Province.

PURPOSE OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holdings SOC Limited is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed wind farm on a site west of Kleinzee, in the Northern Cape Province. Eskom Holdings SOC Limited has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process is being undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addresses those identified potential environmental impacts and benefits associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised to date have been captured and adequately considered within the study. The Final EIA Report will incorporate all issues and responses prior to submission to the National Department of Environmental Affairs (DEA), the decision-making authority for the project.

EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

As outlined in the Acceptance of the scoping report dated May 2012, Savannah Environmental has compiled a table (refer to Table 1 below) which outline the requirements and where in the final EIR the requirements have been addressed for ease of reference.

TABLE 1: INFORMATION REQUESTED BY DEA

No.	Information	Provided / Reference
1.1	Please ensure that comments from all relevant stakeholders are submitted to the Department with the Final Environmental. Impact Report (EIR), This includes but is not limited to the: Department of Economic Development and Environmental Affairs arid Tourism; Department of Agriculture, Forestry and Fisheries, South African Heritage Resources Agency, and the local municipality,	All comments received during the comment period will be included in the Final EIA report
1.2	Proof of correspondence with the various stakeholders must be included in the, Final EIR Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments	Proof of correspondence with stakeholder will be included in the Final EIA report
1.3	In addition. the following amendment and additional information are required for the EIR: a) The activities as applied for in the application form is not specific to the development activities as in the project description please amend the application form such that activities applied for directly translate to the project activities. b) The total footprint 'of the proposed development should be indicated, Exact locations of the wind turbines and associated infrastructure should be mapped at an appropriate scale c) Should a Wafer Use License be required, proof of application for a license needs to be submitted, d) The impacts of the proposed facility on avifauna and bats must be assessed in the EIA phase, e) The EIR should include information on the following: * Environmental Costs vs, benefits of the wind farm; * Economic: viability of the facility to the surrounding area and how the local community will benefit f) Information on services required on site i.e. sewage, refuse removal water and electricity, who will supply these services and has an agreement and confirmation of capacity been obtained? g) An amended application form must be submitted with the EIR to reflect the listed activities applied for, specific attention should be paid to item 23 of GN R544, which has been excluded in the FSR,	a) An amended application as per section 5.1 will be submitted to the Department b) Refer to Appendix O (A3 Maps) c) Further consultation will be undertake with DWA to determine the need for a WULA d) Both bird and bat pre-construction monitoring programme has been undertaken for the project – refer to Appendix F & G e) Refer to section 10.5 & 2.4 f) Refer to section 2.1 g) An amended application as per section 5.1 will be submitted to the Department with all relevant Listed Activity
1.4	Please ensure that the Final EIA Report includes at least one legible A3 regional map of the area and the site layout map to illustrate the PV positions and associated infrastructure.	Refer to Appendix O

No.	Information	Provided / Reference
	The maps must be of acceptable quality and as a minimum, have the following attributes: » Maps are relatable to one another; » Cardinal points; » Co-ordinates; » Legible legends; » Indicate alternatives; » Latest land Cover; » Vegetation types of the study area; and, » A3 size locality map.	

INFORMATION REQUIRED TO BE INCLUDED IN THE EIA REPORT AS PER EIA REGULATIONS

Table 2 below details how the legal requirements of Section 31 of the EIA Regulations (EIA Report content) have been addressed within this report

TABLE 2: LEGAL REQUIREMENTS OF SECTION 31 OF THE EIA REGULATIONS

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.5 and Appendix A
(b) a detailed description of the proposed activity	Chapter 2
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Chapter 2
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 6
(e) details of the public participation process conducted in terms of sub-regulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	The Plan of study for the EIA Phase was proposed to achieve the following: i. Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 8 & 9) ii. Appendix C iii. Appendix C iv. Appendix C
(f) a description of the need and desirability of the proposed activity;	Section 2.4
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 2.3
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Section 5.4.4
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Section 2.4, Chapter 8

NEMA REGULATIONS GNR 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS EIA REPORT (refer to the following parts in the report)
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 10.6 & 10.7
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	Appendix C
(l) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 8 & 9
(m) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 8 & 9
(n) a description of any assumptions, uncertainties and gaps in knowledge	Section 5.4.5 and specialist reports (Appendix D-M)
(o) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 10.5
(p) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Section 10.5
(q) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix N
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix D-M
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the FEIR.

INVITATION TO COMMENT ON THE DRAFT EIA REPORT

Members of the public, local communities and stakeholders were invited to comment on the Draft Environmental Impact Assessment Report which was made available for comment for a 40-day period from **09 March 2015 – 28 April 2015** at the following locations**:**

» Kleinzee Public Library
» Buffelsrivier Library
» Komaggas office of the Nama Khoi Municipality
» Springbok Public Library
» www.savannahsa.com

Comments were received through written submission via fax, post or e-mail. I&APs were also informed in writing that this Final EIA Report has been prepared and submitted to DEA and is available for comment and for download from the website: www.savannahSA.com. Changes made to this Final Report are underlined for ease of reference. Comments on this final report should be submitted to DEA with a copy to Savannah Environmental. Copies of the Final Scoping Report could be requested, if desired or required by I&APs from the consultant. Relevant contact details are as follows:

National DEA **Muhammad Essop** **Tel:** 012 399 9406 **Fax**: 012 320 7539 **Email:** MEssop@environment.gov.za@environment.gov.za **Post:** Private Bag X 447, Pretoria, 0001	**Sustainable Futures ZA:** **Shawn Johnston** **Tel:** 083 325 9965 **Fax:** 086 510 2537 **Email:** swjohnston@mweb.co.za **Post:** PO Box 749, Rondebosch, Cape Town, 7701

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holdings SOC (State Owned Company) **Limited** is proposing the establishment of a wind farm and associated infrastructure on an identified site which is located approximately 6 km south of the mining town of Kleinsee within the Nama Khoi Local Municipality of the Northern Cape Province.

Wind turbines use the energy from the wind to generate electricity. In essence, the blades of the turbine are turned by the wind and the energy captured is converted into electrical energy and supplied to the electricity grid for use by consumers.

Infrastructure which is required for such a facility includes, inter alia:

- A cluster of up to 200 wind turbines to be constructed over an area of ~ 8 682 ha in extent
  - Installed capacity of each turbine up to 3 MW
  - Hub height up to 140 m
  - Rotor Diameter up to 140 m
  - Maximum length of blades is 70 m
- Concrete foundations to support the turbine towers (22m wide x 22m length x 3m deep)
- Mounting area for erecting of each turbine (also referred to as a laydown area - 40m x 40 m)
- Cabling between the turbines to be lain underground where practical
- An on-site substation to facilitate the connection between the facility and the electricity grid (100 m x 100 m (including HV yard))
- An overhead power line (400kV) feeding into Eskom's electricity grid. Two options are being considered:
  - Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  - Option 2: Turning into the Juno - Gromis power line located to the east of the site[1].
- Internal access roads between each wind turbine (permanent roads of approximately 7 m wide during construction)
- Borrow pits within the site for the construction of access roads
- Office/Workshop area for operations, maintenance and storage
- Information centre and associated billboards
- Water supply pipeline and Water storage reservoir and tanks

The site (~8 682 ha in extent in extent) includes the following farm portions (refer to Figure 1):

- RE of Brazil 329
- RE of Goraap 323,
- RE of Honde Vlei 325,

[1] The loop-in lines options has three sub-options referred to as alternative 2-4 in Figure 1.

» RE of Kannabieduin 324,
» Portion 4 of Rooivlei 327

Savannah Environmental was contracted by Mainstream as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Environmental Impact Assessment Report consists of the following sections:

» **Chapter 1** provides background to the proposed wind energy facility project and an overview of the environmental impact assessment.
» **Chapter 2** describes the project and feasible alternatives identified and investigated.
» **Chapter 3** describes wind energy as a power generation option.
» **Chapter 4** outlines the regulatory and legal context of the EIA study.
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken.
» **Chapter 6** describes the existing biophysical and socio-economic environment affected by the proposed project
» **Chapter 7** describes the scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of the identified environmental impacts associated with the proposed project.
» **Chapter 9** describes the assessment of cumulative impacts associated with the proposed Kleinzee Wind Energy Facility and recommended mitigation measures
» **Chapter 10** presents the conclusions of the impact assessment, recommendations and impact statement for the proposed project.
» **Chapter 11** contains a list references used in compiling the Final EIA report and specialist reports.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addressed those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project.

The release of a draft EIA Report aims to provide stakeholders with an

opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. This Final EIA Report has incorporated all issues and responses raised during the public review of the draft Scoping Report prior to submission to the National Department of Environmental Affairs (DEA).

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility and associated infrastructure.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by the developer. This layout includes 200 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium significance were identified which require mitigation (thereafter the impacts can be reduced to medium – low significance). Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft **Environmental Management Programme (EMPr)** included within **Appendix N**.

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Kleinzee Wind Energy Facility and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation

is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The construction of the Kleinzee Wind Energy Facility will lead to permanent disturbance of an area of approximately 1% of the site. Permanently affected areas include the turbine footprints and associated infrastructure, as well as the internal access roads. From the specialist investigations undertaken for the proposed Kleinzee Wind Energy Facility development site, a number of potentially sensitive areas were identified. The following sensitive areas/environmental features have been identified on the site:

» ***Floral sensitivity***: The area of the Namaqualand coast between Hondeklip Bay in the south and Kleinzee in the north has been poorly explored and documented botanically due to restricted access over many years. However, a limited number of botanical studies have shown that apart from some localized 'special' plant communities, large areas are covered by one or a few types of vegetation. This is true in the Kleinzee WEF study area where the vegetation is mainly Namaqualand Coastal Duneveld with limited areas of Namaqualand Strandveld and Namaqualand Salt Pans on the inland boundary. Certain plant communities and plant species within the general vegetation matrix are considered to be sensitive. These plant communities and species are described in the report and areas of sensitivity are indicated on Figure 10.1. It is essential that these are noted and that the recommended mitigation measures are implemented as per the EMPr. It was recommended that the layout should be altered to remove all roads and turbines around **Turbines 21, 106, 108, 109, 130-132** from areas of Namaqualand Salt Pans. If this is undertaken, then the impacts on the vegetation and flora can be reduced from potentially High negative to **Medium** negative and the proposed wind farm then becomes acceptable within the described botanical context.

» ***Faunal sensitivity***: Overall the site is not considered to be highly sensitive from a faunal perspective. A large proportion of the listed fauna which occurs in the area is likely to be associated with the rocky outcrops. This habitat is highly restricted within the study area and amounts to less than 50 ha, including buffers. Given their limited extent, these areas would be easily avoided. The majority of the site consists of habitat of medium sensitivity. Although there are a number of listed species that would be likely to occur in this habitat such as Grant's Golden Mole, Desert Rain Frog and Namaqua Dwarf Adder.

The affected habitat is relatively abundant in the area, and the amount of transformation required for the development is not significant when considered at the scale of the vegetation type and faunal habitat available. The development area however comprises almost 10% of the Namaqualand Coastal Duneveld vegetation type and the potential for the disruption of north-south connectivity for affected and sensitive fauna associated with this habitat is potentially more significant. Rehabilitation of cleared and disturbed areas would be an important mitigation measure at the site, especially given the high risk of wind erosion at the site. Such rehabilitation should be supervised or conducted by someone with experience in local rehabilitation practices. The actual amount of transformation that will be required would however amount to approximately 1.5% of the total area, which is not highly significant when considered at the landscape scale. It is therefore concluded that the majority of impacts on faunal species associated with the development would be local in nature. Although there are some impacts that may be of wider significance, such as the disruption of landscape connectivity, these impacts are difficult to quantify and the number of species affected is also uncertain, but likely to be low. Overall, the terrestrial faunal impacts associated with the development of the site are assessed as being of **low to moderate significance** and largely local in nature. With the appropriate mitigation, these impacts would be reduced to an acceptable level.

» ***Bird Habitat and Sensitive Areas –*** the proposed wind farm holds several collision-prone and red-listed bird species. These birds use the landscape in a regular way that allowed the identification of high risk and lower risk areas on the site (refer to Figure 10.1). By proposing three mitigation scenarios, it is found that the wind farm can be constructed in the medium and low risk areas and avoid bird displacement and direct mortality. These mitigation measures include:

* Relocation of turbines in the three **high risk zones** to low risk areas. This affects about 33 turbines (**i.e. T10, 12, 22, 23, 25, 34-36, 47-49, 64, 74, 81,83-85, 93, 94, 98, 104, 112-115, 117, 124-126, 129, 137, 138**).
* Those turbines in the medium risk areas (i.e. **T6-8, 16, 27, 28, 31, 82, 91, 108, 144-145**) should be and relocated if possible. If this is difficult then the density of turbines should be reduced to reduce the risk to collision-prone birds in the area. If mitigation is not feasible in the medium

risk areas on-site mitigation measures will be required during the breeding season. These include the use of a bird detection system similar to or identical to the "**DT bird**" detection system developed by the Spanish to reduce direct impacts by birds at wind farms and other facilities. http://www.dtbird.com/index.php/en/.

- All overhead power lines require bird diverters for the full length of the power line.
- A minimum 12-month programme of during- and post-construction bird monitoring is proposed to accurately determine the real impacts and understand the efficacy of the proposed mitigation measures.

» ***Bat sensitive areas -*** With the exception of the areas delineated with higher sensitivities (i.e. areas around **T21, 83, 84, 87, 95, 101, 106, 108, 109, 130-132**), the Kleinzee wind energy facility is considered a low-medium bat sensitive site, with certain seasons considered as having higher sensitivity. The area has a medium to high bat activity compared with other sites for the Succulent Karoo, but lower activity compared with sites in the coastal Lowland Fynbos or Coastal Forest. The potential impacts of key significance for this site would be associated with bat fatalities due to collision with or barotrauma from wind turbines. The significance of this can be reduced if areas of Medium-High and High sensitivity are avoided for development. A tiered adaptive operational mitigation approach is recommended based on the findings of the operational monitoring; this is outlined in the Bat Impact Report (**Appendix G**).

» ***Heritage artefacts -*** There are no significant concerns over impacts to heritage resources as a result of the proposed project. Direct impacts to archaeological sites and human burials can be easily mitigated if the sites cannot be avoided. Mitigation would consist of excavation and possibly dating of the affected sites so as to create a record of the sites which is stored in perpetuity to allow future researchers access to the material. In this way scientific data pertaining to those sites is not lost. Given the scale of the development and the general density of archaeological sites identified during the survey, the final layout should be examined on the ground to confirm that no further archaeological sites will be impacted. It is envisaged that, given the information at hand, only a few more sensitive areas will need a final inspection. These would be in areas where sites are under direct threat from the proposed development (within 20 m of proposed

infrastructure and/or between the turbine and road alignments), highlighted as "heritage sites" on Figure 10.1, these site are deemed to be of archaeological significance.

In terms of fossils, the significance rating is low as a consequence of the low probability of finding fossils in the upper terrestrial deposits.

» ***Noise sensitive receptors -*** With the proposed layout assessed it is considered highly likely that the wind farm will have a noise impact on NSD01 during the operational phase. This is mainly due to the distance between the closest wind turbines and this NSD. This may result in a noise impact of medium significance. It should be noted that the noise impact was determined based on the outcome of a regression analysis that indicated that the likely long-term ambient sound levels could be significant during periods when wind speeds exceeds 4 m/s. The regression analysis is based on a number of measurements taken at various sites during periods when the wind was blowing, but when there were little other noise sources.

» ***Visual impacts -*** The visual environment surrounding the site will be visually impacted upon for the anticipated operational lifespan of the development (i.e. 20 - 30 years). Visual impacts on homesteads and settlements in close proximity (within 5km) to the proposed facility are expected to be of **highest** significance. The post mitigation significance of anticipated visual impacts are of moderate to low levels, with the exception of that on homesteads and settlements in close proximity. This impact is, however, not considered to be a fatal flaw for the proposed project. It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures.

» ***Social impacts -*** The development of the proposed Kleinzee Wind Energy Facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

» ***Cumulative Impacts*** - Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of

these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Integrated Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

The following identified 'no go' areas for the construction of infrastructure (including turbines) are to be observed during construction and operation includes:

» Areas of *Namaqualand Salt Pans* and all areas where there are sensitive micro-habitats (e.g. granite outcrops and where endemic and rare plant species such as *Wooleya farinosa* occur) must be **avoided**.
» Three high-risk avifauna zones overlaid on the flight paths of the most collision-prone red-listed species (i.e. Ludwig's and Kori Bustards) recorded within the wind farm. 33 turbines in these areas must be moved and positioned in low risk areas.
» In terms of bats, it is recommended that the high and high - medium sensitive areas remain undeveloped and that no part of the turbine, including the full rotor sweep encroaches into these areas.

The following conditions would be required to be included within an environmental authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within Appendices D to M must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within **Appendix N** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
» The preferred layout for implementation is indicated in Figure 10.2.
» The preferred power line is Alternative 4.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.

- A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known.
- Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
- The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
- Once the layout has been finalised, an archaeological ground-truthing should be conducted and further recommendations be made to protect the archaeological heritage within the area proposed for development.
- An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
- All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
- Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
- Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bat communities. Where necessary, additional mitigation measures should be implemented to minimise impacts on these communities.
- Disturbed areas during construction should be kept to a minimum and rehabilitated as quickly as possible.
- Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation. Adequate storm-water management measures to be put in place as the soils on the site are prone to erosion.
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- Use of fire prevention and fire management strategies for the

wind energy facility, to reduce risks to landowners.

» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).
» All other relevant and required permits must be obtained by Eskom prior to the commencement of construction.
» Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.

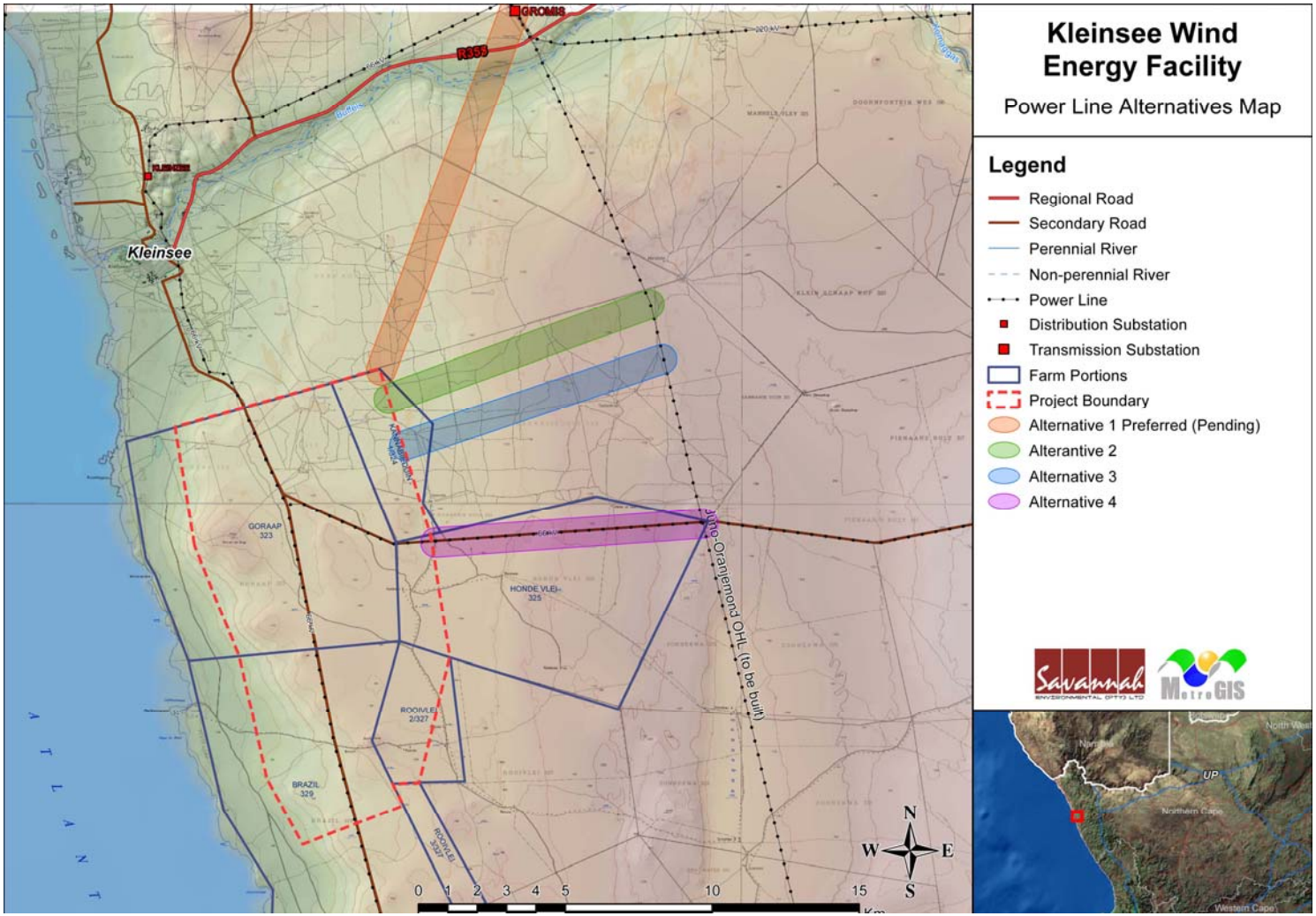

Figure 1: Locality map showing the farm portions and study area for the establishment of the Kleinzee Wind Energy Facility, Northern Cape Province.

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APPENDICES

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Betz Limit: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:

i. the land, water and atmosphere of the earth;
ii. micro-organisms, plant and animal life;
iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 – 140 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be

strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DAFF	Department of Forestry and Fishery
DEADEA	Northern Cape Department of Economic Development, Environmental Affairs and Tourism
DEA	National Department of Environmental Affairs
DME	Department of Minerals and Energy
DOT	Department of Transport
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
Ha	Hectare
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited

INTRODUCTION *CHAPTER 1*

Eskom Holdings SOC (State Owned Company) **Limited** is proposing the establishment of a wind farm and associated infrastructure on an identified site which is located approximately 6 km south of the mining town of Kleinsee in the Northern Cape Province, within the Nama Khoi Local Municipality. This proposed project will be referred to as the **Kleinzee 300 MW Wind Farm**. This development is proposed to comprise a cluster of up to 200 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed over an area of approximately 8 682 ha in extent.

The nature and extent of the Kleinzee Wind Energy Facility, as well as potential environmental impacts associated with the construction and operation of a facility of this nature are assessed in this Final Environmental Impact Assessment (EIA) Report. This EIA Report consists of the following sections:

» **Chapter 1** provides background to the proposed wind energy facility project and an overview of the environmental impact assessment.
» **Chapter 2** describes the project and feasible alternatives identified and investigated.
» **Chapter 3** describes wind energy as a power generation option.
» **Chapter 4** outlines the regulatory and legal context of the EIA study.
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken.
» **Chapter 6** describes the existing biophysical and socio-economic environment affected by the proposed project
» **Chapter 7** describes the scope of the project, including the construction, operation and decommissioning phases of the wind energy facility.
» **Chapter 8** describes the assessment of the identified environmental impacts associated with the proposed project.
» **Chapter 9** describes the assessment of cumulative impacts associated with the proposed Kleinzee Wind Energy Facility and recommended mitigation measures
» **Chapter 10** presents the conclusions of the impact assessment, recommendations and impact statement for the proposed project.
» **Chapter 11** contains a list references used in compiling the Final EIA report and specialist reports.

1.1. Project Overview

Through a regional site identification process undertaken by Eskom and Savannah Environmental in 2009, a broader area falling within the Nama Khoi Local

Municipality on the West Coast (depicted on Figure 1.1) was identified as being potentially suitable for wind energy development. This area was put forward for consideration within an EIA. This area (~8 682ha in extent) comprises the following farms:

» RE of Brazil 329
» RE of Goraap 323,
» RE of Honde Vlei 325
» RE of Kannabieduin 324
» Portion 4 of Rooivlei 327

Wind turbines use the energy from the wind to generate electricity. In essence, the blades of the turbine are turned by the wind and the energy captured is converted into electrical energy and supplied to the electricity grid for use by consumers. Infrastructure which is required for such a facility includes, inter alia:

» A cluster of up to **200 wind turbines** to be constructed over an area of ~ **8 682 ha** in extent
  * Installed capacity of each turbine up to 3 MW
  * Hub height up to 140 m
  * Rotor Diameter up to 140 m
  * Maximum length of blades is 70 m
» **Concrete foundations** to support the turbine towers (22m wide x 22m length x 3m deep)
» **Mounting area** for erecting of each turbine (also referred to as a laydown area - 40m x 40 m))
» **Cabling** between the turbines to be lain underground where practical
» An on-site **substation** to facilitate the connection between the facility and the electricity grid (100 m x 100 m (including HV yard))
» An **overhead power line** (400kV) feeding into Eskom's electricity grid. Two options are being considered:
  * Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  * Option 2: Turning into the Juno - Gromis power line located to the east of the site[2].
» Internal **access roads** between each wind turbine (permanent roads of approximately 7 m wide during construction)
» **Borrow pits** within the site for the construction of access roads
» **Office/Workshop** area for operations, maintenance and storage
» **Information centre** and associated billboards
» **Water supply pipeline** and **Water storage** reservoir and tanks

[2] The loop-in lines options has three sub-options referred to as alternative 2-4 in Figure 1.2

Eskom will be considering various wind turbine technologies in order to maximise the capacity of the site. The capacity of the proposed Kleinzee Wind Energy Facility will depend on the most suitable wind turbine (in terms of the turbine capacity) selected by Eskom. Depending on the final turbine selection, the estimated total installed capacity for the proposed facility is up to 300MW.

Specialist software is available to assist developers in selecting the optimum position for each turbine before the project is constructed. This layout also informs the positioning of other infrastructure such as access roads and the onsite substation/s. Detailed preliminary layout of the wind energy facility has been developed by Eskom base on the results of the on-site wind monitoring. This preliminary layout is shown in **Figure 1.2**. This is the layout assessed in this EIA.

The components of the proposed Kleinzee Wind Energy Facility, (for the construction, operation and decommissioning phases) are discussed in more detail in Chapter 7.

1.2. Environmental Sensitivities Identified during the Scoping Phase

A scoping study was conducted for the project and completed in May 2012 with the acceptance of the scoping report. The scoping report identified areas of potential environmental sensitivity to inform the design of the wind energy facility and for further investigation during the EIA phase.

The majority of potential impacts identified to be associated with the construction and operation of the proposed wind farm are anticipated to be localised and restricted to the proposed site. No environmental fatal flaws were identified to be associated with the site during the scoping study. However, areas of potential sensitivity were identified through the scoping phase. These areas of sensitivity are illustrated in the sensitivity map included as **Figure 1.3**.

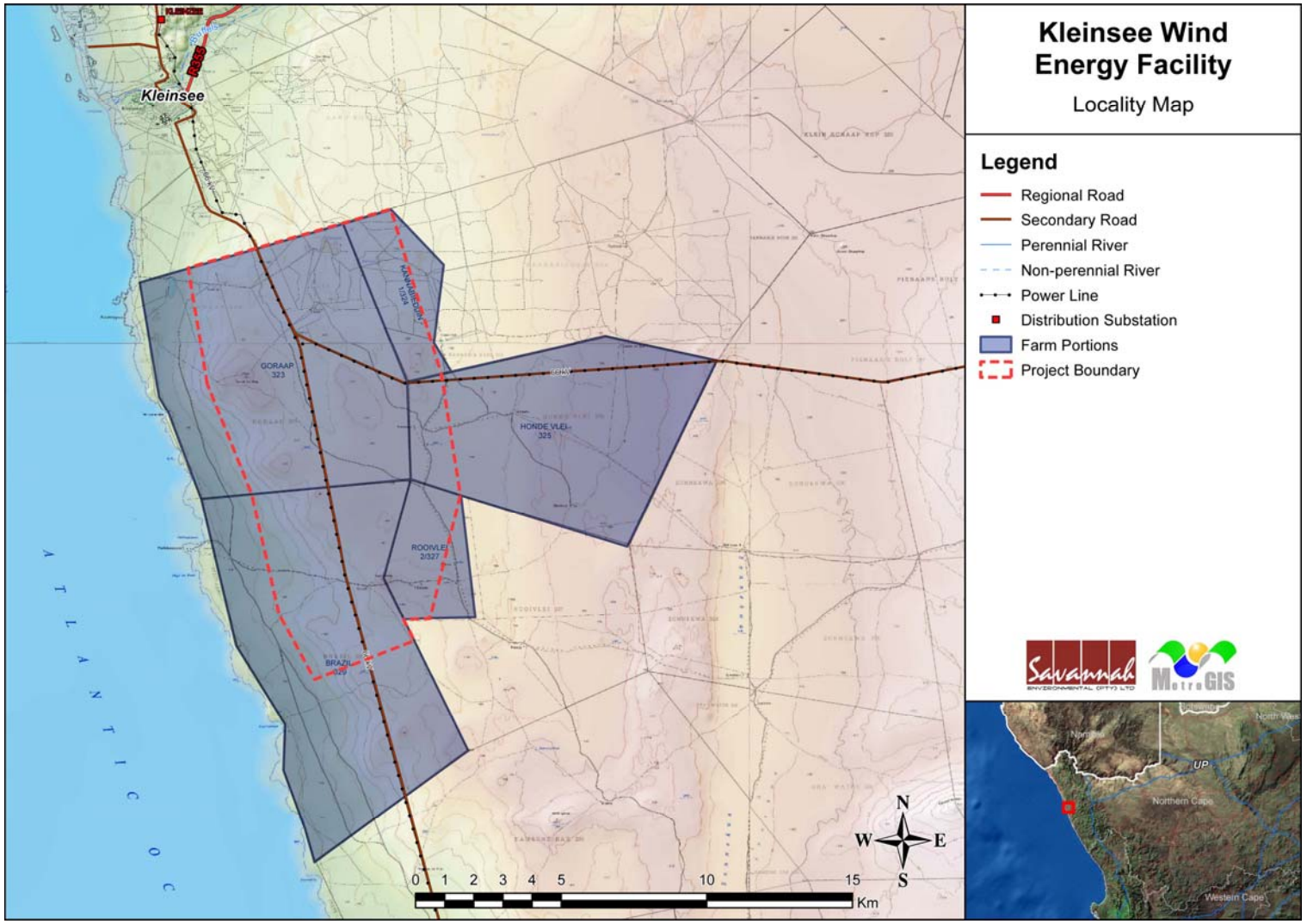


Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Klienzee 300MW Wind Farm, Northern Cape Province

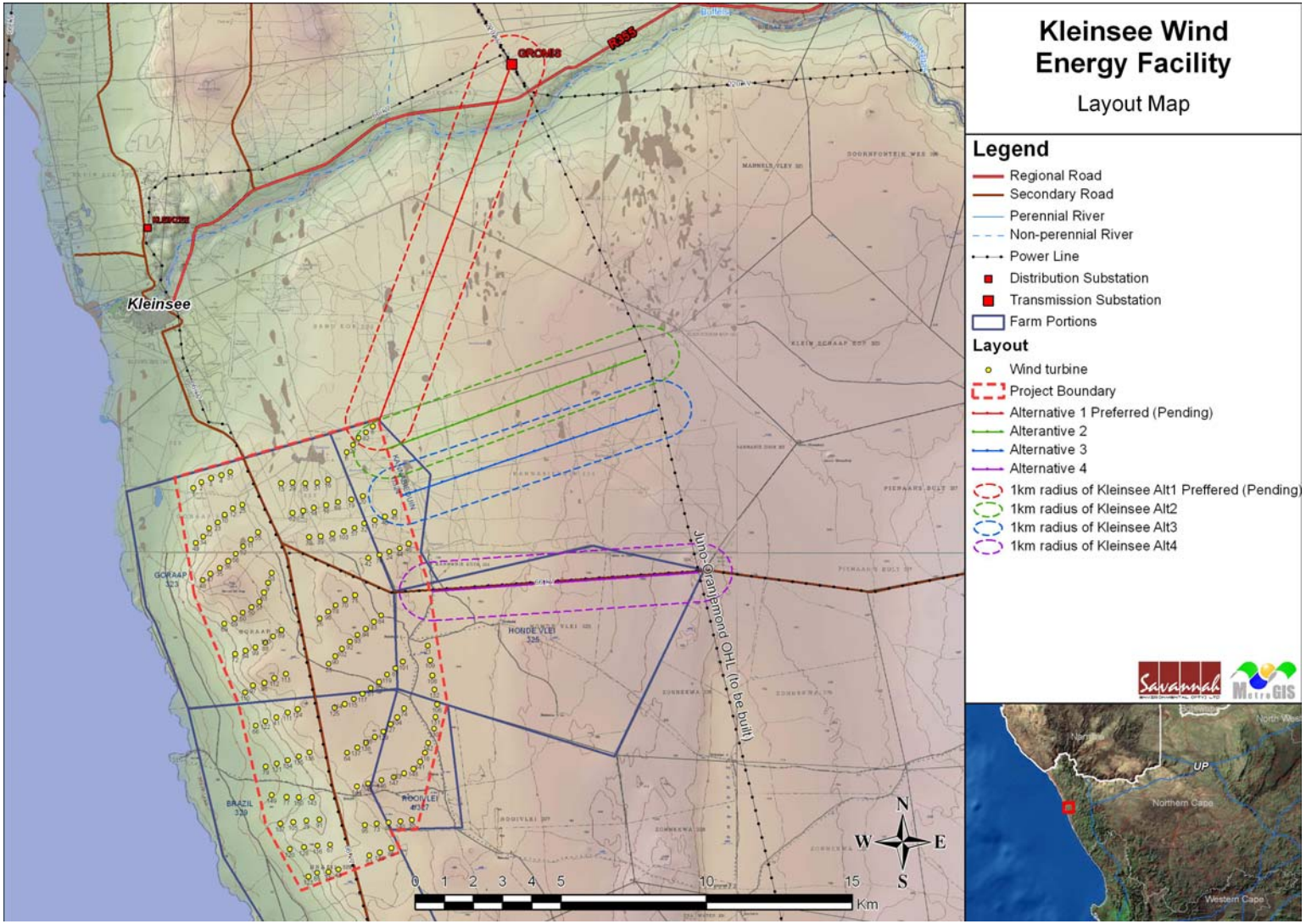


Figure 1.2: Layout map showing the technical design and layout of the Kleinzee 300MW Wind Farm, Northern Cape Province

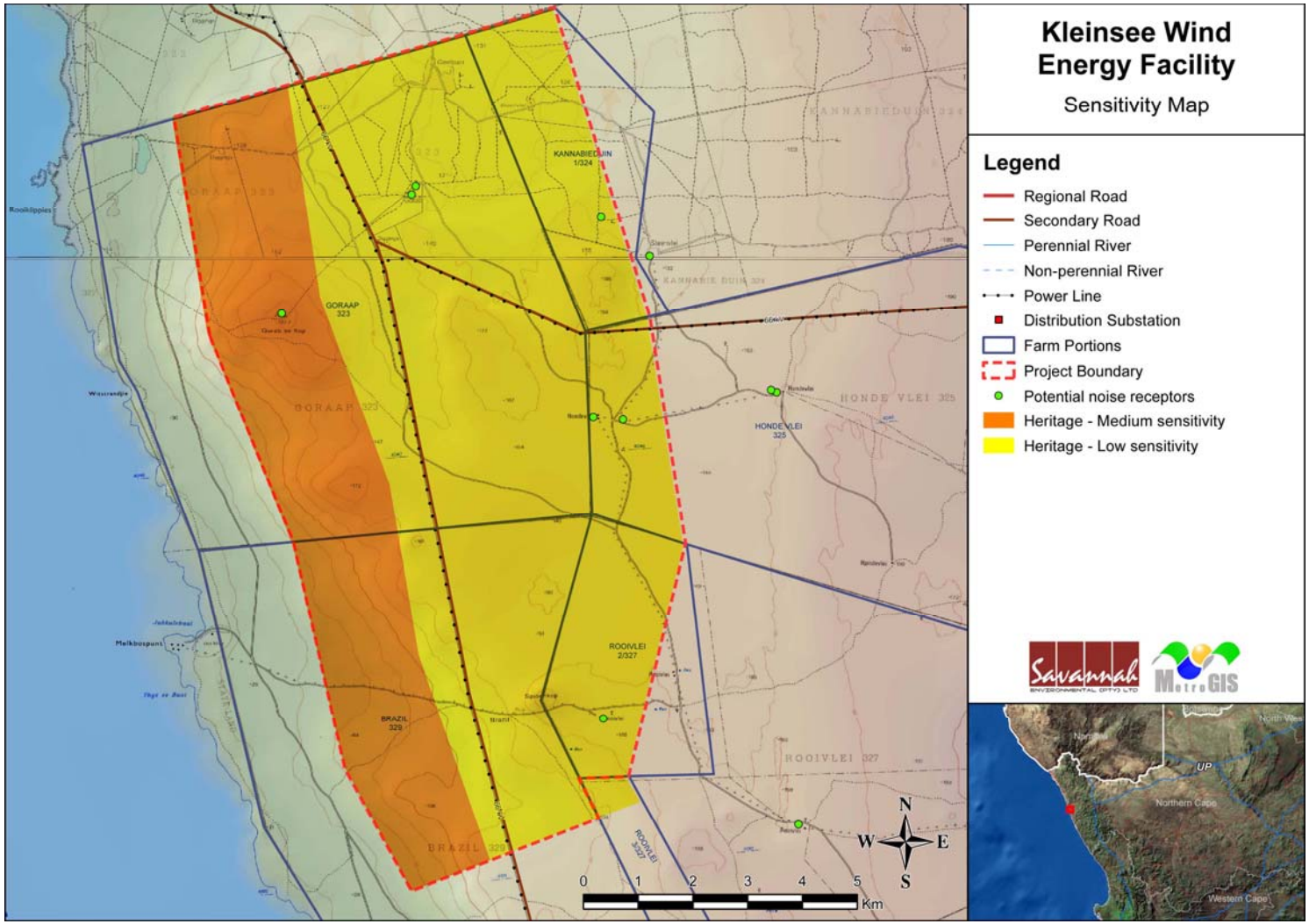


Figure 1.3: Scoping study desktop environmental sensitivity map for the proposed Klienzee 300MW Wind Farm, Northern Cape Province

The potentially sensitive areas/environmental features that have been identified include:

» Impacts on visual receptors within areas of visual exposure within (but not restricted to) 10 km of the proposed wind energy facility site such as homesteads and observers travelling along major and gravel roads,
» Potentially sensitive noise receptors,
» Areas of medium to low heritage sensitivity.
» Vegetation along this coastline is in remarkably good condition given the ravages of diamond mining over the years. However, vegetation types in the area are poorly conserved, except for the southern section, most of the site is rated highly (mainly 60 – 80%) for conservation importance.

The scoping phase sensitivity map provides a rough scale estimate of sensitivity on the site. These areas were subject to survey and ground-truthing during the EIA phase of the project. Based on the scoping environmental sensitivity map (Figure 1.3) it was recommended that areas of high environmental sensitivity should be avoided, while areas of medium and low environmental sensitivity could be considered for the location of the wind turbines and associated infrastructure. It was recommended that further detailed study was however required in order to confirm bat, avifauna, ecological and faunal sensitivity of the site. This has been undertaken in the EIA Phase of the process and is presented in this report.

1.3. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process refers to the process of identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project in order to identify and describe potential environmental impacts. The Scoping Phase included input from the project proponent, specialists with experience in the study area as well as in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA Phase addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project, and recommends appropriate mitigation measures for potentially significant environmental impacts. This EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a this Final EIA Report provides stakeholders with an opportunity to comment on the studies undertaken and to verify the issues they have raised through the EIA process have been captured and adequately considered. The

Final EIA Report incorporates all issues and responses raised regarding the project to date. Additional comments received during the review period of this Draft Report will be included within the FEIR to be submitted to the DEA.

1.4. Requirement for an Environmental Impact Assessment Process

The proposed wind facility and associated infrastructure is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) of June 2010 published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations of June 2010 and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs (DEA) is the competent authority for this project. An application for authorisation has been accepted by the DEA (under Application Reference number: 12/12/20/2212). Through the decision-making process, the DEA will be supported by the Northern Cape Department of Environment and Nature Conservation (Northern Cape DEDENC), as the commenting authority for the project.

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Eskom Holdings SOC Limited has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultant to conduct the EIA process for the proposed project.

An EIA is also an effective planning and decision-making tool for the project proponent. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issue(s) reported on in the Scoping and EIA reports as well as dialogue with affected parties.

This report documents the assessment of the potential environmental impacts of the proposed construction and operation of the Kleinzee Wind Energy Facility, as proposed by Eskom Holdings SOC Limited. This study concludes the EIA process and was conducted in accordance with the requirements of the EIA Regulations of June 2010 published in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.5. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA

Savannah Environmental was contracted by Eskom Holdings SOC Limited as the independent environmental consultant to the EIA process for the proposed project. Neither Savannah Environmental nor any of its specialist sub-consultants on this project are subsidiaries of or are affiliated to Eskom Holdings SOC Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

The EAPs from Savannah Environmental who are responsible for this project are:

» *Sheila Muniongo* the principle author of this report holds an Honours Bachelor degree in Environmental Management and 4 years' experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management programmes, and mapping through ArcGIS for variety of environmental projects. She is currently involved in several EIAs for renewable energy projects EIAs across the country.
» *Jo-Anne Thomas* is a registered Professional Natural Scientist and holds a Master of Science degree. She has 16 years' experience consulting in the environmental field. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which

includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently involved in undertaking siting processes as well as EIAs for several renewable energy projects across the country

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

Specialist	Area of Expertise
Dave McDonald of BergWind Botanical Surveys	Flora
Simon Todd of Simon Todd Consulting	Terrestrial Fauna
Rob Simmons Environmental Consulting	Avifauna pre-construction monitoring and impact assessment
Kate McEwan of Inkuleko Wildlife Services	Bat pre-construction monitoring and impact assessment
Jayson Orton of Asha consulting and Lita Webley of ACO	Heritage / Archaeology
John Pether of Geological and Paleontological consulting	Palaeontology
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping
Johan Lanz	Soils and agricultural potential
Tony Barbour of Tony Barbour Consulting and Research	Social Impact

The curricula vitae for EAPs from Savannah Environmental as well as the specialist consultant are included in **Appendix A**.

2.1 Description of the Project and Site

The proposed project entails the development of the Kleinzee Wind Energy Facility on a site near Kleinzee. The site falls within the Nama Khoi Local Municipality in the Northern Cape Province. The purpose of the proposed wind energy facility will be to generate electricity to be fed into the National electricity grid. Table 2.2 below provides details of the proposed project, including the main infrastructure and services.

Table 2.1: Details of the proposed project

Component	Description/ Dimensions
Location of the site	» RE of Brazil 329 » RE of Goraap 323, » RE of Honde Vlei 325, » RE of Kannabieduin 324, » Portion 4 of Rooivlei 327
Municipal Jurisdiction	Nama Khoi Local Municipality
Electricity Generating capacity	300MW
Details of turbines	» Up to 200 wind turbines with a generating capacity of up to 3 MW each » Hub height of up to 140m » Rotor diameter of up to 140m
Extent of broader site	8 682 ha
Internal access	Gravel roads of ~75 km in extent, 7m width
Site access	The site may be accessed from the N7 via one of three possible routes: » R355, via Springbok (~97 km). This constitutes the most direct tarred route to Kleinsee. » Kommagas gravel road off the R355. This would constitute the shortest route from the N7 to Kleinsee and the proposed wind energy facility site. » Combination of (mainly gravel) roads from Garies (off the N7), via Hondelikpbaai and Koingnaas. This constitutes the most direct road link to the harbours of Cape Town and Saldanha via the N7. Garies is located approximately 176 km south-east of Kleinsee (by road).
Grid connection	» An 400kV on-site **substation** to facilitate the connection between the facility and the electricity grid (100 m x 100 m (including HV yard)) » An **overhead power line** (400kV) feeding into Eskom's electricity grid. Two options are being considered:

Component	Description/ Dimensions
	* Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site) * Option 2: Turning into the Juno - Gromis power line located to the east of the site.
Operations and service building area	» Office/Workshop area for operations, maintenance and storage » Information centre » Ablution facilities » Water supply pipeline » Water storage reservoir and tanks » Fuel storage area » Billboards
Temporary infrastructure required during the construction phase	» Construction camps; » Construction yard and offices; » Laydown area and storage areas; and » Temporary access roads. » Any infilling material that may be required for project development will be obtained from: o Option 1: Cut and fill material from construction activities on the site o Option 2: Contractor to source suitable grade material from an approved/registered borrow pit in the broader Kleinzee region. Any excess/spoil material will be disposed of to a licensed landfill site.
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a contractor to be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – during construction, chemical toilets will be used and all sewage waste will be collected by a contractor to be disposed of at a licensed waste disposal site. This service will be arranged with the municipality when required during the operational phase; septic tanks will be used on site. . » Water – source from the reservoir in the Kleinsee town (about 6.5km away) to be transported by trucks » During construction, electricity will be generated from generators for any electrical work on site or electricity will be obtained from an Eskom auxiliary supply, depending on the feasibility of the various options.

This chapter presents details regarding the selection of the proposed development site, alternatives considered and the need for the project at a National, Provincial and Local scale.

2.2 Site Selection and Pre-Feasibility Analysis

Eskom commissioned the Klipheuwel Wind Energy Demonstration Facility, north of Durbanville, as a research facility in February 2003. As discussed in Chapter 3, the demonstration facility has provided Eskom with valuable research results pertaining to the utilisation of wind as a source of energy in South Africa, and has provided guidance with regards to the establishment of a large-scale commercial facility.

The location of a wind energy facility is highly dependent on technical factors – specifically the available wind resource, site access and the terrain. The technical considerations must, therefore, be weighed against other considerations (including environmental considerations) in the determination of a feasible site for the establishment of a commercially viable wind energy facility. A summary of the prefeasibility study undertaken for the Kleinzee Wind Energy Facility is presented below.

2.2.1 Identification of the West Coast Area for further Investigation

The goal set by Eskom is for the construction of an additional 500MW of electricity generated from wind over and above the 200MW authorised at the SERE Wind Farm on the West Coast.

Eskom identified five broad geographic regions at a strategic level for investigation and the identification of specific sites for further investigation. A site identification and selection process to determine sites suitable for wind energy development was undertaken by Eskom and the EIA consulting team during the period 2009 to 2010. This site selection process was based on the methodology developed and recommended by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) within their guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The sites identified through this process were then considered by Eskom in terms of technical criteria (including aspects such as ease /feasibility of grid connection, site access and [3]land availability). Following this, two sites were identified, based on the Regional Assessment undertaken (March 2010), for further investigation for the establishment of wind energy facilities, i.e. the proposed Kleinzee 300MW Wind Farm south of Kleinsee on the West Coast of the Northern Cape (the subject of this report) and the proposed Aberdeen Wind Farm on a site near Aberdeen in the Eastern Cape Province (assessed within a separate EIA process).

[3] Amount of land available for development

Wind data which informed the identification of these sites was obtained by Eskom through modelled wind data procured from external sources. A wind resource measurement and analysis programme must be conducted for the sites proposed for development, as only on-site measured data will provide a robust prediction of the facility's expected energy production over its lifetime (the importance of the wind resource for energy generation is also discussed in Chapter 3). As such, Eskom has undertaken wind monitoring at their wind monitoring stations erected at these identified sites.

This section of the report provides the outcomes of the regional assessment and technical considerations specific to the study area on the West Coast, and provides results which indicate the suitability of specific area/s for wind energy siting and development. A separate EIA process is being undertaken to assess the potential impacts that may result from the Aberdeen 200MW Wind Farm in the Eastern Cape (DEA Ref no. 12/12/20/2211).

2.2.2 Methodology in Determining Areas Considered Acceptable for the Development of a Wind Energy Facility within the Identified Study Area

In summary, the Regional Methodology guideline includes methods for the assessment and delineation of areas appropriate for wind energy development, including the use of appropriate 'negative' and 'positive' buffer zones (suitable to the South African context) to build in cumulative impact concerns, and the incorporation of landscape issues relating to landscape character, value, sensitivity and capacity. The approach and methodology followed for this assessment within the study area are detailed below.

In undertaking the Regional Assessment, three main steps were followed:

» STEP 1: Review of the Methodology proposed by DEA&DP's guideline document
» STEP 2: Undertaking the Regional Assessments, based on the Regional Methodology proposed by DEA&DP's guideline document
» STEP 3: Consideration of technical criteria

These factors are not specifically addressed through the Regional Methodology assessment. The technical considerations were integrated with the regional assessment findings, and the final physical sites for investigation in the EIA phase were identified and defined. .

2.2.3 Approach in Determining Areas Considered Acceptable for the Development of a Wind Energy Facility within the Identified Study Area

Results of the Regional Assessment

The following maps provide the results of the Regional Assessment undertaken for the Kleinzee area. It is important to note that an area labelled as Area 7 is indicated on each map. This point is indicative of the position of the site identified through the Regional Assessment and is included on the maps for reference and orientation purposes only. This point is not meant to indicate the actual site under investigation but rather just provides an indication of the region of investigation in the Regional Assessment phase of the process.

Criteria Based Assessment Data Layers

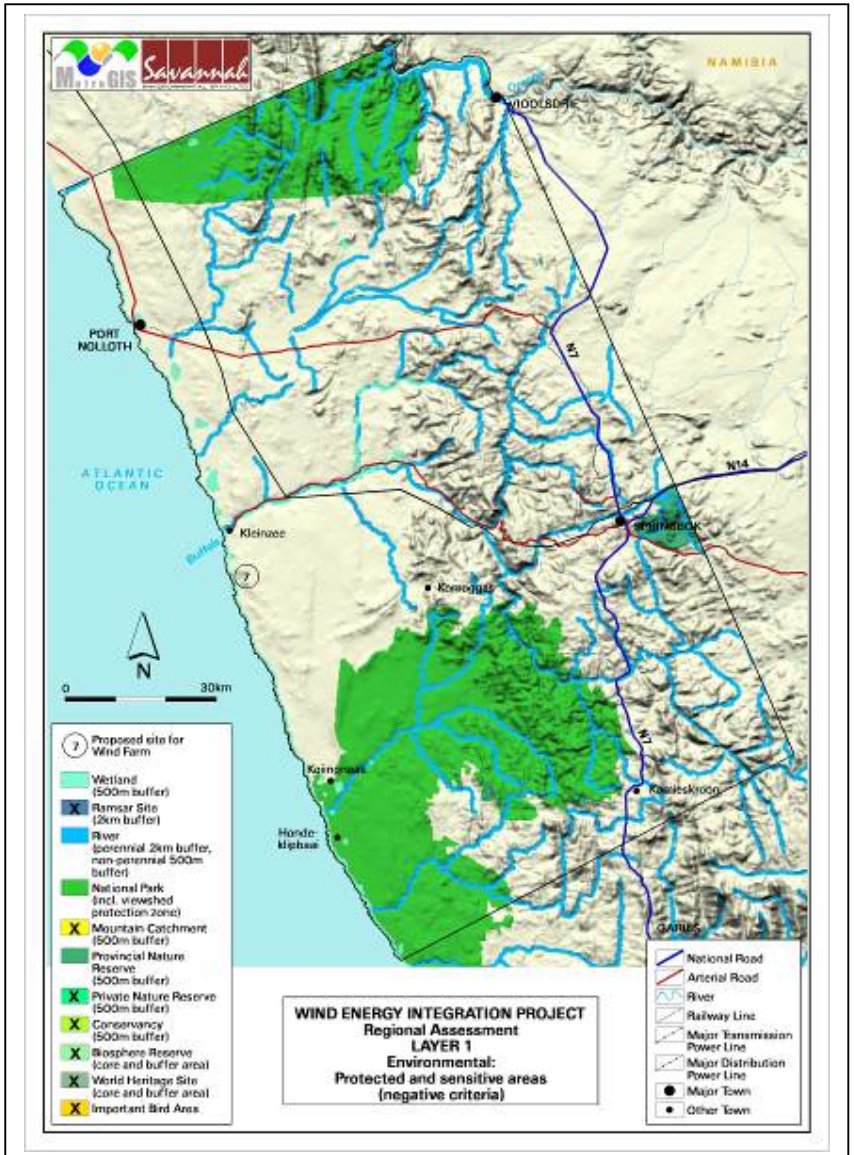
Environmental Criteria

» *Protected and Sensitive Areas (Layer1)*

The information contained in **Layer 1** is focused on Environmental Criteria that would be negatively affected by the development of a wind energy facility (i.e. negative constraints to wind energy development). These include protected and environmentally sensitive areas within the study area including biosphere reserves, conservancies and nature reserves. All these categories are mapped as negative criteria for the development of a wind energy facility and have separate buffer zones. The buffers are used to define exclusionary zones around these protected and sensitive areas. A 2 km buffer around major wetlands was observed as these are sensitive avian areas; other wetlands were assigned 500 m buffers. With regards to rivers, a buffer of 2 km from perennial rivers and 500 m from non-perennial rivers was used. A viewshed protection zone (as calculated by SANParks) was also included for national parks – the zone where development will be visible from within the park.

It is important to note that biosphere reserves have separate areas: core, buffer and transitional. Generally no development is allowed in the core area but certain developments may be permitted in the buffer and transition areas.

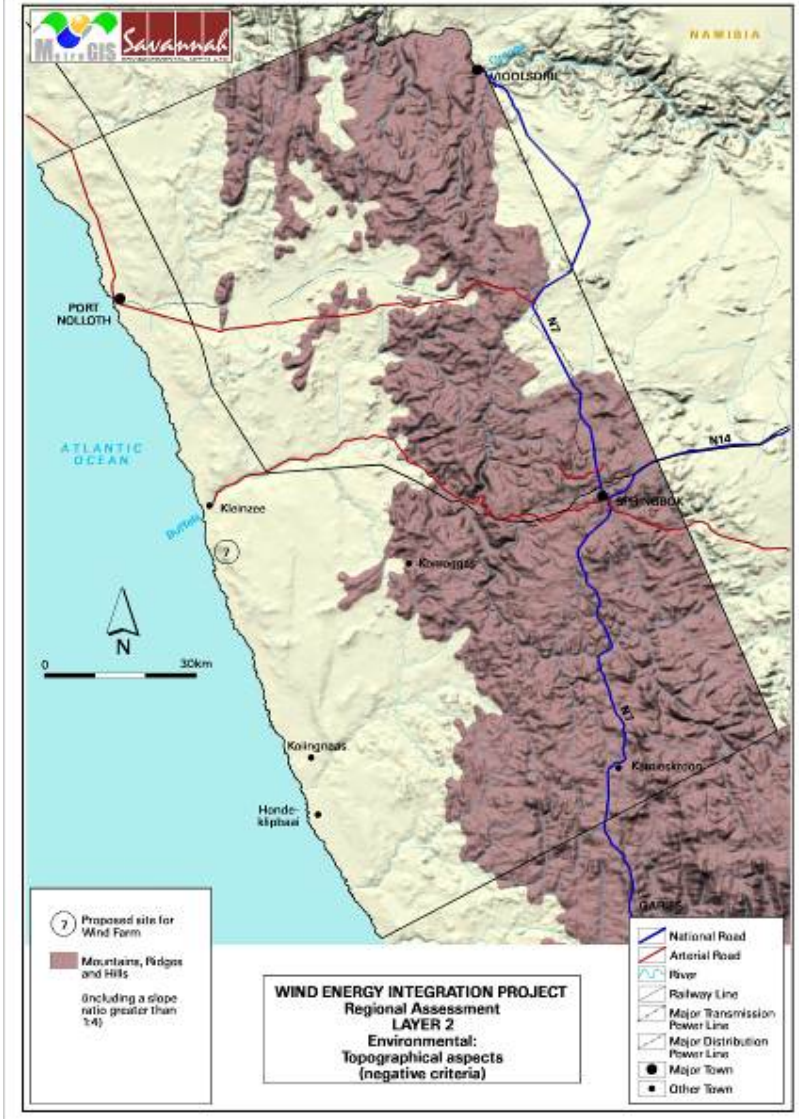
It can be seen from the adjacent map that **no constraints** in terms of protected and sensitive areas were identified to the south of Kleinsee where the proposed site is located).



» *Topographical (Layer 2)*

Layer 2 illustrates topographical information (Environmental Criteria) that are negative constraints for the development of a wind energy facility. This data includes elevation above sea level (areas above the 150 m range were recorded as a negative) and slope, where slopes with a gradient steeper than 1:4 were not preferred/not considered as ideal locations for development. This layer has an important influence on landscape character types as, in addition to exclusionary buffers around or on ridgelines, mountains and hills, the analysis should seek to determine coastal and inland plains, as well as foothill landscape types which may have positive locational attributes for wind turbines. In addition to elevation, this map layer also utilises slope (greater than 1:4) to determine significant topographical features, and defines ridgelines as a fundamental exclusionary layer due to visual impact concerns of wind turbines breaking skylines.

It can be seen from the adjacent map that **no constraints** in terms of topography were identified to the south of Kleinsee.

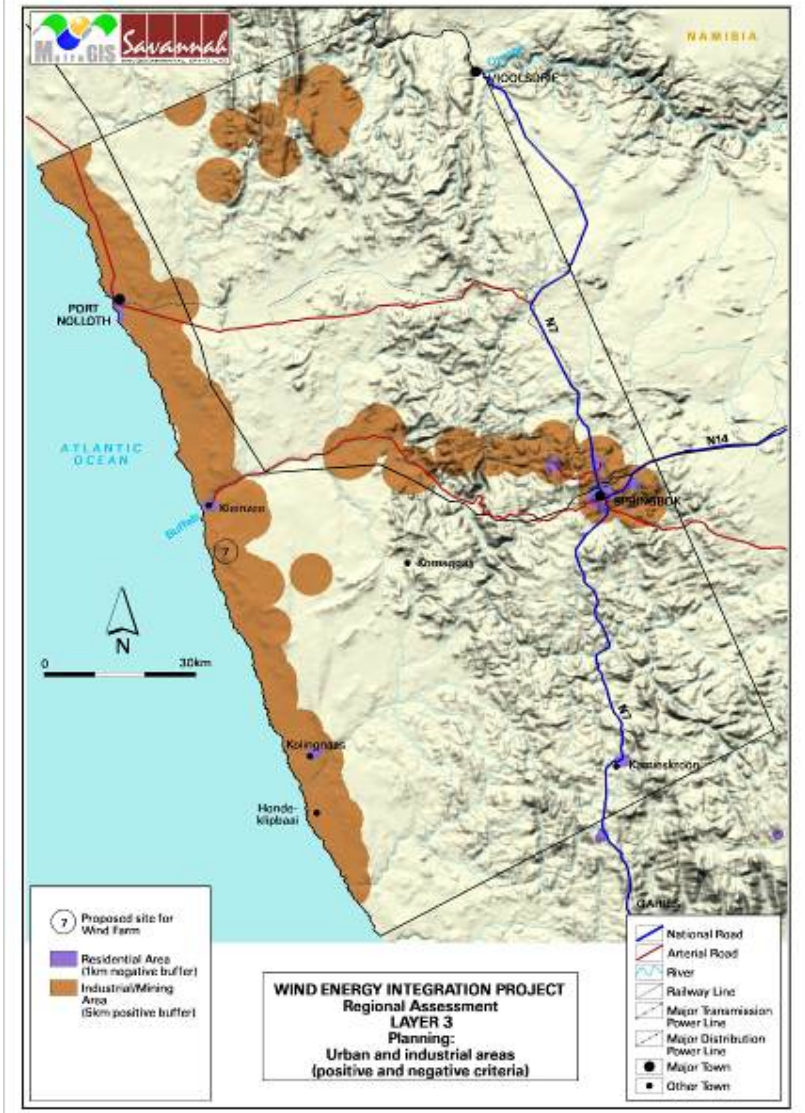


Planning Criteria

» *Urban and Industrial Areas (Layer 3)*

Layer 3 illustrates input layers pertaining to planning: urban and industrial criteria (as per the DEA&DP guideline). For urban residential areas a 1 km buffer was applied. Industrial areas were assigned a 5km **positive buffer** as these are already disturbed and developed landscapes and therefore the siting of the proposed wind energy facility near industrial areas is generally preferred.

It can be seen from the adjacent map that **the area to the south of Kleinsee falls within a positive buffer area** as a result of mining activities in this area.



» *Coastal Areas (Layer 4)*

Layer 4 deals with Planning Criteria specifically aimed at managing and protecting the South African coastline as an important landscape feature. The Regional Methodology guideline acknowledges that coastlines are typically areas of high wind resource, but also usually of high environmental and aesthetic value. This guideline document states that "in order not to arbitrarily exclude the entire coastline by means of a somewhat crude exclusionary buffer, it is proposed in the final recommended regional method that areas may be excluded from the coastal buffer due to lower scenic value".

Much of the West Coast coastline within the study area is of a rural nature. The coastline is characterised by areas of greater 'scenic value', where striking natural features occur. Layer 4 reflects a 2 km coastal buffer from the high water mark as used in previous regional assessments undertaken by the project team. The 4 km buffer zone (as indicated in the DEA&DP guideline document) has also been included.

The buffer areas indicated demarcate 'negative' areas, and it is acknowledged that the intention of DEA&DP is to limit large scale development in close proximity to the coastline in order to minimise the potential for compromising the future potential for the coast.

It can be seen from the adjacent map that **parts of the area** to the south of Kleinsee would be **constrained** by the proximity to the coast.

Infrastructural Criteria

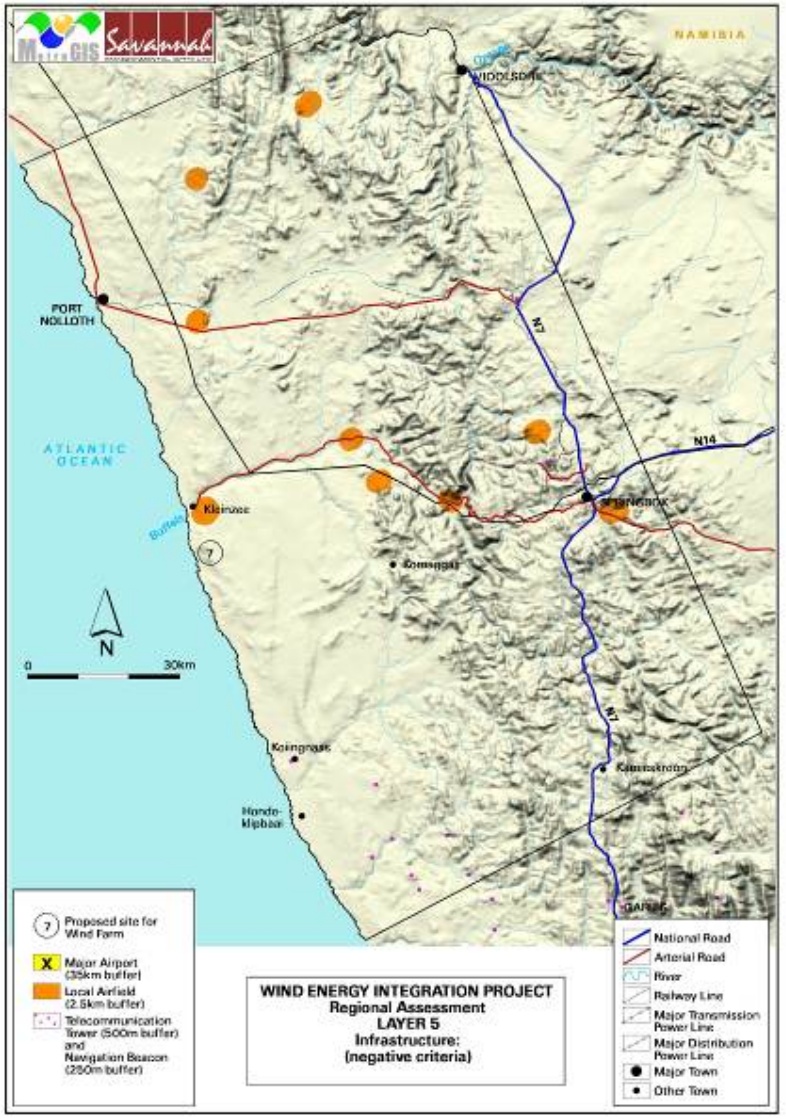
» *Airports and Security Sites (Layer 5)*

Layer 5 includes infrastructure criteria that would be negatively affected by the development of a Wind Energy Facility. A 35 km buffer around major airports and a 3 km buffer around local airfields are applicable for this study due to wind turbines affecting radar devices. However development **may be allowed** within a 35 km buffer area of an airport depending on the exact location and layout of the wind energy facility, through negotiation with the Civil Aviation Authority.

» *Other Infrastructure (Layer 5)*

A 500m buffer around cell masts or communication towers and a 250m buffer around radio and navigation beacons were recommended in the DEA&DP document.

It can be seen from the adjacent map that **no constraints** in terms of airports and security sites were identified for the proposed development site, although there is a local airfield close to Kleinsee which could become a potential issue depending on the flight paths associated with this facility.



Landscape Based Assessment

Infrastructural Criteria

» *Vertical and Disturbed Landscapes (Layer 6)*

Positive criteria for the development of a wind energy facility were identified in the form of vertically disturbed landscape corridors within the study areas. As opposed to the previous negative map layers, this is a positive (inclusionary) map layer that recognises "vertical and disturbed" landscapes as a primary-level criterion for location of wind energy developments from a landscape perspective. The intent of inclusionary buffers is the location of wind energy developments as close as possible to landscapes that are already compromised by vertical structures such as power lines. A 5 km positive buffer for transmission power lines and a 2 km positive buffer for smaller distribution power lines were used. Situating the development near power lines is also regarded as being positive from a technical perspective. Situating the development within 2km of landscapes disturbed by railway lines is also considered to be a positive. These features are shown on **Layer 6**.

It can be seen from the adjacent map that the proposed site to the south of Kleinsee is located some distance from transmission and distribution infrastructure.

Landscape and Cultural Criteria

» *Scenic Drives and Heritage Sites (Layer 7)*

Layer 7 in the DEA&DP study refers to the delineation of heritage and cultural assets, as well as scenic drives and cultural routes, as negative criteria. No specific information regarding heritage sites within the study areas was available at the time of undertaking this assessment. Specific sites of heritage value would, however, be identified during a site-specific EIA and would be demarcated as potentially sensitive areas within the proposed development site, depending on their level of significance. As it is difficult to assess routes which could potentially have scenic value associated with them, and as no specific information regarding scenic routes within the study area was available at the time of undertaking the assessment, a simple 2 km negative buffer was used around all major roads. This is inclusive of most of the possible scenic routes in the study areas.

It can be seen from the adjacent map that the proposed site to the south of Kleinsee is located some distance from major roads in the area.

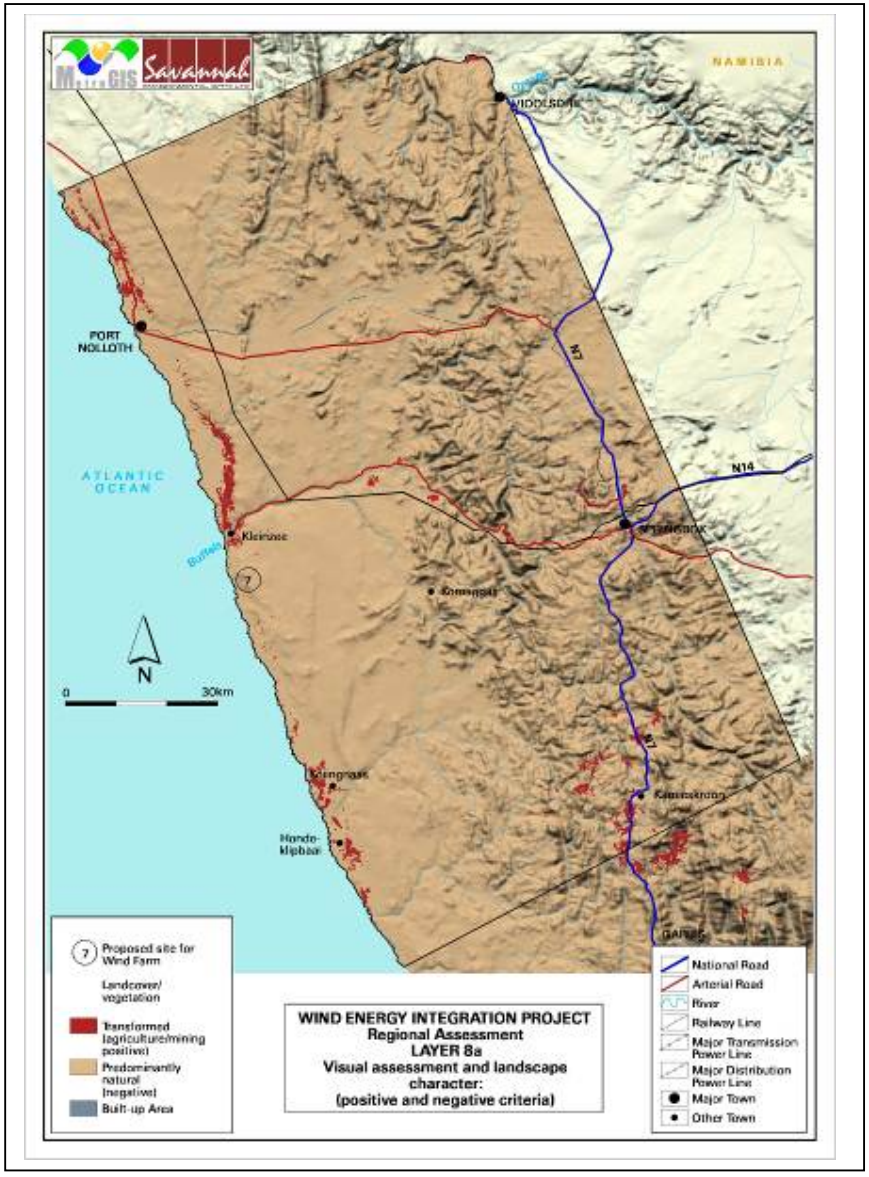
Visual Assessment and Landscape Character

» *Landscape Character and Visual Assessment (Layer 8)*

A landscape-based assessment was completed according to the methodology as set out in *Report 3: Methodology 2* of the DEA&DP guideline report, and is aimed at defining landscape character types and their relative visual sensitivity and capacity to absorb wind energy facility development.

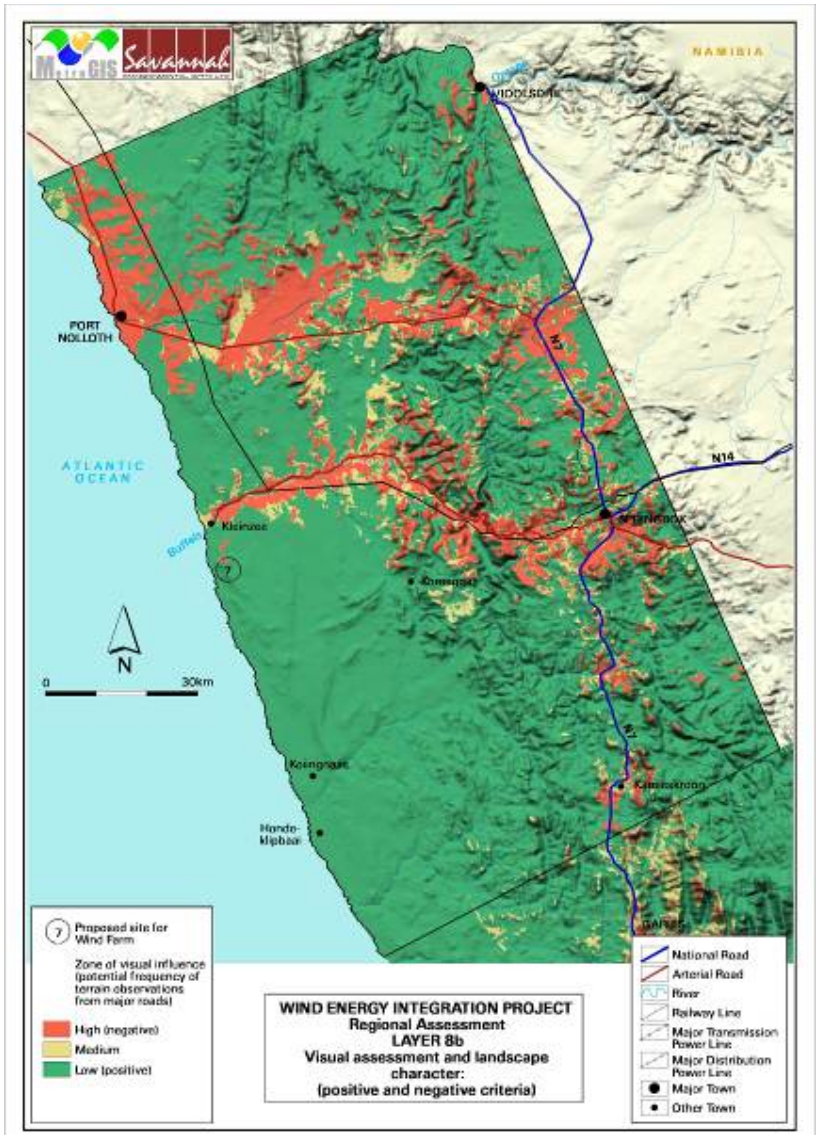
Layer 8a indicates areas that have been permanently transformed, predominantly by agricultural and mining practises. Other areas that are indicated as '*Predominantly Natural'* include areas considered to be natural vegetation and/or land cover types with varying levels of disturbance (e.g. from grazing practices) that are not considered as severe as the transformed areas. 'Predominantly Natural' areas are not mapped as ultimate negative areas in the final mapping overlays. This is due to the broad scale at which this data is available. In this regard, areas mapped as being predominantly natural may, in reality, be largely disturbed. This can only be determined at a site-specific level during the EIA process or through a site-specific survey of the proposed development area. Potentially sensitive areas on the site would be demarcated at the EIA stage for consideration in the layout design of the facility.

From the adjacent map it can be seen that the majority of the area to the south of Kleinsee is indicated as being predominantly natural at this scale. However, it is known that mining activities have been undertaken in this area, although the extent of disturbance on this proposed site have not yet been established.



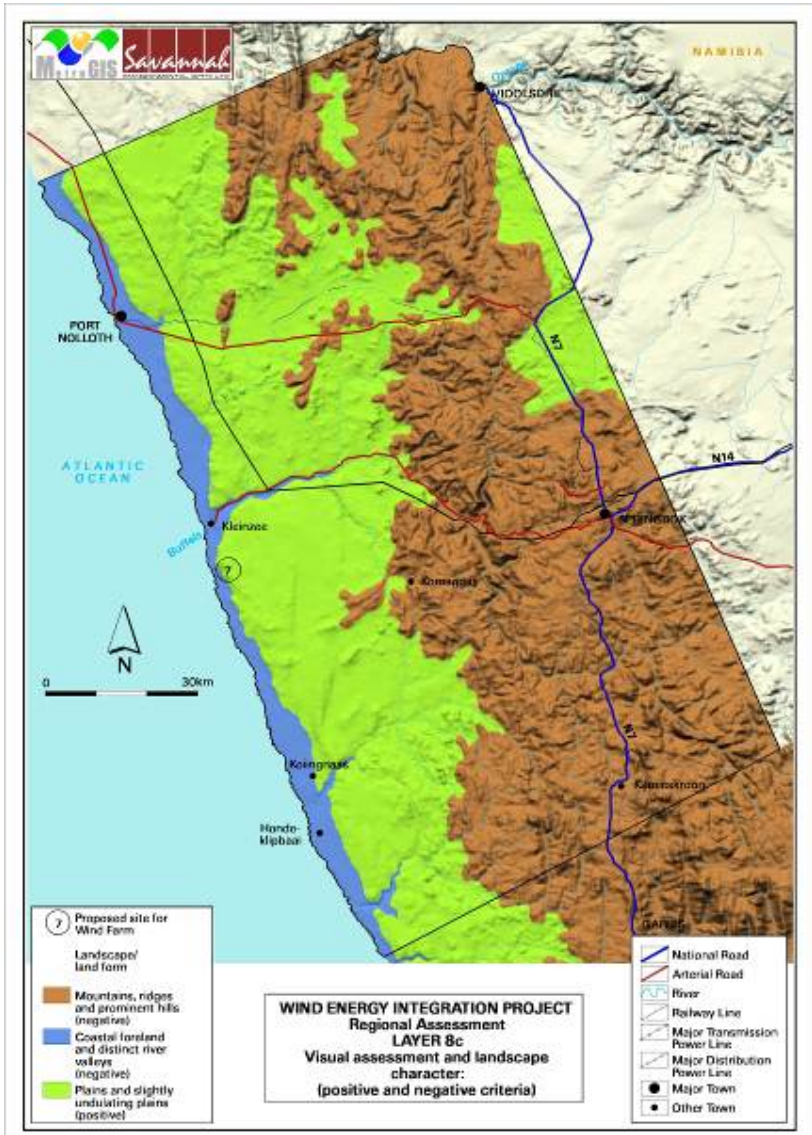
Layer 8b is a composite of the results of visibility analyses undertaken from vantage points along roads within the study area. The resultant index identifies areas that are more frequently exposed to both the national and provincial roads (highly visible areas); areas exposed to either the national road or the provincial roads (visible areas) and areas that are not exposed to any of the major roads within the study area.

From the adjacent map it can be seen that the area to the south of Kleinsee is indicated as being within a zone of low visual influence.



Layer 8c shows the major topographical units within the study area, identifying negative/sensitive units (river valleys, mountains, hills and coastal forelands) and open landscapes (positive units) in the form of large plains.

From the adjacent map it can be seen that the majority of the area to the south of Kleinsee is located within an area indicated as plains and slightly undulating plains. The areas closest to the coast are however located within the coastal foreland area.



Layer 8 shows the composite result of the Landscape Character and Visual Assessment as *Preferred Areas, Negotiable Areas* and *Restricted Areas* for development.

The results displayed on Layer 8 are a composite of a criteria assessment of three input data categories, namely: vegetation/land cover, zone of visual influence and land form/topography. The input data categories were assessed in order to form positive or negative criteria that would aid in determining the landscape character and ultimately areas where development would be acceptable or areas where development would be unacceptable. The following table broadly indicates the positive or negative criteria per input category.

Input Category	Positive Criteria	Negative Criteria
Vegetation/Land Cover (Source: NLC2000)	Areas largely transformed by agriculture, mining, etc.	Areas with predominantly natural vegetation
ZVI Viewshed Analysis	Areas largely hidden from main transport routes (national and provincial roads)	Areas that are highly exposed from major transport routes
Land Form/Topography	Large plains	Mountains and hills, coastal forelands and river valleys/estuaries

From the adjacent map it can be seen that the majority of the area to the south of Kleinsee is located within an area indicated as being preferred. The area closest to the coast is indicated as being restricted due to this area being located within the coastal foreland area.

Composite Result - Preferred Areas for Development

The resultant composite of all the input criteria is illustrated in **Figure 2.1**. This map indicates **preferred areas for development** within all the study areas as various combinations of positive and negative criteria. The table below indicates the possible combinations (based on the DEA&DP study) that resulted in the preferred areas for development index that is displayed in the map legend.

No.	Description	Preference
1	Areas with more than 1 negative criteria	Highly restricted
2	Areas with one negative criteria	Restricted
3	Neutral areas (no positive or negative criteria)	Negotiable
4	Areas with one positive criteria (and no negative criteria)	Preferred
5	Areas with more than one positive criteria (and no negative criteria)	Highly preferred

The rating system utilised in the regional assessments takes a more 'risk adverse approach' than that put forward by the DEA&DP guideline. The rating system used assumes that a criteria rated as negative would always override a criteria rated as positive.

Definition of the terms used to define the level of preference:

» ***Highly Preferred / Preferred:*** Low landscape value with a high to low capacity for change. Wind energy facility development may be possible, subject to site level assessment.
» ***Negotiable:*** Low to high landscape values, but with a high capacity to absorb change. Wind energy development in these areas may be possible, subject to site level assessment.
» ***Restricted / High Restricted:*** High value landscapes combined with low capacity of landscape to adapt to change. These areas should be restricted from wind energy facility development.

From **Figure 2.1** it can be seen that the majority of the proposed site (indicted as Site 1-2) falls within *preferred* and *highly preferred* areas for development in terms of the results of the Regional Assessment. The area along the coastline is indicated as being *restricted* due to the coastal buffer zone. The site is therefore considered to be environmentally acceptable from the results of the Regional Assessment, and it is considered reasonable and feasible for further investigations to be undertaken on this site.

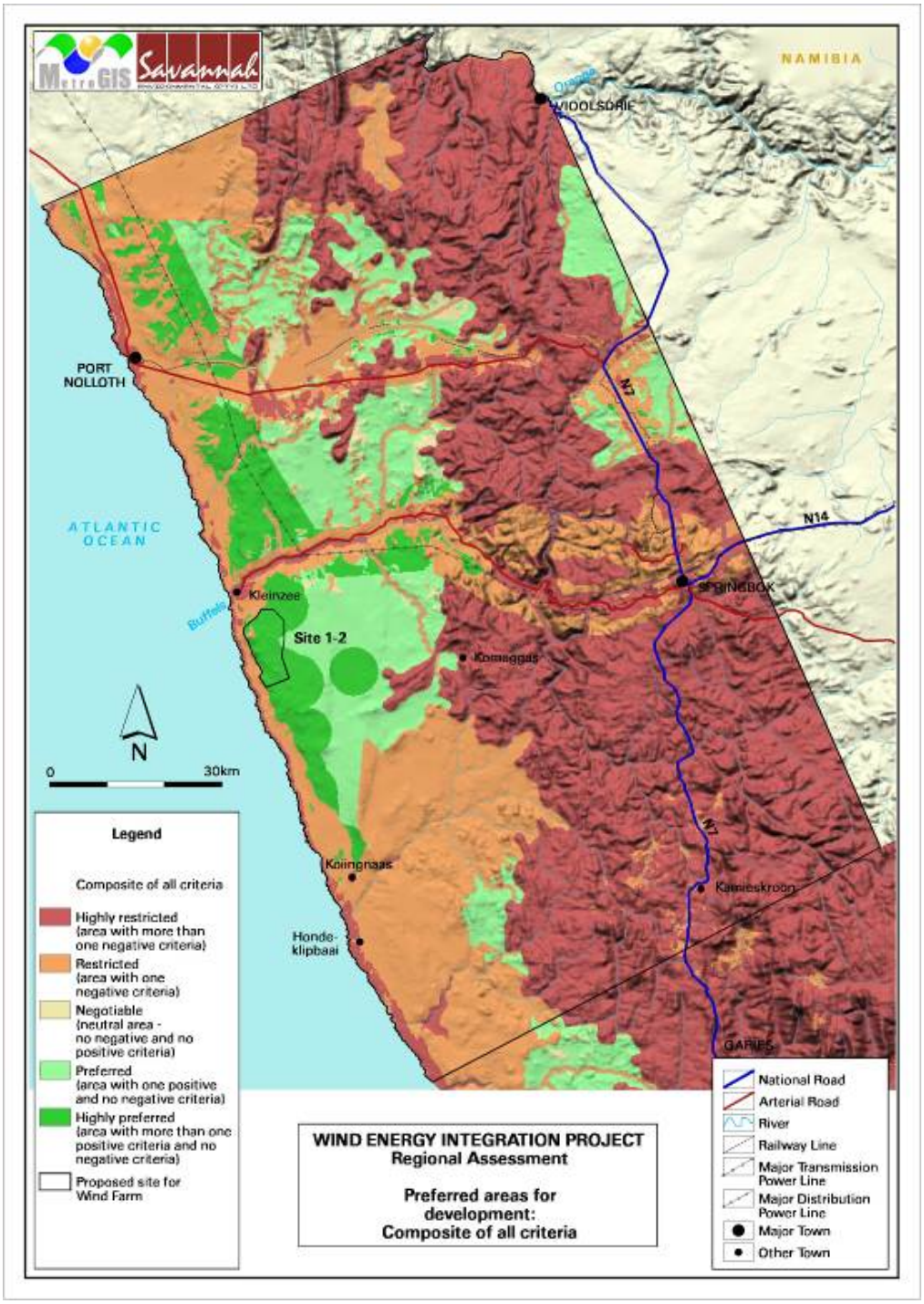


Figure 2.1: Composite map of all criteria of the Regional Assessment indicating the location of the proposed development site (indicated as Sites 1 and 2)

2.2.4 Discussion of Technical Factors Affecting the Placement of a Wind Energy Facility

The placement of a wind energy facility is highly dependent on technical factors – that is the available wind resource and the terrain. The technical considerations must, therefore, be weighed against other considerations (including environmental considerations) in the determination of a feasible site for the establishment of a viable wind energy facility.

Wind Resource Data and its Relevance to Wind Energy Facilities

The wind speed measured at a meteorological station is determined mainly by two factors:

» the overall weather systems, which usually have an extent of several hundred kilometres, and
» the nearby topography, extending to a few tens of kilometres from the station.

The importance of these factors is discussed in further detail in Chapter 3.

Strictly speaking, the direct use of measured wind speed data for wind resource calculations results in power estimates that are representative only for the actual position and height of the wind-measuring instruments. The application of measured wind speed statistics to wind energy resource calculations in a region therefore requires methods for the transformation of wind speed statistics. Great effort at an international level has gone into the development of simulation tools to estimate resource and terrain dependency, resulting in a comprehensive set of models for the horizontal and vertical extrapolation of meteorological data and the estimation of wind resources. The models are based on the physical principles of flows in the atmospheric boundary layer and they take into account the effect of different surface conditions, shading/sheltering effects due to hills or elevated topography, terrain roughness and relief, vegetation and other obstacles, as well as the modification of the wind imposed by the specific variations of the height of ground around the meteorological station in question. Specialised software (WA_sP - developed by Risø in Denmark), is used by Eskom in the analysis of wind and terrain data on the west coast.

The Terrain and its Relevance to Wind Energy Facilities

The terrain on the west coast can be described as land with an open appearance of roughness length 0,05 m, as defined by the following:

» Terrain class I, i.e. water areas, open farmland, etc.

» Nearby sheltering obstacles such as cliff faces, dunes and valleys.
» Terrain height variations (topography), the most important factor in the study area.

The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. These effects of terrain height variations on the wind profile can most clearly be demonstrated by the well-known results from the international field experiments at the Askervein Hill on the Isle of South Uist in the Hebrides (Taylor and Teunissen, 1987; Salmon et al, 1987). Figure 2.2 shows a perspective plot of the Askervein Hill. The line along which measurements of wind speed and direction were recorded is indicated by the meteorological towers in Figure 2.2.

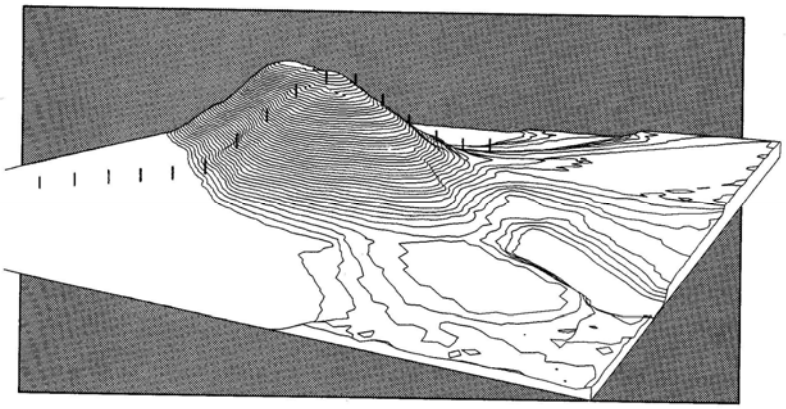


Figure 2.2: Perspective plot of the Askervein Hill

The experimental data recorded is illustrated in Figure 2.3 with the relative speed-up/slow-down (ΔS) at 10 m above ground level plotted against the distance from the crest. The relative speed variation ΔS is defined as:

$$\Delta S = \frac{u_2 - u_1}{u_1} \qquad (1)$$

where u_2 and u_1 are the wind speeds at the same height above ground level at the top of the hill and over the terrain upstream of the hill, respectively.

From the results the following can clearly be seen:

» The speed-up at the crest is 80% as compared with the undisturbed upstream mean wind speed.
» The negative speed-up (slow-down) in the front and lee of the elevated ground/hill is 20% to 40% as compared with the undisturbed upstream mean wind speed.

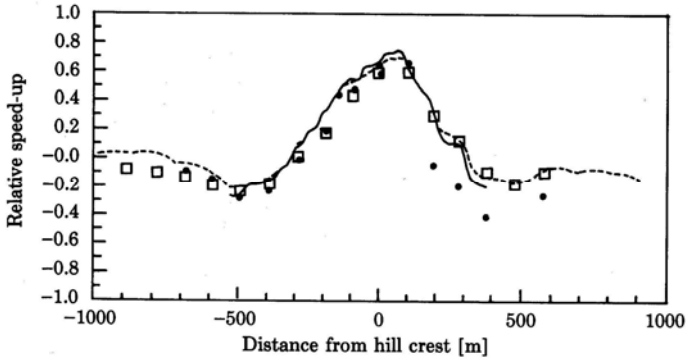


Figure 2.3: Relative speed-up ratios for flow over the Askervein hill at 10m above ground level. Measurements are indicated by dots and results from the orographic model by squares

If R is defined R as the characteristic radius of the elevated ground/hill, typically at the half-width diameter with h the height an approximate expression for ΔS can be found in Jensen *et al*. (1984):

$$\Delta S = 2\frac{h}{R} \qquad (2)$$

It is evident from the above example that elevated ground/hills exert a profound influence on the flow of air, and this has to be taken into account in the placement of turbines. It is often difficult (and impossible in complicated terrain) to apply simple formulas such as Equation 2. For this reason, it is necessary to determine the wind resource at specific locations and then in most cases to use a numerical fluid dynamic model for the calculations as found typically in WA_sP.

Consideration of Technical Factors in Identifying a Proposed Development Site

The identified area as indicated in Figure 2.1 is, in terms of the results of the Regional Assessment, a preferred area for development. The placement of a wind energy facility in this area must, however, consider the following technical factors:

» Predominant wind direction
» Distance from coast
» Obstruction obscuring the wind farm in the topography (dunes etc. causing shading effects and turbulence of air flow)
» Land - size and availability for layout
» Effect of adjacent turbines – minimum spacing (due to wake turbulence)

» Practicality of layout (underground electrical infrastructure length and interlinking roads)

Based on the consideration of the above factors, as well as the outcomes of the Regional Assessment process (which considers environmental and planning criteria), a potentially feasible site for further investigation has been identified (refer to Figure 2.4).

2.2.5. Identification of a Site for Investigation in the EIA Process

As this Regional Assessment has guided Eskom to site/locate their proposed facility within an area/zone of preference (as per the regional methodology followed), no alternative locations/sites will be required to be considered through the EIA process.

The demarcated area is an indicative area (approximately 8 682 ha in extent) considered to be favourable/most viable for the development of a large-scale Wind Energy Facility. The demarcated area is considerably larger than that area required for the facility (as less than ~1.5% of the proposed site will be disturbed by the proposed wind energy facility), which allows for a degree of flexibility in turbine placement to accommodate both technical factors (wind resource and/or lie of the land) and environmental factors (sensitive environmental receptors).

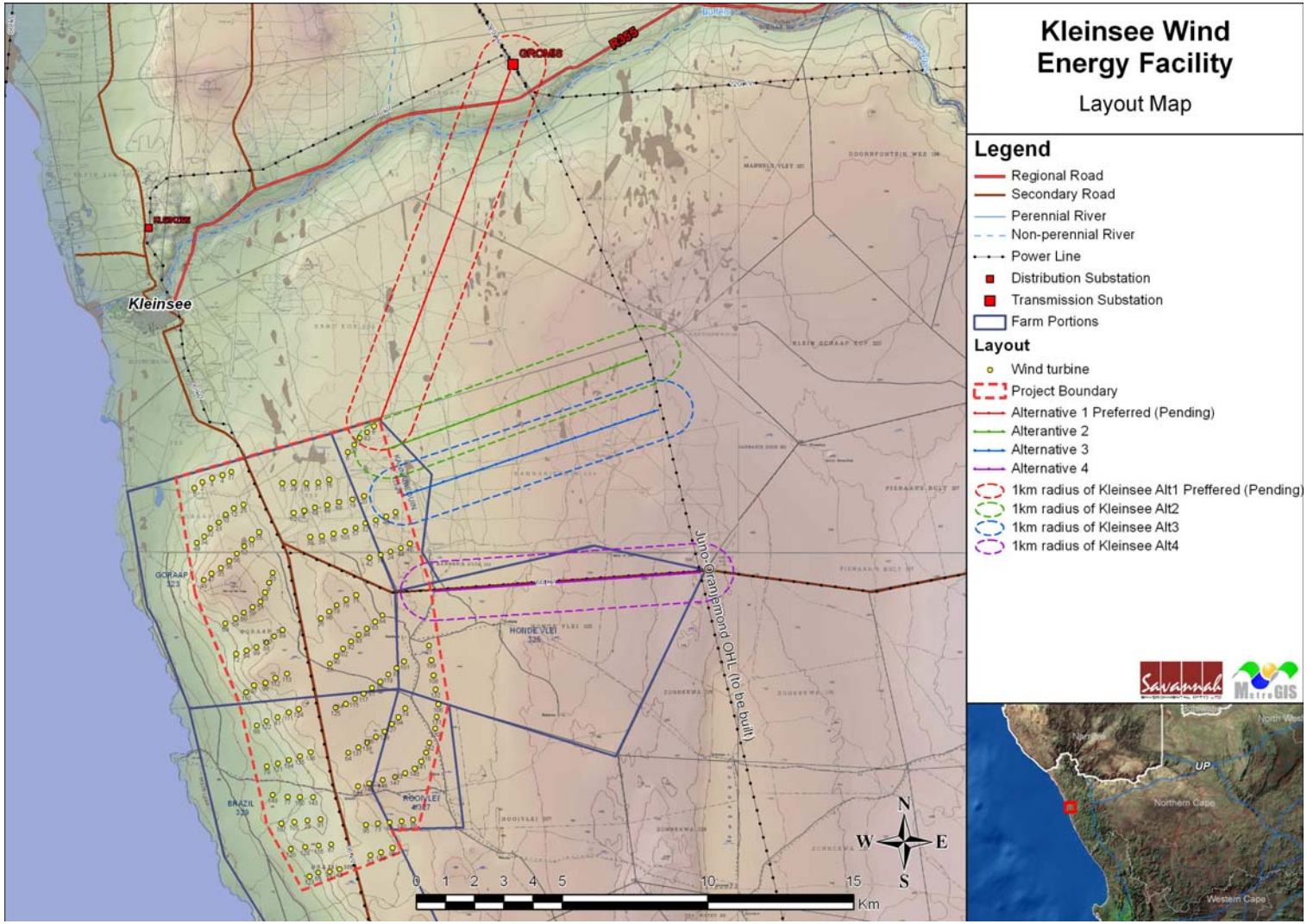


Figure 2.4: Layout map showing the technical design and layout of the Kleinzee 300MW Wind Farm, Northern Cape Province

2.3 Description of alternatives

2.3.1 Activity Alternatives

No activity alternatives were assessed since the site has been identified by Eskom as being highly desirable for the establishment of a wind energy generating facility and not any other development or renewable technologies such as photovoltaic solar (PV) or concentrated solar power (CSP). Therefore, a wind facility is considered by Eskom to be the only feasible and reasonable activity for consideration on the proposed site.

2.3.2 Technology Alternatives

Based on site characteristics it was determined by Eskom that the site would only be suitable for a wind energy facility, and is not suitable for the installation of other renewable energy technologies. Through the project development process, Eskom is considering various wind turbine designs in order to maximise the capacity of the site. It is anticipated that the turbines utilised for the proposed Kleinzee Wind Energy Facility will have a hub height of up to 140 m, and rotor diameter of up to 140 m. The technology provider has not yet been confirmed, and will only be decided after further wind analysis as well as a tender process. As this stage, the use of 3MW turbines has been assumed to be utilised at the site, and have been assessed in the EIA (as the worst case scenario).

2.3.3 Site-specific or Layout Design Alternatives

A wind turbine layout has been undertaken to effectively 'design' the wind energy facility. Through the process of determining constraining factors and environmentally sensitive areas during the scoping phase, the layout of the wind turbines and infrastructure has been developed by Eskom This layout is considered to be highly accurate (80%) but still allows for some adjustment to avoid site-specific environmental and technical constraints, where necessary. The overall aim of the layout is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. This micro-siting information provided by the developer has informed the specialist impact assessments in this EIA phase. The planning process also included the positioning of other ancillary infrastructure, including internal substation site.

The following layout alternatives have been proposed for consideration within the EIA:

Power Line Site Alternatives:

A **400kV** overhead power line of with a servitude of 55m wide feeding into Eskom's electricity grid, two alternative corridors for grid connection have been proposed by Eskom for investigation through this EIA process as follows (refer to Figure 2.4):

» Alternative 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site).
» Alternative 2: Turning into the Juno - Gromis power line (this is a recently authorised power line located to the east of the site). Three sub-options have been identified for this alternative (indicated as Alternative 2, 3 and 4 on Figure 2.2).

Access Road Alternatives

The proposed site is essentially only accessible from the N7 (via Garies or Springbok). The N7 links Cape Town in the south to Noordoewer (Namibian border) in the north. North of Noordoewer, the N7 continues north to Windhoek as the B1. The road is of crucial importance to the economies of the West Coast and Namaqualand regions, as well as that of Namibia. At Springbok the N7 links up with the N15, which provides a link with Upington to the west (and ultimately the Gauteng Province). Springbok is located approximately 558 km north of Cape Town (N7), and ~450 km north of Saldanha (port). Kleinsee may be accessed from the N7 via one of three possible routes (refer to **Figure 2.5**):

» R355, via Springbok (~97 km). This constitutes the most direct tarred route to Kleinsee;
» Kommagas gravel road off the R355. This would constitute the shortest route from the N7 to Kleinsee and the proposed wind energy facility site;
» Combination of (mainly gravel) roads from Garies (off the N7), via Hondelikpbaai and Koingnaas. This constitutes the most direct road link to the harbours of Cape Town and Saldanha via the N7. Garies is located approximately 176 km south-east of Kleinsee (by road).

2.3.4 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Kleinzee Wind Energy Facility on the proposed site. In this scenario the potential environmental and social impacts will not occur and the status quo will be maintained. This alternative is assessed within Chapter 8 of this report.

Figure 2.5: Road network of the study area and surrounds

2.4 The Need and Desirability of the Proposed Project

According to the DEA Draft Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010 (October 2012) the need and desirability of a development must be measured against the contents of the Integrated Development Plan (IDP), Spatial Development Framework (SDF) and Environmental Management Framework (EMF) for an area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF.

2.4.1 The Need for the Project at a National Scale

The need for harnessing renewable energy resources (such as wind energy for electricity generation) is linked to increasing pressure on countries to increase their share of renewable energy generation due to concerns such as exploitation of non-renewable resources and the rising cost of fossil fuels. In order to meet the long-term goal of a sustainable renewable energy industry, a target of 17.8 GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This 17,8GW of power from renewable energy amounts to ~42% of all new power generation being derived from renewable energy forms by 2030.

Renewable energy technologies are among the supply-side options being considered by Eskom. The organisation has developed a renewable energy strategy which outlines a number of focus areas, including research and development of various technologies. Renewable energy sources which are being evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure, namely:

a) the identification of feasible options
b) an assessment of the financial and economic viability as well as resource potential in the country
c) the implementation of demonstration projects to conduct operational research
d) the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

Eskom has identified the potential to develop up to 500MW of wind energy within the southern portion of South Africa. Through a detailed environmental and technical screening study, two potential sites were identified for further

investigation within a feasibility study (including the EIA process). The Kleinzee Wind Energy Facility site is one of these sites.

2.4.2 The Need for the Project at a Provincial and Local Scale

Northern Cape Provincial Spatial Development Framework

The Northern Cape Province Spatial Development Framework (NCPSDF) makes reference to the need to ensure the availability of inexpensive energy. The Framework notes that in order to promote economic growth in the Northern Cape the availability of electricity to key industrial users at critical localities at rates that enhance the competitiveness of their industries must be ensured. At the same time, the development of new sources of energy through the promotion of the adoption of energy applications that display a synergy with the province's natural resource endowments must be encouraged.

The Northern Cape Provincial Spatial Development Framework (2012) Section C8.2.3, Energy Objectives, sets out the energy objectives for the Northern Cape Province. The section makes specific reference to the desirability for renewable energy. Of specific relevance to the proposed Kleinzee wind energy facility, the NCPSDF notes that "Renewable energy sources such as wind, solar thermal, biomass and domestic hydroelectricity are to constitute 25% of the province's energy generation capacity by 2020. Promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimising detrimental environmental impacts". In addition, the NCPSDF aims to "develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by the White Paper on Renewable Energy (2003)."

There is therefore a need for the development of the proposed wind facility at a Provincial Level, and the proposed project will contribute towards the objectives of the Northern Cape SDF.

Nama Khoi Local Municipality Integrated Development Plan (IDP) 2014/2015 Revision

The 2014/ 2015 NKLM IDP Revision is the most recent IDP available. Review below is therefore of the 2014/ 2015 IDP. The Integrated Development Plan (IDP) for the Nama Khoi municipality is the over-arching strategic plan for the municipal area. The plan attempts to guide development within the area in order to achieve long-term sustainable development.

The IDP 2014/2015 priorities and key performance areas include the following objectives:

» Basic Service Delivery: Sustainable delivery of basic services (electricity, water, sanitation, streets, storm water, and solid waste removal), improve living conditions, effective land use management and building control, develop health and secure environment.
» Good Governance and Public Participation: Establish and maintain effective community engagement, build and strengthen accountability and transparency.
» Local Economic Development: Explore investment opportunities and partnerships; promote entrepreneurship amongst SMME's, optimizing resource efficiency.
» Municipal Financial Viability Management: Ensure sound financial management and accountability, ensure adherence to and improve income and expenditure, ensure compliance on financial and budget processes
» Municipal transformation and Institutional Development: Improve communication, effective community channels, optimizing resources efficiency, ensuring regular reporting on activities of the department,

Of specific relevance to the proposed Kleinzee WEF, the IDP notes that mining used to form the backbone of the economy however it is a declining sector with major mining companies pulling out of the area, but that tourism is currently seen as the "new frontier" for economic development in the municipal area (NKLM Draft 2014/15 IDP). The IDP mentions that there is renewable energy potential in the municipality as one of the area's strengths and opportunities for future growth and development.

The Namakwa District Municipality Draft Integrated Development Plan 2012-2016.

The 2012-2016 NDM Integrated Development Plan (IDP) is the third 5-year IDP of the NDM. The IDP is explicitly aligned with the applicable national and provincial policy and planning frameworks, including the 12 National Outcomes (2010) and National Development Plan (2011), as well as the PGDS. Focus in presentation below is on aspects of relevance to the assessment of the Kleinzee Wind Farm.

Section 2.5 of the IDP includes a summary of a recent NDM research report on the "Possible effects and impact of climate change on human settlements and population development in the Northern Cape" (date unknown). Key findings of the report indicated that the Namakwa District, including its Atlantic fisheries, is in the direct path of extreme anticipated climate change impacts. Key recommendations include the NDM's need to mainstream climate change response into planning activities and implement institutional arrangements that

support integration of climate change response across sectors. Renewable energy is however not explicitly addressed in the document.

Projects listed under Key Performance Area (KPA) 3 (Local Economic Development), of the 2010-2011 NDM IDP indicated current NCPG support for/ involvement with two projects in which the generation of wind energy plays a major role, namely:

» Project no. LE02: *Renewable Energy Sector: the development of a synergy between the energy resources within Namakwa Region,* which, in line with NDM's objective of establishing a competitive renewable energy sector, supports projects related to a variety of renewable energy generation, including "wind farms with capacity to generate 200 MW energy within three Local Municipalities".
» Project LE15: *LEAP – Living Edge - Tourism and Environment Cluster* indicates current support for post-mining LED development in the Koïngnaas/ Hondeklipbaai area (Kamiesberg LM). Significantly, focus is on "post mining economic and employment opportunities with an emphasis on (green economic activities such as) mariculture, wind/other forms of green energy and tourism".

Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, Eskom considers the Eskom Kleinzee project to be financially viable. The "need and desirability" of the local community as reflected in the IDP and SDF for the area is also considered in the EIA. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP and SDF). Although the renewable energy sector is not explicitly identified as a sector or initiative in all current municipal policy and planning documents as outlined above, it could contribute positively to the needs of the local community, including development, social services, education and employment opportunities in this area, as identified in these planning documents. The Kleinzee wind energy facility will create employment and business opportunities during the construction and operational phases, as well as the opportunity for skills development for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

In addition, the development of the project would benefit the local/regional/ national community by developing a renewable energy project which would reduce the country's dependence on fossil-fuel generated electricity.

The Desirability for the Eskom Kleinzee 300MW Wind Energy Facility Project

Compared with other renewable energy sources such as solar and bio-energy, wind turbines generate the highest energy yield while directly affecting the smallest land space. Wind technologies convert the energy of moving air masses at the earth's surface to mechanical power that can be directly used for mechanical needs (e.g. milling or water pumping) or converted to electric power in a generator (i.e. a wind turbine).

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The proposed Eskom Kleinzee Wind Energy Facility is located in an area considered to be highly desirable for wind energy generation based on the average wind speeds recorded. The proposed site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), suitable proximity in relation to the existing electricity grid, ease of access, land availability and minimum technical constraints from a construction and technical point of view. The potential environmental suitability of the site was determined through the regional assessment undertaken in 2009 (refer to Figure 2.1). This assessment concluded that the majority of the proposed site falls within *preferred* and *highly preferred* areas for development. The area along the coastline is indicated as being *restricted* due to the coastal buffer zone (refer to Section 2.3 for further details regarding this assessment). The site is considered to be environmentally acceptable from the results of the Regional Assessment, and it is considered reasonable and feasible.

Eskom considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development, and therefore identified the site for further investigation.

Wind monitoring is currently being undertaken on site in order to confirm the wind resource on the site, and ultimately inform the layout of the facility as well as the turbine selection process. From a land-use perspective, most of the proposed area is currently classified as ‘Vacant’ or ‘Unspecified’, and the site is used exclusively for extensive grazing due to climatic and water constraints.

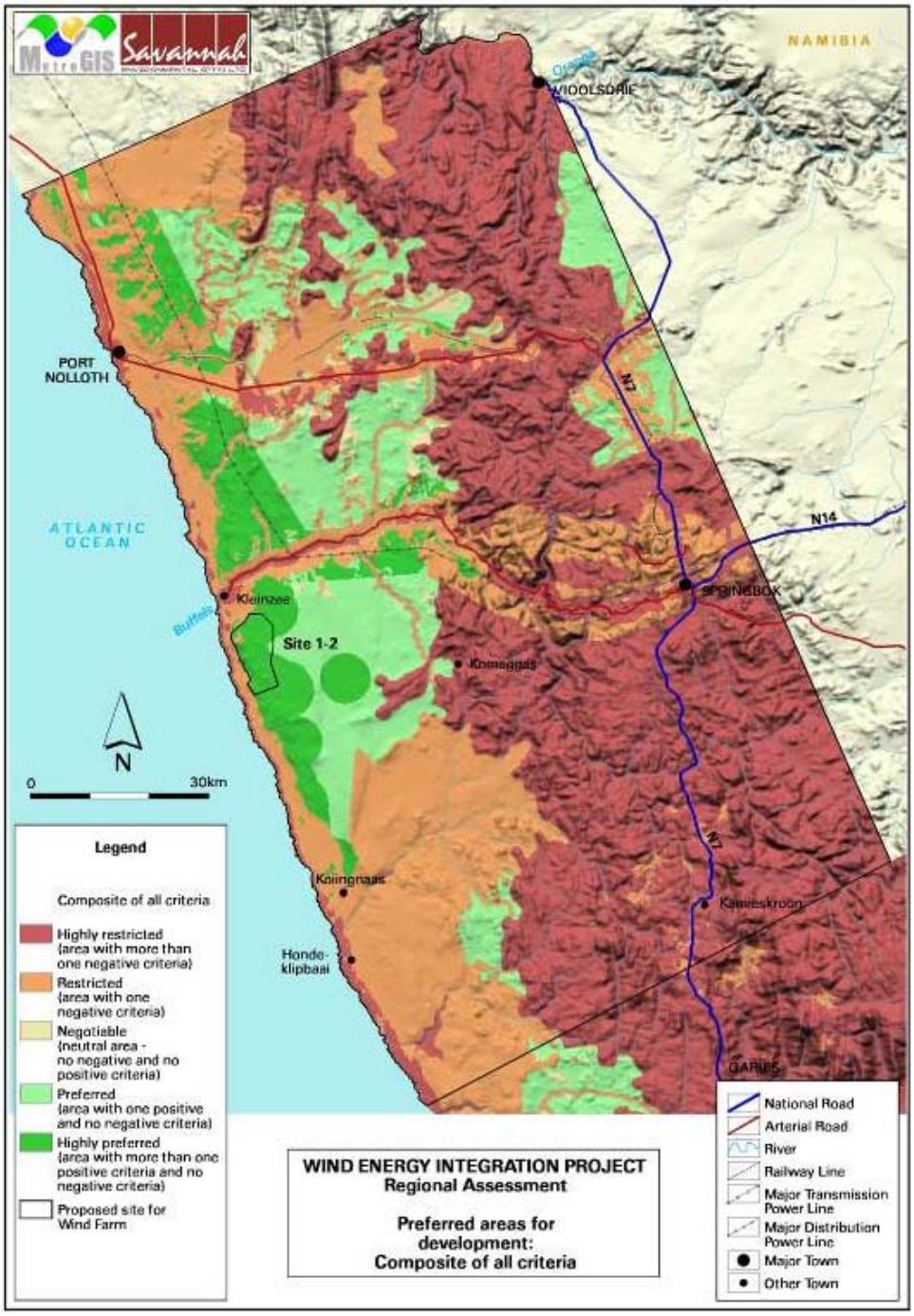


Figure 2.1: Composite map of all criteria of the Regional Assessment indicating the location of the proposed development site (indicated as Sites 1 and 2)

Use of wind for electricity generation is essentially a non-consumptive use of a natural resource. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets all international requirements in this regard. The power generated from the Kleinzee Wind Energy Facility will be up to 300MW, at a commercial scale to feed into the Eskom grid.

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The climate change challenge needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions and approaches are being developed to reduce emissions. However, it is important to acknowledge that the more cost-effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy is considered a 'clean source of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future. The challenge now is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

3.1 The Importance of the Wind Resource for Energy Generation

The importance of using the wind resource for energy generation has the attractive attribute that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the site. Detailed and reliable information about the speed, strength, direction, and frequency of the wind resource is vital when considering the installation of a wind energy facility, as the wind resource is a critical factor to the success of the installation.

» **Wind speed** is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. The doubling of wind speed increases the wind power by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm. Wind turbines can start generating at wind speeds of between ~3 m/s to 4 m/s, with wind average speeds greater than 6 m/s currently required for a wind energy facility to be economically viable. Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain. The effect of height variation/relief in the terrain is

seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography influences the flow of air, and results in turbulence within the air stream, and this has to be considered in the placement of turbines.

» **Wind power** is a measure of the energy available in the wind.

» **Wind direction** is reported by the direction from which it originates. Wind direction at a site is important to understand, but it is not typically critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

A wind resource measurement and analysis programme must be conducted for the site proposed for development, as only measured data will provide a robust prediction of the facility's expected energy production over its lifetime.

The placement of the individual turbines within a wind energy facility must consider the following technical factors:

» Predominant wind direction, wind strength and frequency
» Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)
» Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 3 to 8 times the rotor diameter apart in order to minimise the induced wake effect the turbines might have on each other (refer to Figure 3.1). Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria) the spacing requirements can be considered through the process of micro-siting the turbines on the site.

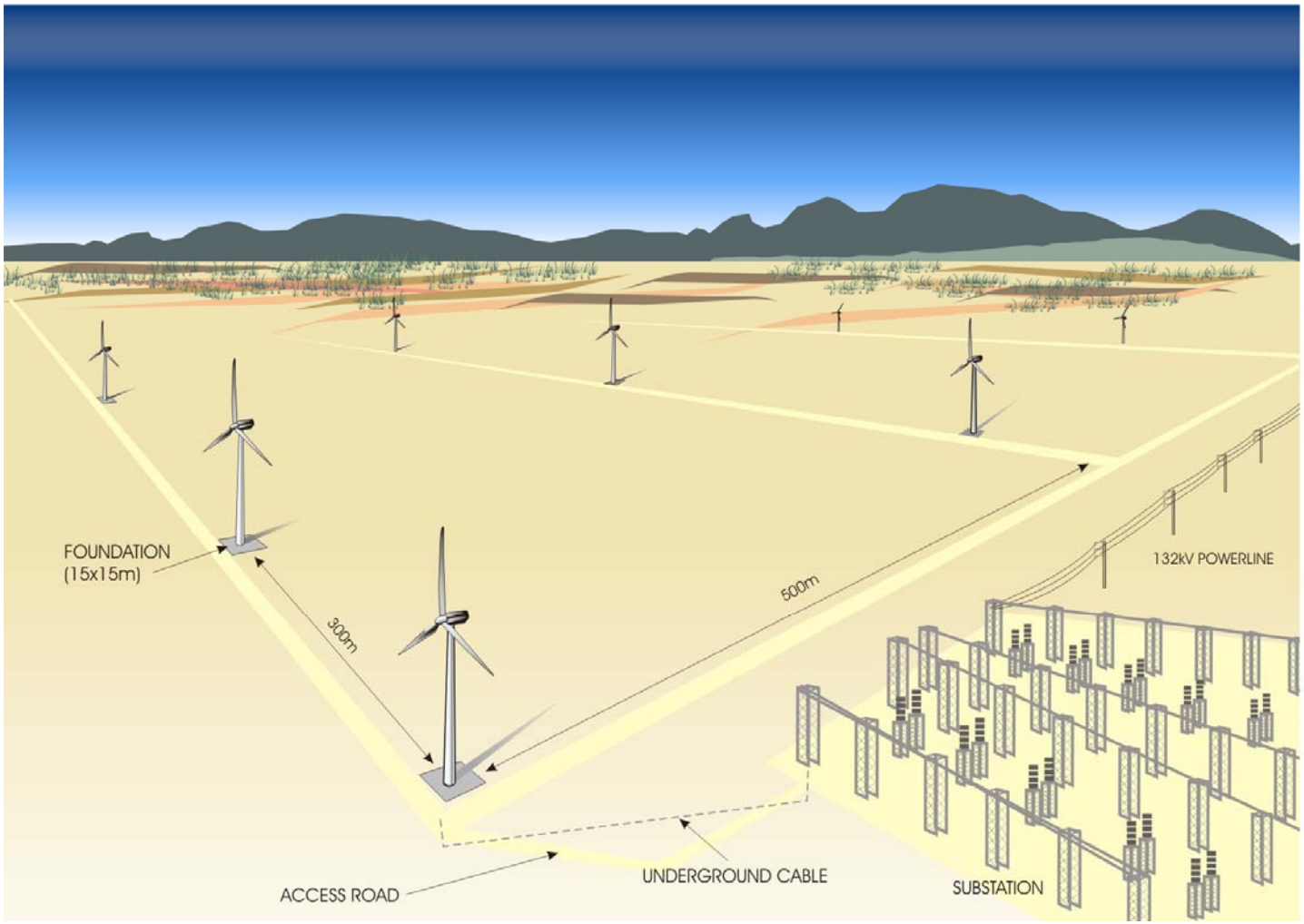


Figure 3.1: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

3.2 What is a Wind Turbine and How Does It Work

The kinetic energy of wind is used to turn a wind turbine to generate electricity. A wind turbine typically consists of **three rotor blades** and a **nacelle** mounted at the top of a tapered **tower**. The mechanical power generated by the rotation of the blades is transmitted to the generator within the nacelle via a gearbox and drive train.

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed Kleinzee Wind Energy Facility in the Western Cape Province will have a hub height of up to 140 m, and rotor diameter of 140 m. These turbines would be capable of generating in the order of up to 3 MW each (in optimal wind conditions).

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components (refer to Figure 3.2):

» The foundation
» The tower
» The rotor
» The nacelle

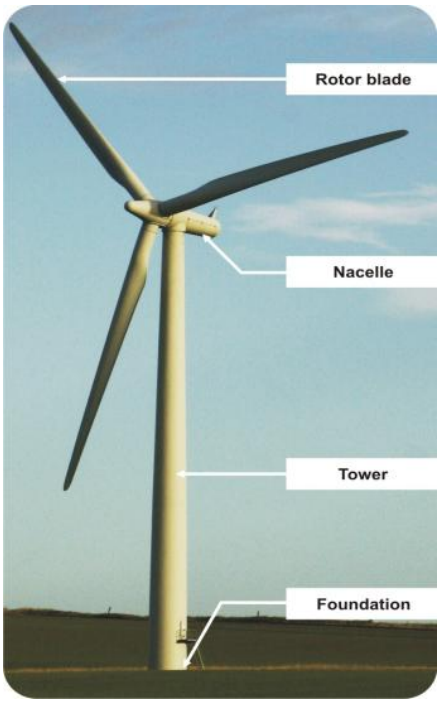


Figure 3.2: Illustration of the main components of a wind turbine

The foundation

The foundation is used to secure each wind turbine to the ground. These structures are commonly made of concrete and are designed for vertical loads (weight) and lateral loads (wind).

The tower

The tower, which supports the rotor, is constructed from tubular steel or concrete. The towers planned to be used for this project are up to 140m in height. The nacelle and the rotor are attached to the top of the tower.

The tower is part of the overall wind turbine structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

The rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades, typically made from fibreglass materials or carbon fibre reinforced plastics. When a rotor blade is in contact with wind, the airflow is deflected, airflow over the top arched edge has to take a longer path than at the relatively straight underside. This results in a low pressure at the upper side and a high pressure at the lower side. The pressure differential causes the blades to start moving. The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

The nacelle (geared)

The nacelle at the top of the tower accommodates the gears, the generator, anemometer for monitoring the wind speed and direction, cooling and electronic control devices, and yaw mechanism. Geared nacelles generally have a longer form than a gearless turbine.

3.2.2. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a wind farm can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 3 m/s and 4 m/s.

At very high wind speeds, typically over 25 m/s, the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

4.1 Policy and Planning Context for Wind Energy Facility Development in South Africa

The need to expand electricity generation capacity in South Africa is based on **national policy** and informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in **Figure 4.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the proposed wind energy facility development.

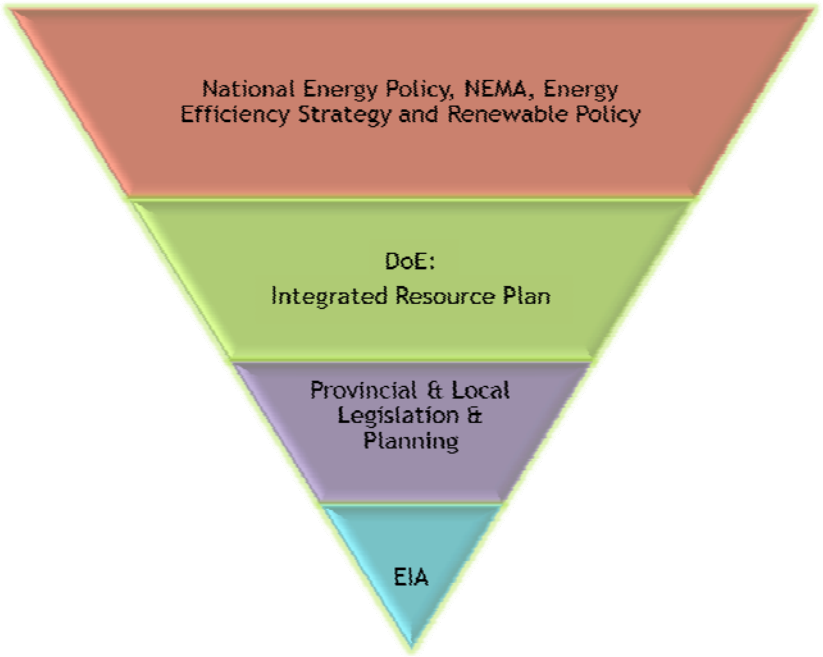


Figure 4.1: Hierarchy of electricity policy and planning documents

4.1.1 The Kyoto Protocol, 1997

South Africa's electricity is currently mainly generated from coal-based technologies. South Africa accounts for ~38% of Africa's CO_2 (a greenhouse gas contributing to climate change) from burning of fossil fuels and industrial processes. The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. South Africa ratified the Kyoto Protocol in 2002. The Kyoto Protocol requires developing countries to reduce their greenhouse gas emissions through actively cutting down on using fossil fuels, or by utilising more renewable resources. Therefore certain guidelines and policies (discussed further in the sections below) were put in place for the Government's

plans to reduce greenhouse gas emissions. The development of renewable energy projects (such as the proposed wind energy facility) is therefore in line with South Africa's international obligations in terms of the Kyoto Protocol.

4.1.2. The National Energy Act (2008)

The National Energy Act was promulgated in 2008 (Act No 34 of 2008). One of the objectives of the Act was to promote diversity of supply of energy and its sources. The National Energy Act aims to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors. The Act provides the legal framework which supports the development of power generation facilities.

4.1.3 White Paper on the Energy Policy of the Republic of South Africa, 1998

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by the then Department of Minerals and Energy (DME) in 1998. This White Paper identifies key objectives for energy supply within South Africa, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes that government policy is based on an understanding that renewable energy sources have significant medium- and long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and ***wind*** and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

4.1.4 White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)

Internationally there is increasing development and the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the

convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with addressing the following challenges:

- Ensuring that economically feasible technologies and applications are implemented;
- Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
- Addressing constraints on the development of the renewable industry.

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet*."

4.1.5 Integrated Energy Plan, 2013

The purpose and objectives of the Integrated Energy Plan (IEP) are anchored in the National Energy Act, 2008 (Act No. 34 of 2008). Integrated energy planning is undertaken to determine the best way to meet current and future energy service needs in the most efficient and socially beneficial manner, while:

» Maintaining control over economic costs;
» Serving national imperatives such as job creation and poverty alleviation; and
» Minimising the adverse impacts of the energy sector on the environment.

The IEP takes into consideration the crucial role that energy plays in the entire economy and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple objectives, some of which include:

» To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector;
» To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels);
» To guide investment in and the development of energy infrastructure in South Africa; and
» To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

As a fast emerging economy, South Africa needs to balance the competing need for continued economic growth with its social needs and the protection of the natural environment. South Africa needs to grow its energy supply to support economic expansion and in so doing, alleviate supply bottlenecks and supply-demand deficits. In addition, it is essential that all citizens are provided with clean and modern forms of energy at an affordable price. The IEP will take these and other constraints into consideration. From the myriad of factors which need to be considered and addressed during the Integrated Energy Planning process, eight key objectives were identified.

» Objective 1: Ensure the security of supply;
» Objective 2: Minimise the cost of energy;
» Objective 3: Increase access to energy;
» Objective 4: Diversify supply sources and primary sources of energy;
» Objective 5: Minimise emissions from the energy sector;
» Objective 6: Promote energy efficiency in the economy;
» Objective 7: Promote localisation and technology transfer

4.1.6 Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

» Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
» Ascertain South Africa's capacity investment needs for the medium term business planning environment;
» Consider environmental and other externality impacts and the effect of renewable energy technologies;
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies)

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March 2011. This Policy-Adjusted IRP was recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

4.1.7 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent Power Producers (IPPs). NERSA's Vision is to be a world-class leader in energy regulation. NERSA's

Mission is to regulate the energy industry in accordance with Government laws, policies, standards and international best practices in support of sustainable development.

4.1.8. Eskom's Climate Change and Renewable Energy Strategies

Eskom's core business is in the generation and transmission (transport) of electricity. Eskom is responsible for the provision of electricity to their customers, and currently generates approximately 95% of the electricity used in the country. Therefore the reliable provision of electricity by Eskom is critical for industrial development and related employment in the region and therefore a contributing factor to the overall challenge of poverty alleviation and sustainable development in South Africa. Electricity, by nature, cannot be stored and therefore must be used as it is generated. Therefore, electricity is generated in accordance with supply-demand requirements, and must be efficiently transmitted from the point of generation to the end-user.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis. With current energy and electricity demands within the country projected to continue increasing, new investments in electricity generation and transmission capacity are required. Eskom is currently expanding its electricity generation, transmission and distribution capacity through the construction of additional power stations and power lines and associated infrastructure. In addition to these, other clean electricity generation projects are being investigated. Since the capacity expansion programme started in 2005, an additional 4453.5 MW has already been commissioned. The plan is to deliver an additional 16 304MW in power station capacity by 2017. Ultimately Eskom will double its capacity to 80 000MW by 2026 (www.eskom.co.za). In line with Government's targets for renewable energy, Eskom plans to include at least 1600MW of renewable energy (wind and solar) within the electricity generation mix (*extract from Eskom's Climate Change Commitment - The 6 Point Plan*).

Eskom has developed a renewable energy strategy which outlines a number of focus areas, including research, demonstration and development opportunities. The proposed wind energy facility has a potential to avoid air emissions (including CO_2, SO_X, NO_X), water demand and waste generation (in the form of ash) compared to what will occur without the introduction of renewable energy technology, which would arise from coal-fired power generation.

In addition, Eskom has developed a Climate Change Strategy in order to contribute to global efforts to combat climate change while ensuring the sustainability of the economy, environment and society. This strategy supports investment in

renewable energy technologies as part of the power generation mix for the country. Eskom's Climate Change Strategy unpacks its commitment to climate change challenge in 6 key focal areas:

1. ***Diversification*** of the generation mix to lower carbon emitting technologies
2. ***Energy efficiency*** measures to reduce demand and greenhouse gas and other emissions
3. ***Adaptation*** to the negative impacts of climate change
4. ***Innovation*** through research, demonstration and development
5. ***Investment*** through carbon market mechanisms
6. ***Progress*** through advocacy, partnerships and collaboration

Renewable energy technologies which have been evaluated (and still being investigated) by Eskom include wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure, namely: the identification of promising options, an assessment of the financial and economic viability as well as resource potential in the country, the implementation of demonstration projects to conduct operational research, and the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

4.2. Regulatory Hierarchy for Energy Generation Projects

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

At **National Level**, the main regulatory agencies are:

» *Department of Energy*: This department is responsible for policy relating to all energy forms, including renewable energy, and are responsible for forming and approving the IRP (Integrated Resource Plan for Electricity). It is the controlling authority in terms of the Electricity Regulation Act (Act No 4 of 2006).
» *National Energy Regulator of South Africa (NERSA):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the

EIA Regulations. The DEA is the competent authority for this project, and charged with granting the relevant environmental authorisation.

» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provide legislative protection for listed or proclaimed heritage sites.
» *Department of Transport – South African Civil Aviation Authority (SACAA):* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *South African National Roads Agency Limited (SANRAL):* This department is responsible for all National road routes.
» *Department of Water and Sanitation (DWS):* The DWS is mandated to manage South Africa's water resources by ensuring the security and quality thereof. This Department is responsible for evaluating and issuing licenses pertaining to water use.
» *The Department of Agriculture, Forestry and Fisheries (DAFF):* This Department is the custodian of South Africa's agriculture, fisheries and forestry resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. This Department has published a guideline for the development of wind farms on agricultural land. Deals with sub-division or registration of a long term lease on agricultural land. Consent from this Department is required for the development and reckoning of the land to be utilised by the wind energy facility.
» *Department of Mineral Resources*: According to Section 53 of the Minerals and Petroleum Resources Development Act (Act No. 28 of 2002) an application is required by the DMR. DMR consent required.

At **Provincial Level**, the main regulatory agencies are:

» *Northern Cape – Department of Environment and Nature Conservation (NC DENC).* This department is the commenting authority for this project.
» *Department of Transport and Public Works, Northern Cape.* This department is responsible provincial for roads and the granting of exemption permits for the *conveyance of abnormal loads on public roads.*
» *Northern Cape – Department of Water and Sanitation (NC DWS).* This department is the permitting authority for water use and crossings.
» *Northern Cape Heritage: provides legislative protection for listed or proclaimed heritage sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.*

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Northern Cape, both Municipalities i.e. *Nama Khoi Local Municipality* and District Municipalities i.e. *Namakwa District Municipality* play a role.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.

There are also numerous non-statutory bodies such as Wind Energy Associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence wind energy development.

4.3 Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this Final EIA Report:

» National Environmental Management Act (Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Companion to the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations of 2010 (Draft Guideline; DEA, 2010)
  * Public Participation in the EIA Process (DEA, 2010)
  * Integrated Environmental Management Information Series (published by DEA)
» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007)

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in Table 4.1.

Table 4.1: Relevant legislative permitting requirements applicable to the Kleinzee Wind Energy Facility Project EIA

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	National Legislation		
National Environmental Management Act (Act No 107 of 1998)	» NEMA requires, inter alia, that: * Development must be socially, environmentally, and economically sustainable. * Disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied. * A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions. » EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. » In terms of S24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. » In terms of GNR 543 of 18 June 2010, a Scoping EIA Process is required to be	» National Department of Environmental Affairs (DEA) » Northern Cape Department of Environment and Nature Conservation (NC DENC)	» The Final EIA Report is to be submitted to the DEA for review and decision making. » The NC DENC is the commenting authority.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	undertaken for the proposed project.		
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
National Environmental Management: Waste Act (Act No 59 of 2008)	» The purpose of this Act is to reform the law regulating waste management in order to protect health and the environment by providing for the licensing and control of waste management activities. » The Act provides listed activities requiring a waste license.	» National Department of Water and Environmental Affairs » Northern Cape Department of Environment and Nature Conservation (NC DENC)	Waste licence could be required in the event that more than $100m^3$ of general waste or more than $80m^2$ of hazardous waste is to be stored on site at any one time. The volumes of waste generated during construction and operation of the facility are not expected to be large enough to require a waste license.
Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.	National Department of Environmental Affairs Northern Cape Department of Environment and Nature Conservation (NC DENC) Local authorities	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix J). There are noise level limits which must be adhered to.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Northern Cape province have not yet adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns	Local Municipality	
National Water Act (Act No 36 of 1998)	» Under S21 of the Act, water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under the general authorisation. » In terms of S19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing, or recurring.	Department of Water and Sanitation	A water use permits or licenses are required to be applied for or obtained due to infrastructure such as access roads crossing the drainage lines.
National Water Act (Act No 36 of 1998)	In terms of Section 19, the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water and Sanitation	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			project.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	» A mining permit or mining right may be required where a mineral in question is to be mined (i.e. materials from a borrow pit) in accordance with the provisions of the Act. » S53 Department of Mineral Resources: Approval from the Department of Mineral Resources (DMR) may be required to use land surface contrary to the objects of the Act in terms of section 53 of the Mineral and Petroleum Resources Development Act, (Act No 28 of 2002): In terms of the Act approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that might occur on site.	Department of Mineral Resources	» If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained if these are not located on the project site, which is owned by Eskom » Approval in terms of S53 will be required to be obtained.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	» S18, S19 and S20 of the Act allow certain areas to be declared and managed as "priority areas" » Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards » The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act. » Dust control regulations promulgated in November 2013 may require the	» National Department of Environmental Affairs » Northern Cape Department of Environment and Nature Conservation (NC DENC).	» While no permitting or licensing requirements arise from this legislation, this Act will find application during the construction phase of the project. » The Air Emissions Authority (AEL) may require the compilation of a dust management plan.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	implementation of a dust management plan.		
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. Heritage Western Cape	A Heritage Impact Assessment has been undertaken for the proposed project (**Appendix H**). A permit may be required should identified cultural/heritage sites on site be required to be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	those components not addressed by the EIA should be covered by the heritage component.		
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	» Provides for the MEC/Minister to identify any process or activity in such a listed ecosystem as a threatening process (S53) » A list of threatened and protected species has been published in terms of S56(1) - Government Gazette 29657. » Three government notices have been published, i.e. GN R 150 (Commencement of Threatened and Protected Species Regulations, 2007), GN R 151 (Lists of critically endangered, vulnerable and protected species) and GN R 152 (Threatened or Protected Species Regulations). » Provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (National Environmental	» DEA » DENC	An Ecological Impact Assessment has been undertaken as part of the EIA process (Appendix D). A permit may be required should any listed plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Management: Biodiversity Act: National list of ecosystems that are threatened and in need of protection, (G 34809, GN 1002), 9 December 2011).		
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be implemented.
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that	Department of Water and Sanitation	While no permitting or licensing requirements arise from this

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	should a veld fire occur on the property, that it does not spread to adjoining land. In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.		legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency.
National Forests Act (Act No 84 of 1998)	Protected trees: (S13) According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. (S15)The prohibitions provide that ' no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'. Forests: (S7) Prohibits the destruction of indigenous trees in any natural forest without a licence.	Department of Agriculture, Forestry and Fisheries	No permitting or licensing requirements.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.		phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		(height and width).
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	Northern Cape Department of Environment and Nature Conservation (NC DENC). Nama Khoi Local Municipality	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area must comply with procedures set out in the DFA.
Astronomy Geographic Advantage Act (Act No. 21 of 2007)	» The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.	South Africa Kilometre Array	On 19 February 2010, the Minister of Science and Technology (the Minister) declared the whole of the territory of the Northern Cape province, excluding Sol Plaatje Municipality, as an astronomy advantage area for radio astronomy purposes in terms of Section 5 of the Act and on 20 August 2010 declared the Karoo Core Astronomy Advantage Area for the

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Chapter 2 of the act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following: » Restrictions on use of radio frequency spectrum in astronomy advantage areas; » Declared activities in core or central astronomy advantage area; » Identified activities in coordinated astronomy advantage area; and » Authorisation to undertake identified activities.		purposes of radio astronomy.
Provincial Legislation / Policies / Plans			
Northern Cape Nature Conservation Act, 2009	To provide for the sustainable utilisation of wild animals, aquatic biota and plants; to provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; to provide for offences and penalties for contravention of the Act; to provide for the appointment of nature conservators to implement the provisions of the Act; to provide for the issuing of permits and other authorisations; and to provide for matters connected therewith.	Northern Cape Department of Environmental Affairs and Nature Conservation	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant species found on site. .
Local Legislation / Policies / Plans			

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Nama Khoi Local Municipality Integrated Development Plan (IDP) 2014/2015 Revision	» Of specific relevance to the proposed Kleinzee WEF, the IDP notes that mining used to form the backbone of the economy, but that tourism is currently seen as the "new frontier" for economic development in the municipal area (Nama Khoi Local Municipality Draft 2011/12 IDP). The IDP makes no mention of renewable energy projects or policy pertaining thereto.	Nama Khoi Local Municipality	» New developments in the municipality to be in line with the IDP.
Standards			
Noise Standards	Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are: » SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. » SANS 10210:2004. 'Calculating and predicting road traffic noise'. » SANS 10328:2008. 'Methods for environmental noise impact assessments'. » SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels	Local Municipality	The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful per se.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes.		
Waste standards	» DWAF (1998) Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste » National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) – National norms and standard for the storage of waste.	DEA DAFF	» Provides uniform national approach relating the management of waste facilities » Ensure best practice in management of waste storage » Provides minimum standards for the design and operation of new and existing waste storage
South African Good Practice Guidelines for Surveying Bats in Wind Farm Developments	These Best Practice Guidelines are similar to existing international guidelines and provide technical guidance for consultants charged with carrying out Environmental Impact Assessments (EIAs) for proposed WEFs. Furthermore, the Guidelines ensure that bat scoping assessments and pre-construction monitoring studies produce the required level of detail to assist authorities with evaluating WEF applications. If the guidelines are followed correctly, pre-construction assessments should result in understanding: » Seasonal and nightly bat activity patterns at the site. » Bat activity levels and which species are utilizing the site.	DEA	This document was developed to guide the development of wind projects. As a minimum, the following should be conducted during pre-construction bat monitoring: » Monitoring should cover one year (12 months) » Successful static acoustic monitoring for a minimum of 75% of one year of data for each site, covering all four seasons. » No of monitoring points dependant on size of WEF and no. of biotopes » Permanent microphones at >7m and at least one at >50m » Roost searches and surveys » Eight nights of manual surveys/

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	» Site specific risks/ impacts to bats associated with a proposed WEF. » Effective mitigation and monitoring methods that will be appropriate for the WEF.		transects, spread evenly across all four seasons
BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa (Jenkins et al 2011).	The present guidelines were designed with the specific objective of protecting South Africa's bird species from negative impacts associated with wind farm developments, specifically those which are conservation concern and/or those which may be sensitive to the potential impacts of wind energy facilities. In order for the South African wind energy industry as a whole, and each individual project, to be developed in a sustainable manner it is important that this objective is met.	DEA	The following are amongst the key steps in the successful design and implementation of bird monitoring at a proposed wind energy development site: » Appoint a qualified and expert advising scientist and a capable monitoring agency to conduct » pre- and post-construction monitoring. » Start baseline monitoring. » Periodically collate and analyse baseline monitoring data, and adjust the data collection
Draft Guidelines For The Evaluation And Review Of Applications Pertaining To Wind Farming On Agricultural Land (September 2010)	This document provides an outline of the type of agricultural / soil study required for wind farms and for submission to DAFF.	National Department of Agriculture	Requirements for soils and agricultural potential assessments to inform decisions regarding layouts affecting agricultural land and food security.
The Equator Principles (June 2003)	The Equator principles is benchmark in the financing of projects, which deals with determining, assessing and managing social and environmental risks related to the financing of projects, such as wind energy	International Finance Corporation (IFC) and World Bank	A wind energy facility is considered a Category B project

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	facilities.		
Environmental, Health, and Safety (EH&S) Guidelines for Wind Energy (2007)	The EH&S Guidelines for wind energy developments are technical reference documents with general and wind energy specific examples of Good International Industry Practice.	International Finance Corporation (IFC) and World Bank	This document was developed to guide the development of wind projects (which intend on applying for WB/IFC funding). Broad recommendations for management of environmental, health and safety impacts of wing energy facilities are provided in this document, which developers who intend on applying for finance must consider.
Regional Methodology for Wind Energy Site Selection: a Guideline Document prepared by DEA&DP	The methodology proposed within this guideline document is intended to be a regional-level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters) for the Western Cape	DEA&DP	Developers can use the guideline document as a tool for siting of wind energy facilities in the Western Cape.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 5

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an environmental management programme (EMP)) to the competent authority for decision-making. The EIA process is illustrated below:

The EIA Phase for the proposed Kleinzee Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice GN33306 of 18 June 2010, in terms of Section 24(5) of NEMA (Act No. 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

5.1. Relevant Listed Activities

The EIA Regulations were revised in December 2014 in terms of GNR 982 – 985. In terms of Sub-Regulations 53(2) and 53(3) of these Regulations) Transitional Arrangements):

" If a situation arises where an activity or activities, identified under the previous NEMA Notices, no longer requires environmental authorisation in terms of the current activities and competent authorities identified in terms of section 24(2) and 24D of the National Environmental Management Act, 1998 (Act No. 107 of 1998) or in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), and where a decision on an application submitted under the previous NEMA regulations is still pending, the competent authority will consider such application to be withdrawn". And "where an application submitted in terms of the

previous NEMA regulations, is pending in relation to an activity of which a component of the same activity was not identified under the previous NEMA notices, but is now identified in terms of section 24(2) of the Act, the competent authority must dispense of such application in terms of the previous NEMA regulations and may authorise the activity identified in terms of section 24(2) as if it was applied for, on condition that all impacts of the newly identified activity and requirements of these Regulations have also been considered and adequately assessed."

Therefore, similarly listed and additional activities relevant to the current application have been identified and are listed in the table below.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
GN 544, activity 10 The construction of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275kV;	GN983, activity 11 (i) The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts	Underground cabling and substation to facilitate the connection between the facility and the electricity grid
GN 544, activity 11 The construction of: **(xi)** infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse.	GN983, activity 12 The development of (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse, or c) within 32m of a watercourse	There are drainage lines on the proposed site which will be impacted by the proposed infrastructure.
GN 544, activity 18 The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from	GN983, activity 19 The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5	There are drainage lines on the proposed site which will be impacted by the proposed infrastructure.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
(i) a water course	cubic metres from- (i) a watercourse	
GN 544, activity 22 The construction of a road, outside urban areas, Where no road reserve exists where the road is wider than 8 metres *(i)* Where no road reserve exists where the road is wider than 8 m;	GN983, activity 24 The development of- (ii) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres	External access roads and internal access roads between turbines need to be constructed. Temporary roads during construction could be up to 13 m in width.
GN 544, activity 47 The widening of a road by more than 6 metres, (i) Where no reserve exists, where the existing road is wider than 8 metres –	GN983, activity 56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters	Existing gravel access roads will lengthen or be widened to be up to 13 metres.
GN 545, activity 1 The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	GN984, activity 1 The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more	Eskom is proposing the establishment of a wind farm up to 300 MW.
GN 545, activity 8 The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	GN984, activity 9 The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	A 400kV power line will be constructed to evacuate electricity into the national grid
GN 545, activity 15 Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or	GN983, activity 28 Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or	The facility is proposed to be established within an area of ~8 682 ha in extent.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
institutional use where the total area to be transformed is 20 hectares or more	afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare	
GN 546, activity 14 The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation **(a)** In the Northern Cape: **i.** All areas outside urban areas	GN 984, activity 15 The clearance of an area of 20 hectares or more of indigenous vegetation	The Wind energy facility will be located outside urban area and will require the clearance of more than 5ha of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation cover.

NB: Borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained if these are not located on the project site, which is owned by Eskom. Listed Activity 21 of GN983, in terms of the 2014 EIA regulations would be applicable to this project should the above apply, and a permit will be applied for from the competent authority for this activity (DMR) if required.

5.2. Phase 1: Scoping Study

The draft Scoping Report was made available at public places for I&AP review and comment from 12 December 2011 – 30 January 2012. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report and Plan of Study for EIA. The Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) on 17 February 2012 and was accepted by the DEA in May 2012. In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA as stated in the Scoping Report.

The Scoping Study provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern. The Scoping Report aimed at detailing the nature and extent of the proposed Kleinzee Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the

project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

5.3. Phase 2: Environmental Impact Assessment

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aims to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed alternatives put forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed Kleinzee Wind Energy Facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction, operation and decommissioning, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The EIA process followed for this project is described below.

5.4. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations June 2010, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public participation process throughout the EIA process in accordance with Regulation 54 of GN R543 of 2010 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 57 of GN R543 of 2010).

» Undertaking of independent specialist studies in accordance with Regulation 32 of GN R543 of 2010.
» Preparation of an EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.

These tasks are discussed in detail below.

5.4.1 Authority Consultation

The National DEA is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report and EIA report. Consultation with the regulating authorities and relevant Organs of State who may have jurisdiction over the project has continued throughout the EIA process.

The following will be undertaken as part of the EIA process:
» Submission of a Final Environmental Impact Assessment (EIA) Report following the public review period.
» An opportunity for DEA and NC DENC representatives to visit and inspect the proposed site.
» Consultation with Organs of State that may have jurisdiction over the project:
  * Department of Economic Development and Environmental Affairs
  * Department of Energy
  * Department of Water and Sanitation
  * Department of Agriculture, Forestry and Fisheries (DAFF)
  * Department of Mineral Resources (DMR)
  * South African Heritage Resources Agency (SAHRA)
  * Northern Cape Provincial Heritage Resources Agency, Ngwao-Boswa Jwa Kapa Bokone
  * Provincial Conservation Authorities
  * Department of Transport and Public Works and various District Roads Departments
  * South African National Roads Agency
  * Department of Land Affairs
  * Civil Aviation Authority
  * Nama Khoi Local Municipality
  * Namakwa District Municipality

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. A record of the authority consultation in the EIA process is included within **Appendix B**.

5.4.2 Public Involvement and Consultation: EIA Phase

The public participation process was undertaken in accordance with Chapter 6 of the EIA Regulations. The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded and incorporated into the EIA process.

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C** for a listing of registered parties). Adjacent landowners were identified and informed of the project. While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA process and the project database has been updated on an on-going basis.

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

» Focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local press: Die Burger, Die Namakwalander)
» Written, faxed or e-mail correspondence

Records of all consultation undertaken are included within **Appendix C.** In summary, the public participation process for this project has included the following key steps/activities to date:

Scoping Phase	Advertisement of EIA Process – First round of adverts (Die Burger, Die Namakwalander; Die Namakwa Kletz)	April – May 2011
	Advertisement of Public Meeting & Availability of Scoping report for public review – Second round of adverts	September 2011
	Distribution of Background Information Document (BID) and written notice	June 2011-current
	Focus group & site meeting for key stakeholders	11-13 October 2011

	Public review period for DSR	12 December 2011 – 30 January 2012
	Public meeting - Kleinsee Recreational Hall	13 October 2011
	Notification to registered I&APs that the Final Scoping report was available & submitted to DEA	February 2012
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting - (Die Burger, Die Namakwalander)	March 2015-July 2015
	Public meeting & stakeholder meetings » **Date:** Thursday, 26 March 2015 » **Time:** 18:00 -19:30 » **Venue:** Kleinzee Recreation Hall, Kleinzee Town	

5.4.3 Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs to date over the duration of the EIA process have been synthesised into a Comments and Response Report (refer to **Appendix C** for the Comments and Response Report compiled from comments received during both the Scoping Phase and current EIA Phase).

The Comments and Response Report include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

5.4.4 Assessment of Issues Identified through the Scoping Process

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in the table below.

Specialist	Area of Expertise	Refer Appendix
Simon Todd of Simon Todd Consulting	Terrestrial Fauna	D
Dave McDonald of BergWind Botanical Surveys	Vegetation	E
Rob Simmons	Avifauna pre-construction monitoring and impact assessment	F
Kate McEwan of Inkuleko Wildlife Services	Bat pre-construction monitoring and impact assessment	G

Specialist	Area of Expertise	Refer Appendix
Johann Lanz of Johann Lanz Consulting	Geology, soils and agricultural potential	H
Jayson Orton of Asha consulting and Lita Webley of ACO	Heritage / Archaeology	I
John Pether	Palaeontology	J
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise	K
Lourens du Plessis of MetroGIS	Visual impacts and GIS mapping	L
Tony Barbour of Tony Barbour Consulting and Research	Social Impact	M

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the wind energy facility. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:

- Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
- Assigned a score of 2 is improbable (some possibility, but low likelihood);
- Assigned a score of 3 is probable (distinct possibility);
- Assigned a score of 4 is highly probable (most likely); and
- Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).

» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» The **status**, which is described as either positive, negative or neutral.
» The degree to which the impact can be reversed.
» The degree to which the impact may cause irreplaceable loss of resources.
» The degree to which the impact can be mitigated.

The **significance** is determined by combining the criteria in the following formula:

S=(E+D+M)P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As Eskom has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Programme is included as **Appendix N**.

5.4.5 Assumptions and Limitations

Wind energy facilities are a fairly new development in South Africa and have not been implemented on a large scale in the country, to date. Therefore certain gaps

in knowledge, assumptions and uncertainties are likely to occur during the EIA process. These are discussed below.

In conducting this EIA process, the following general assumptions have been made:

» The technical motivation as to the selection of the proposed development site (including details pertaining to the wind resource, etc.) provided by Eskom is sufficient and defendable.
» Only one site is available for the establishment of the proposed facility and will be considered in the EIA, and no other sites are available to be included as alternative sites in the EIA. This is based on the detailed wind analysis (with specific measurements on site) which has been done to date, as well as on land availability, access to the site, grid connectivity, etc. It is assumed that the pre-feasibility study undertaken by Eskom will be sufficient to motivate the selection of the site to DEA.
» It is assumed that the development site identified by Eskom represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure.
» It is assumed that the Gromis substation can accommodate the additional power generated from the wind energy facility.
» The EIA study was conducted based on a preliminary layout of the wind energy facility provided by Eskom. It is understood that this layout is preliminary at this stage, but it is assumed that the layout is approximately 80% accurate, and subject to change based on the environmental sensitivities/outcomes from this EIA phase.

Details of specific assumptions, limitations and/ gaps in knowledge for each of the environmental aspects / specialist studies undertaken are briefly highlighted below (refer to specialist studies contained in **Appendix D- M** for more details).

5.4.6 Public Review of Draft EIA Report and Feedback Meeting

A Draft EIA report was made available for public review from **09 March – 28 April 2015** the following locations:

» www.savannahsa.com
» Kleinzee Public Library / Admin Offices
» Buffelsrivier Library/ Admin Offices
» Komaggas office of the Nama Khoi Municipality
» Springbok Public Library

In order to provide feedback of the findings of the studies undertaken and receive comments to address in the Final EIA report, a public feedback meeting was held within the review period of the Draft EIA Report. All interested and affected parties

were invited to attend the **public feedback meeting** (held on **27 April 2015** at the Kleinzee Recreation Hall, Kleinzee Town at 18h00 – 19h30).

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Die Burger and Die Namakwalander on 06 March 2015 - refer to Appendix C).

5.4.7 Final Environmental Impact Assessment (EIA) Report

The final stage in the EIA Phase will entail the capturing of responses from I&APs on the Draft EIA Report in order to refine this report. The Final EIA report is submitted to the decision-making Authorities, and it is this Final report upon which a decision is made regarding the proposed project.

This section of the EIA Report provides a description of the environment that may be affected by the proposed Kleinzee Wind Energy Facility. This information is provided in order to assist the reader in understanding the pre-construction environment. Aspects of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect, the proposed development have been described. This information has been sourced from both existing information available for the area as well as collected field data, and aims to provide the context within which this EIA is being conducted. A more detailed description of each aspect of the affected environment is included within the specialist reports contained within **Appendices D – M.**

6.1 Regional Setting: Location of the Study Area

At a broad scale the study area is located in Namaqualand in the Nama Khoi Local Municipality of the Northern Cape Province. The survey area lies 75 km west of the town of Springbok (centre point co-ordinate: 29° 42' 28'' and 29° 51' 30'' south and 17° 04' 01'' and 17° 10' 45'' east). The site falls within the quarter degree grids 2917CA and 2917CC, and is situated along the West Coast of South Africa within 2 km of the coastline.

At a more site-specific scale the wind farm study area is located approximately 6 km south of the small town of Kleinsee on the followings farms:

» RE of Brazil 329
» RE of Goraap 323,
» RE of Honde Vlei 325,
» RE of Kannabieduin 324,
» Portion 4 of Rooivlei 327

The site falls within the West Coast Resources on the coast of Namaqualand, inland of Melkbospunt, Jakkalsbaai and Thys se Baai. Large parts of the region are mine-owned, and as a result, significant diamond mining activities are evident, especially within a 7km band along the coast.

Other than the mining activity, industrial infrastructure within the region includes a network of distribution power lines, a distribution substation in Kleinsee and the Gromis Transmission Substation. A 400kV transmission line will link the Kleinzee 300MW Wind Farm to the Gromis Substation that is approximately 16 km north-east of the proposed development site.

The Namaqua National Park lies approximately 45km to the south east and is therefore outside of the study area (and not shown on the maps in the visual assessment- refer to **Appendix K**). The greater region is generally seen as having a high scenic value and high tourism value potential.

6.2 Climatic Conditions

The Namaqualand coastal region is arid and experiences winter rainfall (rainfall occurs from May to August). A rainfall gradient from the coast to inland has been described for the area south of Kleinsee where mean annual precipitation is 75 mm on the coast increasing to 160 mm in the inland uplands. This information is extrapolated from meteorological data collected at Koingnaas, ~60km south of the study area (Burger 2007 in Arcus Gibb 2008). Kleinsee experiences 98 mm rainfall per annum, the mean maximum temperature does not vary much throughout the year whereas there is slightly greater amplitude in mean minimum temperature, this is due to the proximity to the Atlantic Ocean and the effect of the Benguela Current with regular fog occurring over the coastal zone. However, there are extremes with summer temperatures as high as 40°C having been recorded at Koingnaas (November 2006) and regularly above 30°C away from the coast inland from the farm Brazil. Winter temperatures can fall to 4°C (Koingnaas, June 2006).

Temperatures can also be influenced by easterly berg wind conditions (off shore flow) in winter when the temperature may exceed 35°C. The prevailing surface winds are mostly from the south and south-east in the summer when winds are strong and speeds can exceed 10 m/s. Strong winds can also occur from the west and north-west, mainly in winter.

6.3 Topographical & Geological Profile

The study area for visual assessment occurs on land that ranges in elevation from 0m above sea level (asl) along the coast to about 380m asl at the top of the local hills. The terrain surrounding the proposed site is generally flat, sloping gently westwards towards the shore. The terrain type of the region is described as slightly undulating plains. Hilly terrain is evident in the north and east of the study area. These mountains mark the beginning of the escarpment which rises to the east (**Figure 6.1**).

The region of the study area is underlain by rock of the Namaqua-Natal Metamorphic Belt (Cornell *et al.* 2006). At the coast the surface geology consists of deep, white to grey and calcareous stabilized aeolian sands (Quaternary), overlying marine sediments composed of calcrete or dorbank hardpans. Immediately above the high-water mark the coastline has exposed granite of the Dikgat and Brazil Formations (Goraap Suite) (Marais, 2001). Further inland the soils are yellow sands becoming either red or yellowish-red overlying granite or gneisses. The

undulating coastal plain is about 30 km wide and separates the coast from the inland Namaqualand Klipkoppe comprising Mokolian granites and gneisses that form domes and rock sheets and which weather to form yellow-brown to brown loamy sand (Mucina *et al.* 2006). Le Roux (1991) described the coastal Sandveld topography as consisting of three major landforms, based on the presence or absence of dunes: unstable dunes, semi-stable dunes and shallow, flat sand. Low and Desmet (2007) describe the coastal zone incorporating the study area as having parabolic dune fields stretching south-north parallel to the coast. The dunes are further described as undulating with gentle hummocking and are partially vegetated.

6.4 Land-Use / Land Cover

Land use is largely unspecified within the study area, and extensive surface based mining takes place along the coastline in the vicinity of, and north of Kleinzee. Large parts of the region are mine-owned, and as a result, significant mining activities are evident, especially within a 7km band along the coast. A small settlement, Grootmis, with four residential buildings and a church building, is situated 2.5 km north of Kleinzee. This location is approximately 8 km from the closest wind turbine. Although only a couple of buildings occur, they are regarded as having some heritage value. These include a large stone house that is likely early 20th century and a church building that is known to have been built in 1936. It is still in use and being maintained.

Roads include the R355 arterial route (to Springbok) and a number of lower order secondary roads extending to the north and south from Kleinzee. Other than the mining activity, industrial infrastructure within the region includes a network of distribution power lines leading into and from Kleinzee and the Gromis Transmission Substation.

The greater region beyond the study area is generally seen as having a high scenic value and high tourism value. It is well known for its scenic natural beauty (West Coast as a whole) and annual wild flower displays (Namaqualand). This occurs once a year between July and October, depending on a number of environmental factors, but mainly the occurrence and duration of rainfall. The length of the display is also highly variable, and depends on the rainfall. The Namaqua National Park lies approximately 45km to the south east and is therefore outside of the study area. Of relevance, however, is the location of the proposed wind energy facility within an area demarcated as a *Priority Natural Area* by the SANParks Planning Department (**Figure 6.2**). The West Coast of the Northern Cape attracts tourists to the Koingnaas – Kleinzee tourist route, also referred to as the “Diamond Route”.

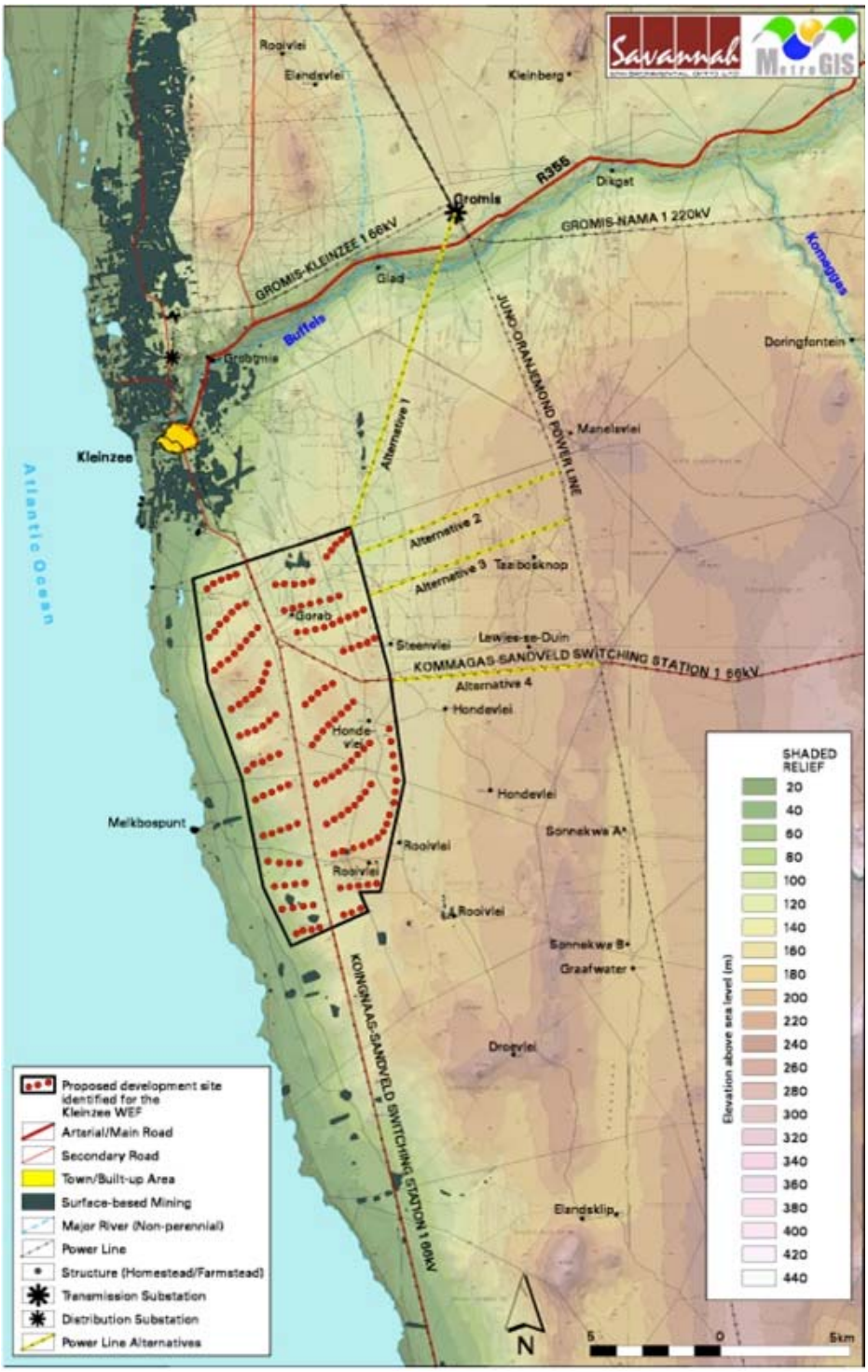


Figure 6.1: Shaded relief/ topographical map for the Kleinzee site and broader study area

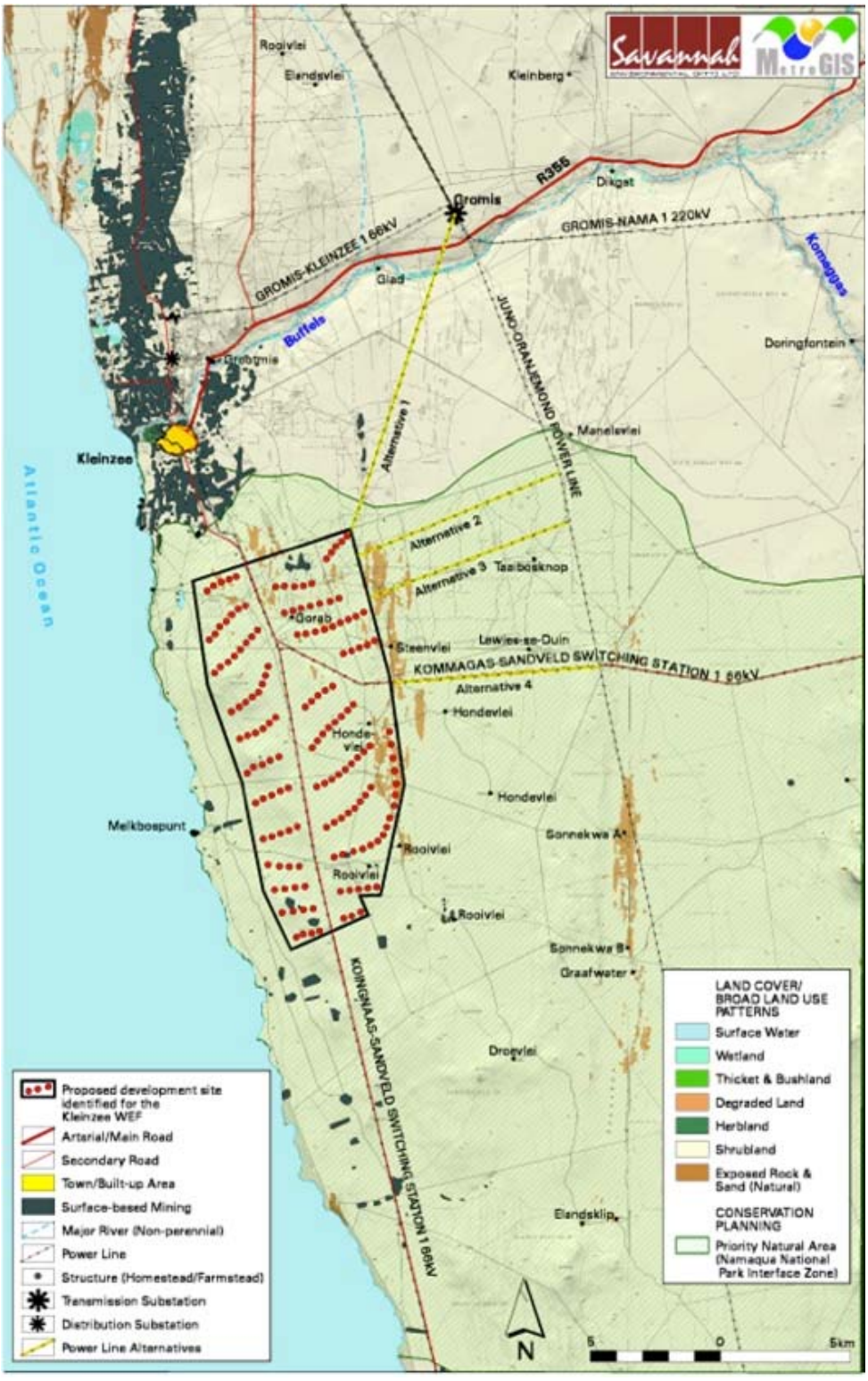


Figure 6.2: Land cover and broad land use patterns within the study area.

In addition to its function as a primary access route linking Kleinzee with the N7, the R355 is a scenic route, especially as it descends through the mountains of the escarpment (in the east, just beyond the study area). This road thus carries both commuters and tourists. During the flower season, the secondary roads in the region are also utilised by tourists as scenic drives.

6.5 Site access

The proposed site is essentially only accessible from local roads off the N7 (via Garies or Springbok). The N7 links Cape Town in the south to Noordoewer (Namibian border) in the north. North of Noordoewer, the N7 continues north to Windhoek as the B1. The road is of crucial importance to the economies of the West Coast and Namaqualand regions, as well as that of Namibia. At Springbok the N7 links up with the N15, which provides a link with Upington to the west (and ultimately the Gauteng Province). Springbok is located approximately 558 km north of Cape Town (N7), and ~450 km north of Saldanha (port).

Kleinsee may be accessed from the N7 via one of three possible routes (refer to Figure 6.3):

» R355, via Springbok (~97 km). This constitutes the most direct tarred route to Kleinsee;
» Kommagas gravel road off the R355. This would constitute the shortest route from the N7 to Kleinsee and the proposed wind energy facility site;
» Combination of (mainly gravel) roads from Garies (off the N7), via Hondelikpbaai and Koingnaas. This constitutes the most direct road link to the harbours of Cape Town and Saldanha via the N7. Garies is located approximately 176 km south-east of Kleinsee (by road).

6.6 Hydrology

The non-perennial, westward flowing Buffels River and its tributary, the Komaggas River, are the main hydrological features within the study area. The Buffels River bypasses the site some 7 km to the north.

6.7 Ecological Profile

6.7.1 Flora

Vegetation overview

The study area falls within the extensive, arid Succulent Karoo Biome (Rutherford & Westfall, 1994; Mucina et al. 2006 in Mucina & Rutherford, 2006) and regionally within the Namaqualand Sandveld Bioregion which lies parallel to the

west coast in the western part of the Succulent Karoo Biome (Rutherford, Mucina & Powrie, 2006 in Mucina & Rutherford, 2006; Desmet, Turner & Helme, 2009) (**Figure 6.3**). The Succulent Karoo Biome has high levels of plant diversity and endemism and is one of the earth's 'hotspots' of plant diversity and the only entirely arid hotspot in the world (Van Wyk & Smith, 2001). Four vegetation types are found in or near the study area, i.e. (1) azonal Namaqualand Seashore Vegetation (AZd2) along the coast and immediately outside the western boundary of the study; (2) azonal Namaqualand Salt Pans (AZi2) in the northwest of the study area; (3) Namaqualand Coastal Duneveld (SKs8) on the semi-mobile coastal dunes and (4) Namaqualand Strandveld (SKs7) found on red to yellow stabilized aeolian sand overlying a basement of marine sediments and granite-gneisses.

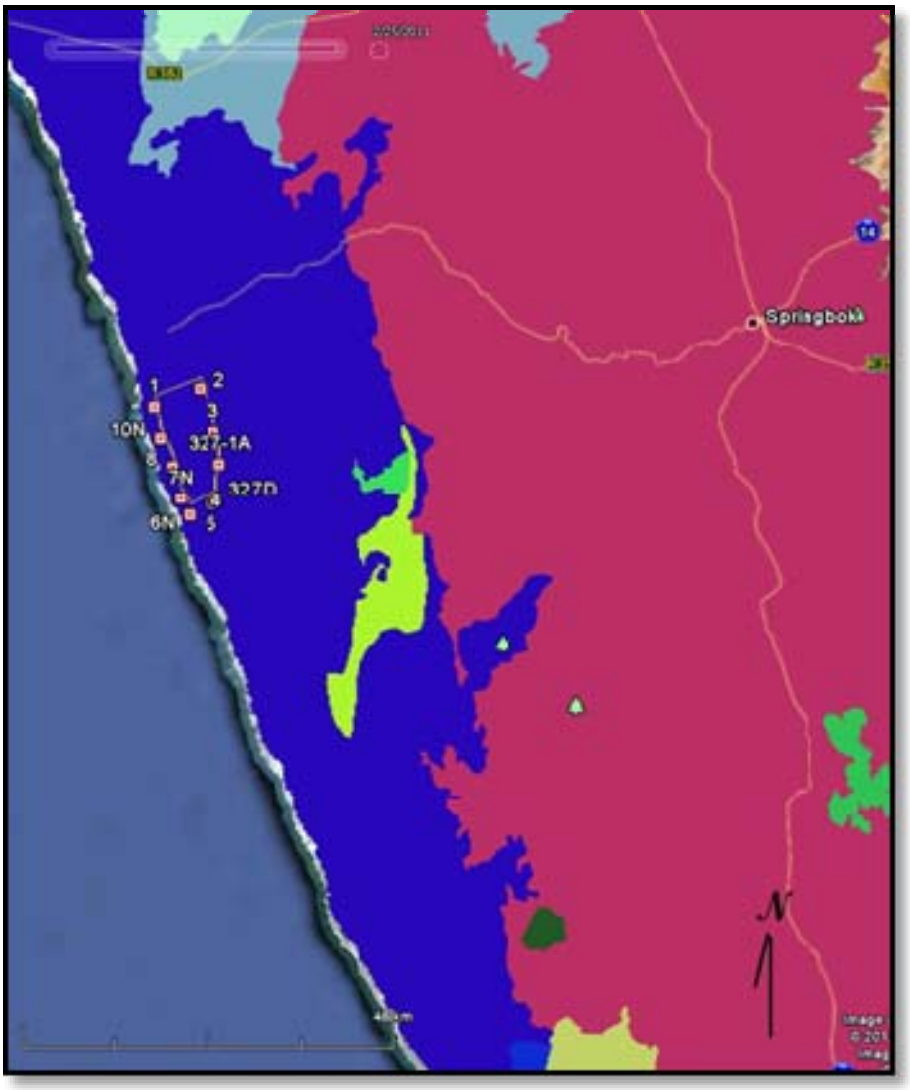


Figure 6.3: Portion of the bioregions map from Mucina, Rutherford and Powrie (2005) with the dark blue indicating the Namaqualand Sandveld bioregion. The footprint of the proposed wind energy facility is shown with position markers near the coast.

Local vegetation communities

Owing mainly to restricted access to the diamond-mining areas along the Namaqualand coast there have been few detailed botanical studies in the coastal sandveld of Namaqualand. Le Roux (1991) in a study of the farm Brazil recognised three major plant communities: *Zygophyllum cordifolium–Drosanthemum marinum* Shrubland with *Stoeberia beetzii-Wooleya farinosa* Shrubland on flat, shallow sands and *Zygophyllum morgsana-Arctotis scullyi* (syn. *A. merxmuelleri*) Shrubland on unstable to semi-stable white dunes. Low & Desmet (2007) observed that the dunes in the south of the Brazil area are unstable and poorly vegetated but overall the vegetation is in moderate to good condition with 43 species found in the above communities. These species include *Fenestraria rhopalophylla* subsp. *aurantiaca* the "window succulent", also of conservation importance.

The vegetation units recognized by Mucina, Rutherford & Powrie (2005) and Mucina *et al.* (2006) which occur within the study area are Namaqualand Coastal Duneveld, Namaqualand Strandveld and Namaqualand Salt Pans

Critical Biodiversity Areas

Critical Biodiversity Areas (CBAs) within the Namaqualand District Municipality (NDM) were mapped by Desmet and Marsh (2008). The footprint of the study area including the power line route falls outside any CBA but does fall within the coastal corridor that has conservation importance. This is supported by the view of Low & Desmet (2007) that had the Nuclear 1 project proceeded at either Brazil or Schulpfontein, the surrounding area that would have been conserved would have been highly beneficial for conservation of the Namaqualand coastal vegetation which is otherwise poorly conserved in formal conservation areas.

Conservation status and Listed Plant Species

Low & Desmet (2007) found that despite the high impact of diamond mining on the coast south of Kleinzee, the vegetation has survived well. They state for the area they surveyed at Brazil that,

"Vegetation along this coastline is in remarkably good condition given the ravages of diamond mining over the years. However, vegetation types in the area are poorly conserved …. Except for the southern section, most of the site is rated highly (mainly 60 – 80%) for conservation importance."

The farms Brazil, Goraap and the areas of farms Kannabieduin, Rooivlei and Honde Vlei falling within the designated wind energy facility footprint have only been affected by mining to a limited extent, mainly on the coast and in some localized small areas inland. These farms are currently farmed with livestock, mainly sheep,

and the vegetation is in relatively good condition with no loss of plant species that can be attributed to grazing

A checklist of plant species recorded from the quarter degree grids where the study area is located was obtained from the South African National Biodiversity Institute SIBIS database. *Wooleya farinosa* is a Namaqualand Coastal Sandveld endemic species and therefore has important conservation value. It has been impacted by diamond-mining along the Namaqualand coast and is listed as RARE although locally dominant not only on sandy dune substrates but also on granite-gneisses. Low & Desmet (2007) speculated that several Namibian endemic plant species may occur in the vegetation found at Brazil and by inference could occur on the remainder of the site being considered for the proposed Kleinzee Wind Farm. Determination of this would require systematic plant collection over a wide area which was beyond the scope of the field-work for the botanical impact assessment reported here.

6.7.2 Fauna

Faunal habitat

The following faunal habitats were identified within the site:

Coastal Duneveld: The vast majority of the site consists of the coastal duneveld. This habitat consists of low to medium sized succulent and woody shrubs on undifferentiated pale yellow and greyish sands. In general this habitat is well vegetated, but some areas with sparsely vegetated hummocks or sandy slopes also occurred. The reptile community of this area is likely to consist largely of sand-loving species such as sand lizards and horned adders. Species observed in this habitat included Variegated Skink, Angulate Tortoise, and Namaqua Sand Lizard. This is also the habitat of Grant's Golden Mole which is listed as Vulnerable. Given the broad availability of this habitat in the area, it is not considered highly sensitive. However, a potentially significant impact to this habitat may result from the access roads that will be constructed along the strings of turbines. The hardened roads may disrupt the underground connectivity of this habitat for subterranean species such as golden moles, blind snakes and legless skinks. This species would be more likely to occur within the areas of loose sand, as the sand in the other areas is quite compacted and full of plant roots making it difficult to 'swim' through the sand. The near-surface runs of this species were not observed at the site

Rocky outcrops: Rocky outcrops are very scarce at the site and occurred largely along the coastal bluff with a few other outcrops associated with the summits of the larger hills at the site. The rocky outcrops are generally very restricted in extent and most cover only a few square meters. Nevertheless, these are important

habitats for reptiles and a number of listed and local endemic species were recorded at these sites, including the Namaqua Day Gecko (Near Threatened) and Lawrence's Girdled Lizard (Near Threatened), as well as more widespread species such as Namaqua Gecko and Southern Rock Agama. Given the scarcity of this habitat in the landscape and the observed presence of the above listed species as well as the likely presence of several others, the rocky outcrops should be considered highly sensitive and should be protected from impact.

Faunal communities

» *Terrestrial Mammals:* Approximately 40 mammal species potentially occur at the site. Larger mammals recorded or likely to occur at the site include Steenbok, Common Duiker, Jackal, Caracal, Porcupine and Aardvark. Due to the mobility and broad habitat tolerances of these species, they are not likely to be highly sensitive to the development of the area. Two listed species, the Brown Hyaena (Near Threatened) and Black-footed cat (Vulnerable) may occur in the area. As parts of the site are used for extensive sheep farming, predators are usually persecuted under these circumstances and so it is unlikely that the Brown Hyaena is abundant within the site. The Black-footed Cat may occur at the site, but the loss of habitat that may result from the development would not be highly significant given the wide distribution of this species.
The site contains a diverse small mammal community and a relatively large number of rodents, shrews, moles and mole rats occur in the area. Common species reorded within the site include Brants's Whistling Rat, Namaqua Rock Mouse and the Bush Vlei Rat. Brants's Whistling Rat were particular common and occurred in most places where the substrate was firm enough to support burrows, such as low-lying areas between hills and places where the calcrete horizon was near the surface. Grant's Golden Mole (Vulnerable) is likely to occur in the dunes of the site while De Winton's Golden Mole (Vulnerable) is a little-known species recorded only from the Port Nolloth area, but could potentially occur at the site. Both of these species are listed as Vulnerable as a result of their scarcity and the impact coastal mining activities have had on their habitat.

» *Reptiles:* As many as 67 reptiles potentially occur within the study site, including several listed species and narrow endemics. Of these 49 species have been recorded in the area by SARCA[4] and an additional 18 potentially occur in the area according to distribution maps, but have not been recorded by SARCA. Based on the habitat requirements of the listed and narrow endemic species particularly significant habitats within the area are likely to be the coastal dunes and the rocky outcrops. The coastal dunes are however outside of the development footprint and would not be impacted by the development. A

[4] Southern African Reptile Conservation Assessment

number of turbines are however near the rocky outcrops and would potentially have a significant impact on these areas.

» The Variable Skink and Angulate Tortoise were observed to be common throughout the site, while the Spotted Desert Lizard was common on the firmer lowland substrates. Other species observed include the Namaqua Day Gecko, Namaqua Gecko, Southern Rock Agama and Lawrence's Girdled Lizard, all of which were associated with the rocky outcrops at the site. The Namaqua Day Gecko and Lawrence's Girdled Lizard are both listed species (**Table 6.1**) and several other listed species are highly likely to occur at the site. Both of these species as well as several other listed species are associated with the rocky outcrops of the site.

Table 6.1: Reptile species of conservation concern which were observed or may occur in the vicinity of the study site.

Scientific Name	Common Name	Distribution	Status	Likelihood
Homopus signatus	Speckled Padloper	Endemic	Near Threatened	High
Lamprophis fiskii	Fisk's House Snake	Endemic	VU	V.Low
Naja nigricollis woodi	Black Spitting Cobra	Endemic	SARDB Rare	High
Bitis schneideri	Namaqua Dwarf Adder	Endemic	VU	High
Typhlosaurus lomiae	Lomi's Blind Legless Skink	Narrow Endemic	VU	High
Typhlosaurus vermis	Boulenger's Blind Legless Skink	Narrow Endemic	Data Deficient	High
Meroles ctenodactylus	Smith's Desert Lizard	Narrow Endemic	Data Deficient	High
Gerrhosaurus typicus	Namaqua Plated Lizard	Endemic	NT/SA RDB Rare	High
Cordylus cataphractus	Armadillo Girdled Lizard	Endemic	VU	High
Namazonurus lawrenci	Lawrence's Girdled Lizard	Narrow Endemic	Near Threatened	Definite
Phelsuma ocellata	Namaqua Day Gecko	Endemic	NT	Definite
Bitis Schneideri	Namaqua Dwarf Adder	Narrow Endemic	Vulnerable	High

» *Amphibians:* The site lies within the known distribution range of seven frog and toad species. However as there is very little perennial water in the area, many of these are not likely to occur at the site. Species such as the Common Platanna, Namaqua Stream Frog and to a lesser extent the Namaqua Caco are dependent to a greater or lesser degree on surface water for habitat or breeding purposes. The remaining species are either largely independent of water or well adapted to arid conditions. The Desert Rain Frog occurs in Strandveld vegetation up to 10 km from the coastline and is listed as Vulnerable. The greatest threat to amphibians associated with the development is probably chemical and fuel/oil spills related to the construction activities, rather than the presence of the development in the long-term. Provided that suitable precautions are followed to avoid impacts on amphibians and their habitats during the construction phase, it is not likely that the development of the facilities would have a significant long-term impact on local amphibian populations.

6.7.3 Avifauna

In order to characterise the bird communities on the site (baseline) a 12-month pre-construction bird monitoring programme was undertaken at the Kleinzee Wind Energy Facility site and at a control site. The findings from observations through the bird monitoring programme have been incorporated into this section, and have informed the avifaunal impact assessment.

Avifauna Habitat

Bird habitats just west of the Kleinzee boundary comprise coastal marine rocky shore habitat. Inside the Wind farm boundary the vegetation is intact low succulent karoo bush used mainly by small endemic species. Other microhabitats are provided by one large artificial wetland in the north-west corner and a few farm dams that are scattered across the landscape (both attracting wetland species), the power line poles (attracting crows and Greater Kestrels) and the communication towers on the hills (attracting nesting crows, Rock Kestrels and Parus tits).

Species richness, endemism and red data species

The region supports over 160 bird species, including 15 threatened (red-listed) species, and 44 endemic species (tp://sabap2.adu.org.za/species_maps.php, Simmons, 2012). Those of most concern are the locally found raptors including the collision-prone *Endangered* Black Harrier, Peregrine *Falco* (not threatened) and *Vulnerable* Lanner Falcons as well as influxes of more nomadic species such *Endangered* Ludwig's Bustard and *Near Threatened* Kori Bustard.

The study site supports several raptor species many of which are not red-listed species but are prone to collision with infrastructure such as power lines and turbines. Of these the most commonly recorded species were (in order): Greater Kestrel (6 of 6 visits), Pale chanting Goshawk (6 of 6 visits), Black-chested Snake Eagle (4 of 6 visits), Jackal Buzzard (2 of 6 visits), Peregrine Falcon (1 of 6 visits) and Spotted Eagle Owl (1 of 6 visits). Of the total 44 endemic species recorded within the study area both species of long-billed Lark – Cape and Karoo *Lark* - and the range-restricted Black-eared Sparrow-Lark were recorded displaying in the study area, and presumably breeding.

Collision-prone species

A total of 11 large collision-prone species were recorded in the study area – 11 species in the wind energy facility and 11 species in the Control site. These species varied seasonally in their occurrence within the wind farm site and the control. The most frequently occurring species were the Greater Kestrel, Pale chanting Goshawk, Black-chested Snake Eagle and the Southern Black Korhaan. The most commonly occurring red data species were Ludwig's Bustards that were recorded particularly in winter in both the wind energy facility and Control ste.

6.7.4 Bat Communities

In order to characterise the bat community on the site (baseline) and inform the impact assessment, a pre-construction bat monitoring programme (refer to **Appendix G**) was undertaken at the Kleinzee Wind Energy Facility site and at a control site.

a. Potential bat species

Based on historical records and modelled distributions (Monadjem *et al*., 2010) and IWS's knowledge, 14 bats, presented in **Table 6.2** have the potential to occur at Kleinzee Wind Farm Facility, but vary in their level of occurance (LoO), five (5) highly likely, sixe (6) moderately likely and three (3) with a low likelihood, but possible.

Table 6.2: Potential Bat species within the Kleinzee Wind Energy Facility

Family	Species	Common Name	Likelihood Of Occurrence	National Conservation Status
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	High	LC
RHINOLOPHIDAE	*Rhinolophus capensis*	Cape horseshoe bat	High	NT
VESPERTILIONIDAE	*Cistugo seabre*	Angolan wing-gland bat	High	V
VESPERTILIONIDAE	*Eptesicus hottentotus*	Long-tailed serotine	High	LC
VESPERTILIONIDAE	*Neoromicia capensis*	Cape serotine	High	LC
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	Moderate	NT
RHINOLOPHIDAE	*Rhinolophus darlingi*	Darling's horseshoe bat	Moderate	NT
RHINOLOPHIDAE	*Rhinolophus clivosus*	Geoffreoy's horseshoe bat	Moderate	NT
MOLOSSIDAE	*Sauromys petrophilus*	Roberts's flat-headed bat	Moderate	LC
NYCTERIDAE	*Nycteris thebaica*	Egyptian slit-faced bat	Moderate	LC
PTEROPODIDAE	*Rousettus*	Egyptian Rousette	Moderate	LC

	aegyptiacus			
EMBALLONURIDAE	*Taphozous mauritianus*	Mauritian tomb bat	Low	LC
MOLOSSIDAE	*Chaerophon ansorgei*	Ansorge's free-tailed bat	Low	LC
PTEROPODIDAE	*Lissonycteris angolensis*	Angolan soft-furred fruit bat	Low	-

Legend: LC = Least Concern; NE = Not Evaluated; NT = Near Threatened; PS = Protected Species; V = Vulnerable

b. Confirmed bat species

Of the 14 potentially occurring bats, 6 have been confirmed at the Kleinzee Wind Farm Facility,, through call analyses, roost surveys and driven transects and 1 other species has the potential to occur based on calls recorded similar to their known call structure. The confirmed and suspected species, their foraging and roosting ecology and conservation status is presented in **Table 6.3**. All bat species confirmed are insectivorous foragers.

Table 6.3: Confirmed Bat species for Kleinzee Wind Energy Facility

Family	Species	Common Name	Conservation Status (National)	Conservation Status (Global)	Confirmation Method
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	NT	LC	Confirmed – calls only
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	LC	LC	Confirmed – calls only
NYCTERIDAE	*Nycteris thebaica*	Egyptian slit-faced bat	LC	LC	Confirmed – Roost Surveys
RHINOLOPHIDAE	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	NT	LC	Confirmed – calls only
VESPERTILIONIDAE	*Eptesicus hottentotus*	Long-tailed Serotine	LC	LC	Confirmed – calls only
VESPERTILIONIDAE	*Cistugo seabrae*	Angolan wing-gland bat	V	LC	Suspected – calls only

Legend: LC = Least Concern; NE = Not Evaluated; NT = Near Threatened; PS = Protected Species; V = Vulnerable

6.8 Land Types, Soils and Agricultural Potential

6.8.1 Soils

Terrain, soil and veld conditions are largely uniform across the site. There are only two land type classifications across it (**Figure 6.4**), and they do not differ greatly in terms of soil conditions. The land type classification is a nation-wide survey that groups areas of similar soil and terrain conditions into different land types. Soils are predominantly deep, very sandy, light yellow to white coloured sands, with some

shallow calcrete hard bank horizons, and even more rarely underlying clay. The main difference between the land types is that Ai13 is dominated by yellow coloured sand while Hb80 has a higher proportion of white coloured sand. Soil variation has very little influence on agricultural capability across the site.

The soils are categorized as having a high susceptibility to wind erosion because of their sandy texture. Susceptibility to water erosion is low to moderate.

Figure 6.4: Map showing land types on and surrounding the site (red outline)

6.8.2 Agricultural Potential

The aridity is the major agricultural constraint. The land capability (on the 8 class scale – refer to Table 6.4) is classified across the entire site as class VII - Non-arable, low potential grazing land. The long term grazing capacity of the site is classified as 41-60 hectares per large stock unit. The farmers currently utilizing the site for grazing work at a stocking rate of 8-10 hectares per sheep, dependent on rainfall.

Table 6.4: Land type data for site. Land types and dominant soil forms are listed in decreasing order of surface coverage.

Land type	Land capability class	Dominant soil forms	Depth (cm)	Topsoil clay%
Ai13	VII	Clovelly Pinedene Vilafontes Mispah	60-120 40-80 40-80 20-40	2-4 2-4 2-4 2-4
Hb80	VII	Fernwood Pinedene Mispah Clovelly Kroonstad Vilafontes	>120 40-80 20-30 60->120 50-70 50-80	0-3 1-3 0-4 1-4 2-4 1-7

Capability classes are defined as: VII - Non-arable, low potential grazing land

6.9 Social and Demographic Profile

The CLM consists of 6 Wards and covers an area of 7 230 km^2 and is renowned for its pristine natural environment, rich heritage, diverse peoples and cultures. Important tourist attractions include the beautiful landscapes and a healthy climate.

6.9.1 Population

Despite having the largest surface area, the Northern Cape was home to only about 1 145 861 people (or 2.2% of the national population) in 2011. The most recent estimate of the Namakwa District's population is from Census 2011, and indicates a population of ~115 842. At ~10.1% of the NCP total, the NDM had the smallest population share of the NCP's 5 DMs in 2011. As for the rest of the NCP, the Coloured population group is by far the most dominant ethnic group in the NDM, and Afrikaans the most commonly spoken language. In 2011 the Coloured group constituted ~83.2% of the total NDM population, followed by Whites (~8.7%) and Black Africans (~6.8%). Afrikaans was spoken by an overwhelming ~93.9% of the population as first language in 2011.

The Nama Khoi LM has an estimated population of ~47 041 (13 193 households) (2011), accounting for roughly 41.39% of the NDM's population (on only 14% of the NDM's territory). In comparison to the NDM, the NKLM therefore has a relatively high gross population density, namely of 0.91 people/ km^2.[5] At community level, Census 2011 indicated populations of 728 for Kleinzee, 3 116 for Komaggas, and 1 123 for Buffelsrivier. The entire NKLM rural population was estimated at 3 367 (0.002 people/ km^2).

[5] To put this into perspective: Gauteng Province (18 178 km^2) is roughly the same size as the NKLM, but has a (2011) population of 11.3 million (www.statssa.gov.za).

6.9.2 Education

An estimated 11.3% of the NCP population had had no education at all, while 34.9% had only some secondary education and 23% had only completed matric/grade 12 in 2011. The respective rates in 2001 were 29% with only some secondary education and 15% with completed matric education, thus indicating a significant improvement over the relevant ten year period. Community Survey 2007 indicated that Grade 7-9 qualifications constituted the most significant category in the NDM, while tertiary qualifications were minimal. The lack of sufficient and adequate tertiary institutions and the lack of post-secondary employment opportunities are identified as key factors in the 2012-2016 NDM IDP.

6.9.3 Income and economic development

The Human Development Index[6] (HDI) for the NCP (four indexed factors – life expectancy, adult literacy, GDP per capita (adjusted for real income) and education attainment) as a whole is 0.58, which is substantially below the South African average of 0.72. The HDI in the Springbok area (0.62) is above the NCP, but below the national average (PGDS, 2004). Income distribution in the NCP is extremely skewed, with a high percentage of the population living in extreme poverty. In addition, the relative percentage of poverty is also increasing, with an estimated 36% of households in the NDM living beneath the poverty datum in 2001, increasing to an estimated 44% in 2010. Poverty also has a distinctly ethnic profile, with ~73% of the Black African, and ~47.5% of the Coulored population groups living in poverty in 2010, but only 0.3% of the White group (NDM, 2012).

6.9.3 Employment

Only ~20% of the economically active age group of the NDM population was permanently employed in 2010. The bulk of the NDM's labour force was not economically active in 2010. The unemployment rate as well as the number of unemployed people in the NDM increased steadily from 1996 - a total increase of 6 374 people, or 270% over the period 1996-2010. Of the total unemployed, the Coloured population group accounted for an estimated 96% in 2010. The decline in mining and agriculture activities in the NDM are a key cause. The NDM IDP notes that an increasingly larger part of the population is becoming dependent on state grants (NDM, 2012).

Information contained in the NDM IDP indicates that the total number of employment opportunities in the NDM has only increased by ~1 000 over the

[6] The closer the HDI to 1.0, the higher the level of "living condition". For example, Sweden has an index of 0.91 defined as high, South Africa at 0.72 is defined as middle and Lesotho at 0.47 is defined as low.

period 1996-2010. In 2010 the most significant sectors in terms of employment provision were Community Services (~25%), Trade (~18.5%), Agriculture (~18%) and Mining (~14.5%). Of significance, the share of both the Agriculture and Mining sectors had declined significantly since 1996, namely from ~26% and ~19%, respectively, while those of Community Services (~16.5% in 1996) and Trade (~14%) have increased. An estimated total of ~2 000 jobs were lost in the NDM Agricultural sector 1996-2010 and ~ 1 100 in Mining (NDM, 2012).

As recently as 2005, De Beer Kleinzee employed around 3500 people, and was by far the predominant employment provider to study area communities. Layoffs started around 2007. De Beer Kleinzee currently employs 130 workers. Local unemployment levels are therefore high, particularly in the socially less mobile communities of Kommagas and Buffelsrivier. According to the Ward 8 Councillor, unemployment is currently estimated at 70%, with a large part of the population dependent on social grants. An estimated 10% (higher-skilled portion of the Kommagas/ Buffelsrivier labour force has migrated out of the region.

6.9.4 Urbanisation

In 2011 ~82.4% of the provincial population was living in urban areas in the NCP, of which the most significant number lived in the major towns of Kimberley and Upington. A clear urbanisation trend in the NCP is visible from 1996 to 2011, namely from 78.3% to 82.4%. This trend is common to all arid areas in South Africa, and is related to factors such as the overall decline in rural employment opportunities, loss of tenure on farms as a result of Establishment of Security of Tenure Act (ESTA) legislation on the one hand, and on the other, the national system of localizing subsidized housing opportunities and social grant payment centers in towns.

6.10 Noise Sensitive Receptors

One Noise-sensitive development was identified to occur in the area. The potential Noise-sensitive development identified is highlighted in **Figure 6.5** and considered further in the Noise Impact Assessment (**Appendix J**).

Figure 6.5: Aerial image indicating identified noise-sensitive developments in proximity of the site. Site= (pink outline) NSD (indicated as green dots).

6.11 Scenic routes / Visual Quality of the Area

Within this scenic context, it is of relevance that the mining areas along the coastline are significantly disturbed and visually apparent due to the scale and nature of the surface based mining (Figure 6.6). In this respect the visual quality of the receiving environment is already impacted upon to some extent. Typical visual quality of vegetation and topography within the study area is shown in Figures 6.6 and 6.7.

Figure 6.6: Typical visual quality of the mining areas (to the south of Kleinzee)

Figure 6.7: Typical visual quality of vegetation and topography within the study area (south of Kleinzee)

6.12 Heritage Profile

6.12.1 Archaeology

Stone Age archaeology

Stone Age archaeological resources are widespread across the study area and were the most frequent type of heritage resource encountered. The majority of the finds recorded in the study area were Later Stone Age (LSA) but earlier material and quarry sites were also noted in a few places. In general, archaeological sites are strongly associated with landscape features, be they hills, deflations, rocky outcrops or dunes. The two most prominent hills in the study area are Gorab se Kop and Spioenkop, both around 180 m above sea level. Turbines do not cross the former and it was thus not well searched, but Spioenkop had many archaeological sites on it.

Colonial period archaeology

Very little colonial period material was recorded within the study area. In one instance there were historical and fairly recent artefacts associated with a historical house ruin. Some are quite recent but others may date back to the early 20th century. Aside from ceramics and glass, there were also fragments of metal, bone and ostrich eggshell. Artefacts need to be greater than 100 years of age to be legally protected as archaeology.

Built environment

A few farm buildings were present in the study area. All are likely of 20th century age but nonetheless, some have heritage value. They are in a range of styles, but, besides one modern house, all are vernacular.

Graves

Just southwest of the above house is a small 20th century graveyard. It too is just outside of the study area. The names on the grave stones are Kotze, Mostert, and Cockrell and all deaths occurred between 1951 and 1991. From this it can be suggested that the house was still in use until at least 20 years ago. Isolated and unmarked Later Stone Age graves may be found in any area with soft substrate. Mining activities along the coastline have revealed many burials over the years but only two are known to have been found completely *in situ*. There are likely to be fewer graves inland but their locations can never be predicted.

Cultural landscapes and scenic routes

The Namaqualand Sandveld has a very distinctive feel created by the very remote, wide open spaces, gentle rolling hills and often very uniform vegetation cover. Although the topography at the present site is somewhat hilly, there are no steep slopes or dominating rocky outcrops – the landscape has a generally “soft” feel. This part of the west coast has, until very recently, been strongly driven by the diamond mining industry. However, with the exception of some minor prospecting activity close to the coast, mining is restricted to areas to the northwest of the study area such that as one moves southwards the environment becomes steadily more pristine.

Since the collapse of the diamond mining industry various tourism initiatives have been started and people are using the area recreationally. The tar road between Kleinsee and Koingnaas remains a private road but access restrictions have been relaxed. Nevertheless, the number of people frequenting this area is low but does increase during the flower season. None of the gravel roads in the area or the tar road can be regarded as important scenic routes but it is recognised that they will

be negatively impacted. The gravel road from Kleinsee, through Grootmis and on to Springbok is perhaps more important since it is a public road and the road from Port Nolloth meets it just outside of Grootmis.

6.12.2 Palaeontology

Paleontological research in Namaqualand is sparse. However, a recent review of the paleontological record as represented in the De Beers Namaqualand Mines by Pether (2008) provides details of many different paleontological features of scientific value. They vary in depth with some important features being close to the surface, particularly close to the coast where raised beach sequences are frequently intersected. Deeper paleontological resources would not likely be impacted by the proposed development.

This chapter provides details regarding the scope of the proposed Kleinzee Wind Energy Facility, including all required components of the project and necessary steps for the project to be developed.

7.1 Project Components

The infrastructure required will have the following typical dimensions:

» The site is proposed to accommodate up to 200 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity. The total capacity of the wind energy facility will be up to 300MW.
» Each wind turbine is expected to consist of a concrete foundation (22m wide x 22m length x 3m deep), a tower, a hub (up to 140m above ground level, depending on the turbine type selected) and three blades (each up to 70m in length).
» Internal access roads (up to 7 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised and upgraded as far as possible.
» Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
» An on-site substation (100 m x 100 m (including HV yard) to facilitate grid connection.
» An overhead power line (400kV) feeding into Eskom's electricity grid. Two alternatives are being considered:
  * Alternative 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  * Alternative 2: Turning into the Juno - Gromis power line located to the east of the site[7].
» Water pipeline and water storage facility.

Figure 7.1 illustrates the approximate extent of the wind turbine construction area.

[7] The loop-in lines options has three sub-alternatives referred to as alternative 2-4 in Figure 1.2

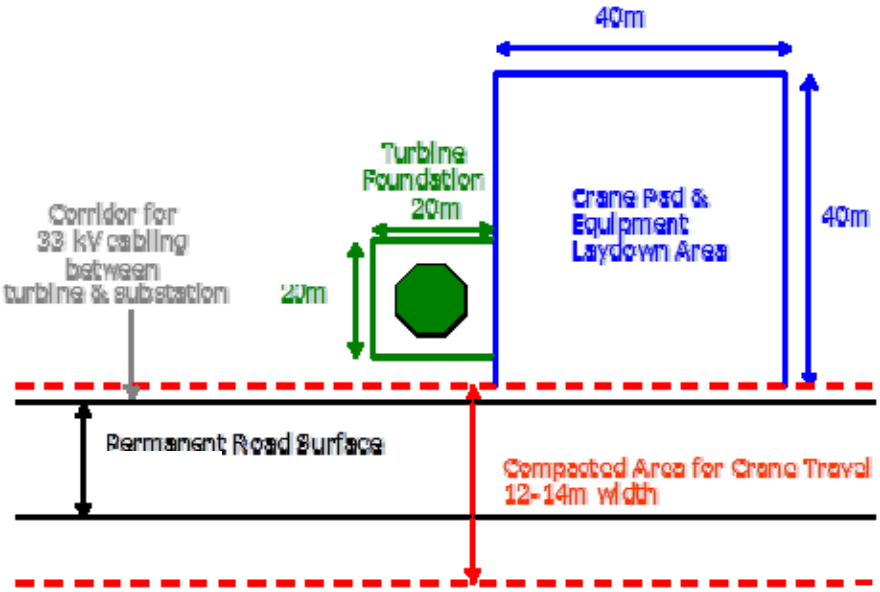


Figure 7.1: Diagrammatic representation of a typical layout of components.

7.2 Activities Associated with Construction of the Wind Energy Facility

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. A construction workforce will be required. Approximately 250-300 jobs could be created during the construction phase. As far as possible, local labour will be utilised. The construction phase is anticipated to be between 18 and 24 months in duration.

The most suitable accommodation for construction workers will be identified prior to construction. No on-site labour camps are envisaged. It is expected that construction workers will be accommodated in the nearby towns and transported to and from site on a daily basis. Overnight on-site worker presence would be limited to security staff. Construction is envisaged to begin in 2016/2017 should the project be approved by DEA and a generating license issued by NERSA. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The construction process is discussed in more detail in Table 7.1 below.

Table 7.1: Activities Associated with Construction of the Wind Energy Facility

Main Activity/Project Component	Components of Activity	Details
Conduct technical surveys	» Geotechnical survey by geotechnical engineer; » Site survey by specialists, and confirmation of the infrastructure micro-siting footprint; » Survey of substation sites; and » Survey of power line servitudes to determine tower locations.	» All surveys are to be undertaken prior to initiating construction.
Establishment of access roads	» Upgrade access/haul roads to the site, as required (this only refers to the main access roads leading directly to site itself). » Temporary access roads will be up to 14m wide in some places due to turning circles that are required. » Establish internal access roads: up to 7 m wide permanent roadway within the site between the turbines for use during construction and operation phase. » Temporary track of 7 m for use during construction phase only.	» The Kleinzee site maybe be accessed from the N7 via one of three possible routes: * R355, via Springbok (~97 km). This constitutes the most direct tarred route to Kleinsee; * Kommagas gravel road off the R355. This would constitute the shortest route from the N7 to Kleinsee and the proposed wind energy facility site; * Combination of (mainly gravel) roads from Garies (off the N7), via Hondelikpbaai and Koingnaas. This constitutes the most direct road link to the harbours of Cape Town and Saldanha via the N7. Garies is located approximately 176 km south-east of Kleinsee (by road). » Access roads will be constructed/upgraded in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary. » Existing access roads to the site will be utilised, and upgraded where possible and required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation.

Main Activity/Project Component	Components of Activity	Details
		» The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines (which will be informed by the EIA and specialist walk through surveys). » To accommodate the large crawler crane required for turbine assembly, a track of up to 14 m in width is required to be established on the site.
Undertake site preparation	» Site establishment of offices / workshop with ablutions (chemical toilets) and stores and contractors' yards. » Clearance of vegetation at the footprint of each turbine and associated laydown area » Excavations for foundations	» These activities will require the stripping of topsoil, which will need to be appropriately stockpiled for use in rehabilitation.
Establishment of laydown areas on site	» Laydown areas at each turbine position for the storage of wind turbine components and accommodation of construction and crane lifting equipment. » Temporary lay down area for crane assembly.	» Each turbine needs a flat and hardened lay down area of ~40m x 40 m during the construction process. » This area can be rehabilitated after construction. » The lay down area will need to accommodate the cranes required for the erection of the turbine. Lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site. A large lay down area will be required at each position where the main lifting crawler crane may be required to be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. » Such areas to make use of already compacted areas as far as possible, such as roadways or other laydown areas.
Construct wind turbine foundations	» Concrete foundations of up to 22m wide x 22m length x 3m deep at each turbine	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected.

Main Activity/Project Component	Components of Activity	Details
	location (final dimensions to be defined by geotechnical survey of the site) – refer to Photograph 7.1	» Aggregate and cement to be transported from the closest centre to the development, with the establishment of a small concrete batching plant on site.
Transport of components and equipment to site	» Flatbed trucks will be used to transport the majority of components to site from the nearest port. * Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. * Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. mobile assembly crane and main lift crawler crane) to erect the wind turbines. * Civil engineering construction equipment for the civil works (e.g. excavators, trucks, graders, compaction equipment etc.). * The components required for the establishment of the substations (including transformers) * Ready-mix cement trucks for turbine and substation foundations (if not batched on site)	» Turbine units consist of a tower comprised of 4 segments, a nacelle, and three rotor blades. Components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines. Other components include components required for the establishment of the substations (including transformers) and those required for the establishment of the power line (including towers and cabling). » The wind turbine will be brought to site by the supplier in sections. The individual components are defined as abnormal loads in terms of the Road Traffic Act (Act No 29 of 1989) by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). The dimensional requirements of the load during the construction phase (length/height) may require alterations to the existing road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.), and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading. The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself.
Erect turbines	» Large lifting crane used for lifting of large,	» The large lifting crane will lift the tower sections into place

Main Activity/Project Component	Components of Activity	Details
	heavy components » A crane for the assembly of the rotor	(Photograph 7.2). » The nacelle, which contains the gearbox, generator, and yawing mechanism, will then be placed onto the top of the assembled tower. » The rotor (i.e. the blades of the turbine) will then be assembled or partially assembled on the ground. It will then be lifted to the nacelle and bolted in place. » It will take approximately 2 days to erect each turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.
Construct substations and associated ancillary infrastructure.	» Substation and associated components; » Security fencing around high-voltage (HV) yard; and » Operations and maintenance building, including workshop building.	» A temporary construction area is needed for containers, chemical toilets, and equipment. » Permanent operational buildings are as follows: * Operations and maintenance facility, including a storage building (100m X 100m), will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. » A laydown area for building materials and equipment associated with these buildings will also be required (40m x 40 m). » An 400kV on-site substation will be constructed with a HV yard footprint of up to 100 m x 100 m (Photograph 7.3 & 7.4). » The substation would be constructed as follows: * Step 1: Survey of the site * Step 2: Site clearing and levelling and construction of access road to substation site * Step 3: Construction of terrace and foundations

Main Activity/Project Component	Components of Activity	Details
		* Step 4: Assembly, erection and installation of equipment (including transformers) * Step 5: Connection of conductors to equipment * Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.
Connection of the wind turbines to the on-site substation/s	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substation/s.	» The installation of cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. » The underground cables would follow the internal access roads as far as reasonably possible.
Connect substations to power grid	» An **overhead power line** (400kV) feeding into Eskom's electricity grid.	» The route for the power line will be assessed, surveyed, and pegged prior to construction.
Commissioning of the facility	» Start up for electricity generation	» Prior to the start-up of a wind turbine, a series of checks and tests will be carried out, including both static and dynamic tests to make sure the turbine is working within appropriate limits. » Grid interconnection and unit synchronisation will be undertaken to confirm the turbine performance. Physical adjustments may be needed such as changing the pitch of the blades of the turbines.
Undertake site rehabilitation	» Remove all construction equipment from the site. » Rehabilitation of temporarily disturbed areas where practical and reasonable.	» On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation.

7.3 Project Operation Phase

Based on information from other proposed wind energy facilities, the establishment of a wind energy facility will create approximately 8 permanent and 4 temporary employment opportunities. The table below highlights the main activities associated with operation of the wind energy facility.

Table 7.2: Activities Associated with Operation of the Wind Energy Facility

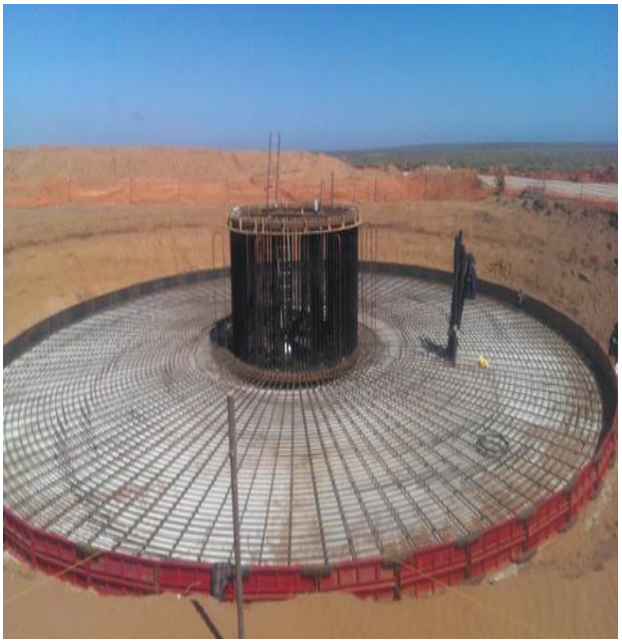
Main Activity/Project Component	Components of Activity	Details
Operation	» Operation of the wind turbines	» It is anticipated that there will be full time security, maintenance and control room staff required on site. » Each turbine in the facility will be operational, except under circumstances of mechanical breakdown, extreme weather conditions, or maintenance activities. » Bird and bat monitoring for first 12 months of operation and recommendations regarding adaptive mitigation to reduce impacts.
Maintenance	Maintenance activities include: » Oil and grease – turbines » Transformer oil – substation » Waste product disposal » Cleaning of turbines	» The wind turbines will be subject to periodic maintenance and inspection. » Periodic oil changes will be required for the substation transformers and any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation. » The turbine infrastructure is expected to have a lifespan of approximately 25 - 30 years, with maintenance.

7.4 Decommissioning

The turbine infrastructure which will be utilised for the proposed wind farm is expected to have a lifespan of approximately 20 - 25 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. The following decommissioning activities have been considered to form part of the project scope.

Table 7.3: Activities Associated with Decommissioning of the Wind Energy Facility

Main Activity/ Project Component	Components of Activity	Details
Site preparation	» Confirming the integrity of the access to the site to accommodate required equipment and lifting cranes. » Preparation of the site (e.g. lay down areas, construction platform) » Mobilisation of construction equipment	» Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility would comprise the disassembly and replacement of the turbines with more appropriate technology/ infrastructure available at that time.
Disassemble wind turbines	» A large crane will be used to disassemble the turbine and tower sections. » The turbines will be disassembled and removed.	» Turbine components would be reused, recycled, or disposed of in accordance with regulatory requirements. » Waste will be dispose of at landfill and scrape sold were possible
Site rehabilitation	» Where disturbed during operation and decommissioning, sites will be rehabilitated through the stabilisation and re-vegetation of disturbed areas. Vegetation compatible with the surrounding area must be used.	» The site will be rehabilitated and can be returned to the agricultural or other land-use



Photograph 7.1: Concrete foundation (Sere Wind Facility)

Photograph 7.2: Tower sections being lifted (Sere Wind Facility)

Photograph 7.3: Construction of terrace and foundations for substation (Sere Wind Facility)

Photograph 7.4: Substation (Sere Wind Facility)

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE CHAPTER 8

Environmental impacts associated with the proposed Kleinzee Wind Energy Facility are expected to be associated with the construction, operation and decommissioning of the facility. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction of a wind energy facility project includes land clearing for site preparation and access/haul roads; transportation of supply materials and fuels; construction of foundations involving excavations and cement pouring; compaction of laydown areas and roadways, manoeuvring and operating cranes for unloading and installation of equipment; laying cabling; and commissioning of new equipment. Decommissioning activities may include removal of the temporary project infrastructure and site rehabilitation. Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to wildlife through mortality, injury and disturbance; impacts to sites of heritage value; soil erosion; and nuisance noise from the movement of vehicles transporting equipment and materials during construction.

Environmental issues specific to the operation of a wind energy facility include visual impacts; noise produced by the spinning of rotor blades; avian/bat mortality resulting from collisions with blades and barotrauma; and light and illumination issues.

These and other environmental issues were identified through the scoping evaluation. Potentially significant impacts identified have now been assessed within the EIA phase of the study. The EIA process has involved input from specialist consultants, the project proponent, as well as input from key stakeholders (including government authorities) and interested and affected parties engaged through the public consultation process. The significance of impacts associated with a particular wind energy facility is dependent on site-specific factors, and therefore impacts vary significantly from site to site.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, power line, access road/s to the site, internal access roads between turbines, underground electrical cabling between turbines, turbine foundations), and to make recommendations regarding preferred alternatives for consideration by

DEA, as well as for the management of the impacts for inclusion in the Draft Environmental Management Programme (refer to **Appendix N**).

In order to assess the impacts associated with the proposed Kleinzee wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. The study area for the Kleinzee site (approximately ~8 682ha) is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated in **Figure 8.1** below, and includes the area covered by the following farm portions:

» RE of Brazil 329
» RE of Goraap 323,
» RE of Honde Vlei 325,
» RE of Kannabieduin 324,
» Portion 4 of Rooivlei 327

The project will include the following infrastructure:

» A cluster of up to **200 wind turbines** to be constructed over an area of ~ **8 682 ha** in extent
  * Installed capacity of up to 3 MW
  * Hub height up to 140 m
  * Rotor Diameter up to 140 m
  * Maximum length of blades is 70 m
» **Concrete foundations** to support the turbine towers (22m wide x 22m length x 3m deep)
» **Mounting area** for erecting of each turbine (also referred to as a laydown area - 40m x 40 m))
» **Cabling** between the turbines to be lain underground where practical
» An on-site **substation** to facilitate the connection between the facility and the electricity grid (80 m x 80 m (including HV yard))
» An **overhead power line** (400kV) feeding into Eskom's electricity grid. Two options are being considered:
  * Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  * Option 2: Turning into the Juno - Gromis power line located to the east of the site[8].
» Internal **access roads** between each wind turbines (permanent roads of approximately 7 m wide).

[8] The loop-in lines options has three sub-options referred to as alternative 2-4 in Figure 8.1

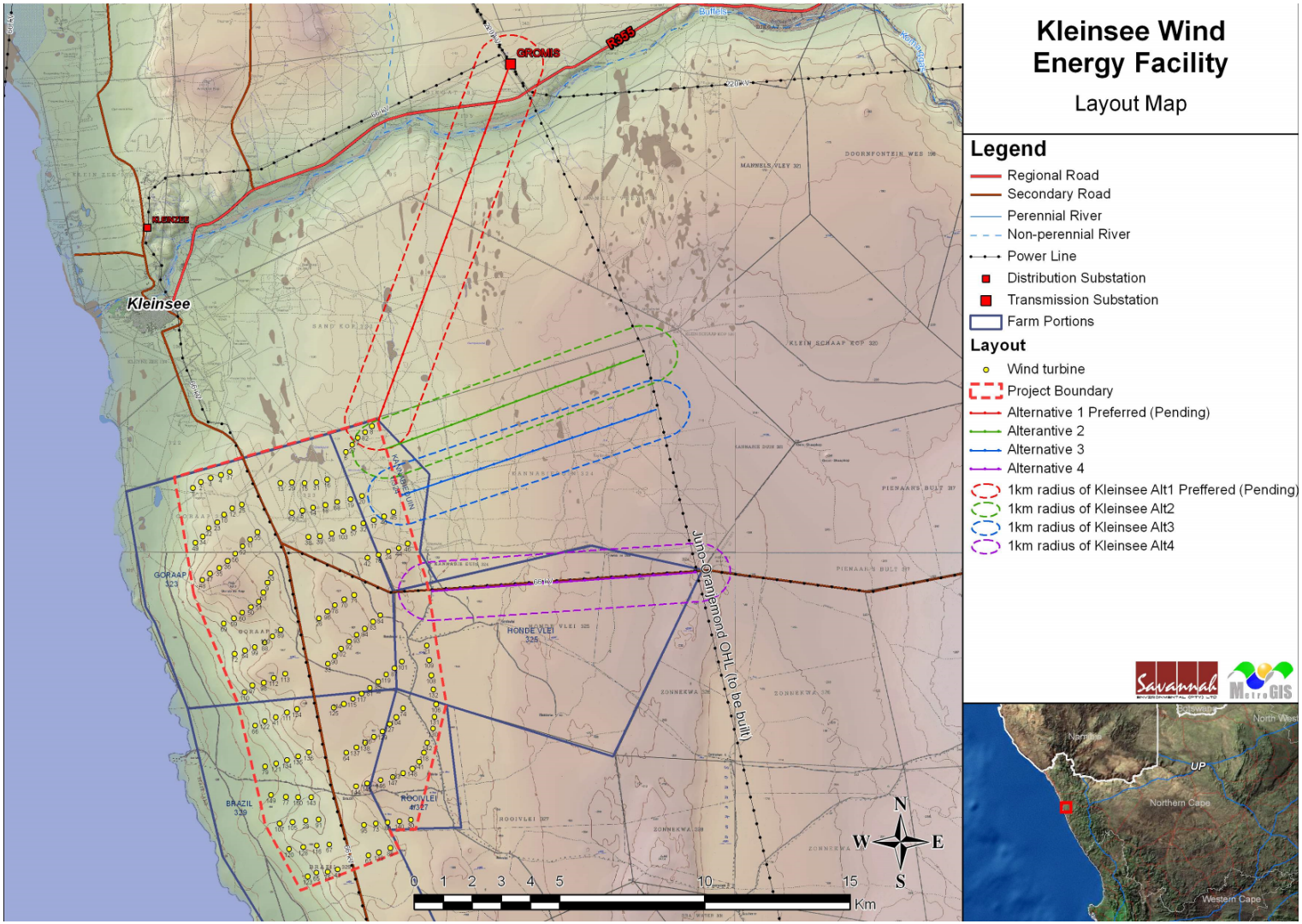


Figure 8.1: Layout map showing the preliminary design and layout of the Kleinzee Wind Energy Facility as well as power line alternatives proposed

» **Borrow pits** within the site for the construction of access roads
» **Office/Workshop**[9] area for operations, maintenance and storage
» **Information centre** and billboards
» **Water supply pipeline** and **Water storage** reservoir and tanks

The assessment presented within this chapter of the report is on the basis of a facility layout provided by Eskom Holdings (SOC) Limited. This layout indicates **200 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies attached **Appendices D – M**) considers the worst-case scenario in terms of potential impacts.

8.1 Assessment of Potential Impacts on Flora

Of paramount importance in assessing the impact of wind energy facility is the ability of the landscape of the selected site to 'absorb' the impact of the infrastructure. At Kleinzee the diamond mining area of the Buffels Marine Complex exemplifies large-scale disturbance of the landscape. The principal vegetation type found in the study area (footprint of the proposed wind energy facility) is Namaqualand Coastal Duneveld. Namaqualand Strandveld and Namaqualand Salt Pans are represented in small areas in the eastern part of the study area. Apart from Namaqualand Salt Pans, the other vegetation types are found over extensive areas in Namaqualand. They are in no way threatened by development of any sort and apart from limited mining activities, impacts are related to agriculture. In the Namaqualand Coastal Duneveld in the study area the repetitive and largely uniform vegetation pattern on the undulating landscape is broken only by some areas of prominent dunes and scattered outcrops of granite. This is similar for the Namaqualand Strandveld vegetation. It may therefore be concluded that, in general, in these vegetation types the negative impact of the proposed wind energy facility would be **medium** provided that areas where granite outcrops occur and areas where the protected species *Wooleya farinosa* occurs are avoided.

With Namaqualand Salt Pans, however, the situation is different. In this case the vegetation is not extensive and the salt pans are ecologically fragile. They should therefore be avoided (refer to Figure 8.1)

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[9] All buildings will be 10m² in total

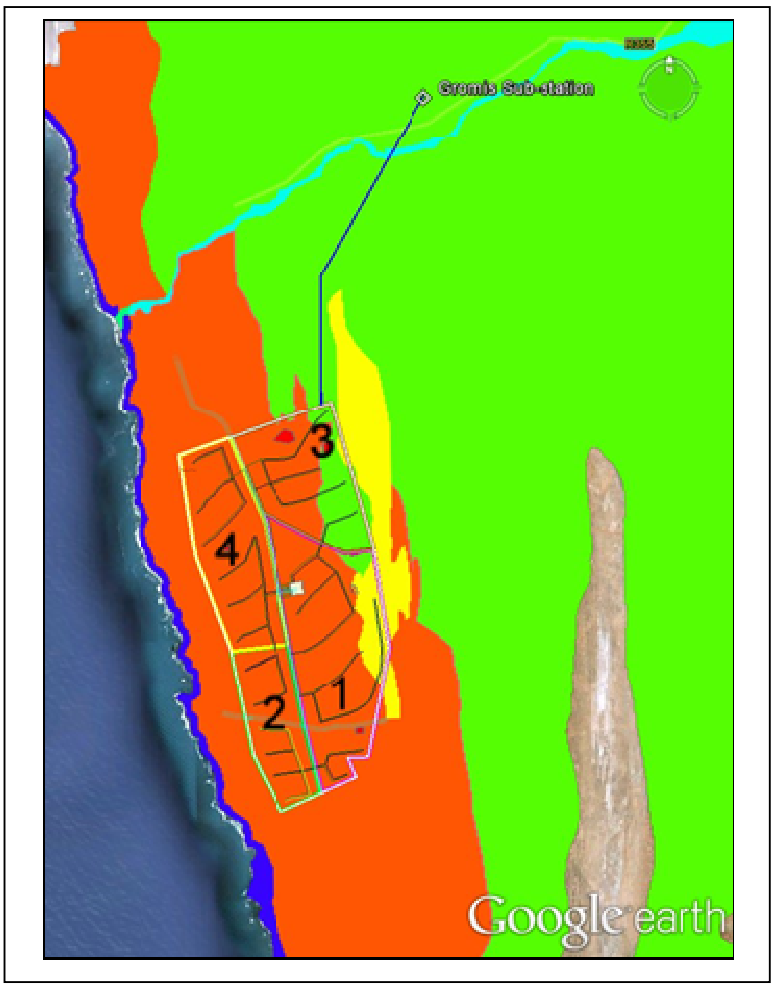

Figure 8.1: Vegetation map of the Eskom Kleinzee WEF area (white boundary) from Mucina et al. (2005). Three vegetation types are found in the study area, Namaqualand Coastal Duneveld (orange), Namaqualand Strandveld (green) and Namaqualand Salt Pans (yellow).

The 'source of impacts' are grouped into three groups based on how they would affect the vegetation (a) wind turbines, transformers and crane hard-standing areas (b) internal access road and underground cabling, and (c) overhead transmission lines.

Two principal direct impacts are assessed in terms of flora, namely:

» Loss of natural vegetation which includes the constituent plant species and the habitat created by the plant communities.
» Loss of ecological processes e.g. pollination and seed dispersal which may occur due to construction impacts or activities during the operational phase.

8.1.1. Impact Tables summarising impacts on Flora

Planning & Construction Phase Impacts

Nature: Loss of vegetation and habitat due to construction of wind turbines, transformers and crane hard-standings

The anticipated impact of the proposed turbines and associated lay-down areas in terms of loss of Namaqualand Coastal Duneveld and Namaqualand Strandveld would be High negative without mitigation lowered to Medium negative with mitigation.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (60)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	No. Both Namaqualand Coastal Duneveld and Namaqualand Strandveld are widespread and 'Least Threatened' therefore the anticipated loss is considered to be of limited importance.	No. Both Namaqualand Coastal Duneveld and Namaqualand Strandveld are widespread and 'Least Threatened' therefore the anticipated loss is considered to be of limited importance. The areas of sensitivity with endemic species or special habitats can be avoided.
Can impacts be mitigated?	Yes	

Mitigation:

» The turbine layout must be altered to accommodate sensitive areas with special species e.g. *Wooleya farinosa* and special habitats e.g. areas of granite exposure.
» *Aloe arenicola* specimens should be re-located if potentially impacted.
» Lay-down areas should be treated as temporary and should be re-vegetated following best practice principles immediately after construction to prevent wind erosion of the soil and degradation of the landscape.

Cumulative impacts:

The wind energy facility would be localised on a few farms between Kleinzee and Koingnaas and would make a low cumulative impact on the loss of Namaqualand Coastal Duneveld and Namaqualand Strandveld due to the extensive occurrence of these vegetation types in Namaqualand.

Residual impacts :

Low negative

***Nature**:* Loss of Namaqualand Salt Pans due to construction of wind turbines, transformers and crane hard-standings.

The anticipated impact of the proposed turbines and associated lay-down areas in terms of loss of Namaqualand Salt Pans would be High negative without and with mitigation and areas where such pans are found should be avoided. This applies to the siting of wind turbines as well as the construction of the transmission line from the wind energy facility to Gromis Substation.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (70)**
Status	Negative	Negative
Reversibility	Low reversibility	Low reversibility
Irreplaceable loss of resources	Yes. The salt pans could be permanently damaged	The salt pans should be AVOIDED
Can impacts be mitigated?	Only by avoidance	

Mitigation:

» The turbine layout must be altered to exclude turbines from areas of salt pans.

Cumulative impacts:

The wind energy facility would have no cumulative effect on salt pans if they are AVOIDED.

Residual impacts:

Low negative

Nature: Loss of vegetation and habitat due to construction of internal roads and underground cables.

The access and internal roads would probably need to be at least 10 m wide during the construction phase, reduced to 6 m wide during the operational phase. This would result in a High negative impact over a large part of the proposed site having a far greater surface area impact than the turbines themselves. The roads would be constructed on a highly unstable sandy substrate and would therefore require intensive stabilization. The road-building would probably require a source of material that would not be available on the site (off-site borrow pits etc.) which would mean that foreign material would be imported to the site. This would have negative implications in terms of changes to soil characteristics. The disturbance would also encourage weedy species (probably exotic weeds such as *Atriplex lindleyi* subsp. *inflata*) to invade. This would have long-term negative implications and would make reversibility of the impacts difficult or even impossible to achieve.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Medium (6)
Probability	Definite (5)	Definite (5)

Significance	**High (70)**	**Medium (60)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	No	Yes – to a limited extent
Mitigation: Some mitigation measures can be implemented, e.g. correct drainage of roads, laying cables immediately alongside roads and by ensuring that roads are built within very strict construction zones. These mitigation measures would have a limited overall effect on the negative impact but could change the ratings from High to Medium negative impact if applied.		
Cumulative impacts: The access roads and internal roads for the wind energy facility would be localised on a few farms between Kleinzee and Koingnaas and would make a low cumulative impact on the loss of Namaqualand Coastal Duneveld and Namaqualand Strandveld due to the extensive occurrence of these vegetation types in Namaqualand.		
Residual impacts: Low negative		

Nature: Loss of vegetation and habitat due to construction of overhead transmission line		
	Without Mitigation	**With Mitigation**
Extent	Local but extending off the wind energy facility site (2)	Local but extending off the wind energy facility site (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Medium (6)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**Medium (60)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	No	Yes
Mitigation: Overhead power-line should avoid any areas of Namaqualand Salt Pans and should follow a route over Namaqualand Strandveld. Construction and servicing of the overhead power-line requires vehicular access (tracks or roads). Such a track or road would impose a greater impact on the vegetation along the recommended route than the pylons that would be required to carry the transmission line. It should also be ensured that the crossing of the Buffels River is planned such that minimal disturbance is caused to the riparian zone.		
Cumulative impacts: Small contribution to loss of Namaqualand Strandveld. Application of mitigation measures would be effective in minimizing negative impacts if applied.		
Residual impacts: Low negative		

8.1.2. Comparative Assessment of power line and Access Road Alternatives

It is recommended that the overhead power line should avoid any areas of Namaqualand Salt Pan. Alternative 1 crosses over the Namaqualand Strandveld vegetation. This type of vegetation is found over extensive areas in Namaqualand and is considered less sensitive than the Namaqualand Salt Pans crossed by Alternative 2 (all three sub-options). In this regard therefore ***alternative 1*** is the most ***preferred option*** as this would minimise/avoid impact on the salt pans which are ecologically fragile.

In terms of access, there is *no preferred alternative* as the roads have already impacted on the surrounding environment.

8.1.3. Implications for Project Implementation

In general the Kleinzee Wind Farm is acceptable from a botanical perspective with certain provisos (mitigations):

- The layout should be *amended* to remove all roads and turbines from areas of Namaqualand Salt Pans.
- All areas where there are sensitive micro-habitats (e.g. granite outcrops) and where endemic and rare species such as *Wooleya farinosa* occur must be **avoided** (*Wooleya farinosa* would not be readily transplanted).
- *Aloe arenicola* and any other protected species should either be avoided or transplanted if possible.
- Micro-siting of roads and turbine positions would be essential, i.e. the conceptual layout would need to be changed where necessary to accommodate sensitive plant communities or habitats. This require involvement of a qualified practitioner in the field to determine locations of roads and turbines.

8.2 Assessment of Potential Impacts on Fauna

Potential impacts on fauna resulting from the development of the wind energy facility would stem from a variety of different activities and risk factors associated with the construction and operational phases of the project including the following:

Construction Phase

- Vegetation clearing & site preparation
- Operation of heavy machinery at the site
- Human presence

Operational Phase

» Site maintenance activities
» Human presence
» Operation of the turbines

The above activities are likely to manifest themselves as the following faunal impacts:

» Direct and indirect loss of habitat for fauna
» Reduced landscape connectivity for fauna
» Direct faunal impacts
» Increased soil erosion risk and habitat degradation for fauna

There are no drainage features or wetlands within the site and the only highly sensitive ecological features that were observed the site are the rocky outcrops. These are however highly restricted in nature and comprise a very small proportion of the site. Only one rocky outcrop was observed to fall within the footprint of the conceptual layout that was assessed. Several listed species are associated with the rocky outcrops, but would be little impacted if these areas are avoided. The majority of the site comprises relatively homogenous dwarf succulent shrubland of moderate sensitivity. A number of listed species are likely to occur within the affect environment, including Grant's Golden Mole, Desert Rain Frog and Namaqua Dwarf Adder .

The faunal sensitivity map for the site is provided (**Figure 8.2**). The vast majority of the site is classified as Medium Sensitivity. From a faunal perspective, the only specific habitats that can be differentiated as being of higher sensitivity are the rocky outcrops at the site.

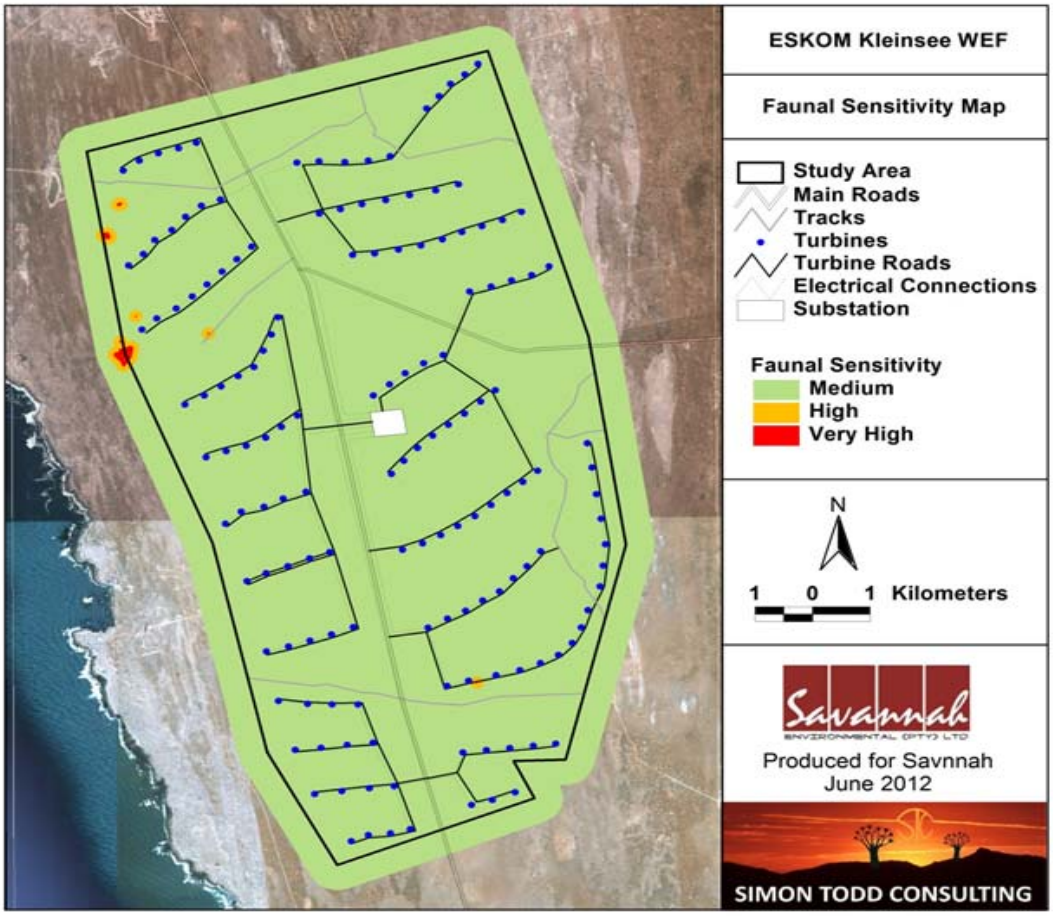

Figure 8.2: Ecological sensitivity map of the Kleinzee Wind Energy Facility study area.

8.2.1 Impact Tables summarising impacts on Fauna

The four major impacts identified above which are likely to be associated with the development of the wind energy facility are assessed below.

Nature: Habitat loss for fauna. Transformation and loss of habitat will have a negative effect on resident fauna.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (5)	Medium-Low (4)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium-High (55)**	**Medium (36)**
Status	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	To a some degree	

Mitigation

» Vegetation clearing should be kept to a minimum.
» Rehabilitation of cleared areas should take place as soon after construction as possible.
» Impacts to the rocky outcrops should be avoided.
» The final placement of turbines must follow a micrositing procedure involving a walk-through and identification of any sensitive areas by botanical, faunal and avifaunal specialists.

Cumulative Impacts

Although there is little other transformation in the vicinity of the development, the area further north around Kleinsee has been heavily impacted by diamond mining activities. The development would contribute to cumulative habitat loss in the wider area. The habitats affected are however somewhat different as the mining is concentrated in the coastal plain, while the wind farm development is further inland.

Residual Impacts

Some habitat loss is an inevitable consequence of the development and cannot be fully mitigated.

Nature*:* Reduced landscape connectivity

Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	Medium(5)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (48)**	**Medium (33)**
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some degree	

Mitigation

» Hardened surfaces should be kept to a minimum.
» Roads should be as narrow as possible and as short as possible. A natural surface such as gravel would be preferable to a tarred or concrete road.
» Vegetation should be allowed to remain alongside or encroach on the roads as much as possible.
» Temporary lay-down areas should be in previously transformed areas or areas that will be used by the development.

Cumulative Impacts

Apart from main access road through the area, there is little development of a similar nature in the area. The current development would add 70km of roads within a concentrated area giving rise to a significant cumulative impact from roads.

Residual Impacts

Hardened roads are necessary to access the site and so there is little that can be done to fully mitigate this impact.

Nature: Direct Faunal Impacts during construction

Fauna will be directly impacted by the development as a result of construction activities and human presence at the site.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (3)	Short-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (32)**	**Low (21)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some extent	

Mitigation

» All personnel should undergo environmental induction before going on site.
» Any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden. Personnel should not be allowed to wander off the construction site.
» Fires should only be allowed within fire-safe demarcated areas.
» No fuelwood collection should be allowed on-site.
» No dogs should be allowed on site.
» If any parts of the site must be lit at night, this should be done with low-UV type lights (such as most LEDs), which do not attract insects.
» All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.
» No unauthorized persons should be allowed onto the site.
» All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.

Cumulative Impacts

The potential for cumulative impacts is relatively low as construction phase will be temporary and there are few other developments currently underway in the area and mining activity in the area is on the decline.

Residual Impacts

Residual impacts for fauna can be mitigated to a large degree, although some mortality of a few immobile species can be expected.

Nature: Increased erosion risk. Increased erosion risk as a result of soil disturbance and loss of vegetation cover. (Associated with the development as well as access roads)		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation » Cleared areas should be rehabilitated as soon as possible and wind erosion mitigation structures constructed where necessary to aid rehabilitation and minimize wind erosion risk. Rehabilitation contractors with the appropriate local skills and experience should be used. » Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance. » All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.		
Cumulative Impacts Wind erosion would contribute to habitat degradation in the area.		
Residual Impacts If erosion at the site is controlled, then there will be no		

8.2.2 Comparative Assessment of power line and Access Road Alternatives

In terms of the grid connection options, there are two Options, the direct connection to the Gromis substation or a connection to the planned Juno-Gromis line along one of three possible routes. The majority of the impact associated with the grid connection is likely to occur during the construction phase and there is likely to be little interaction between fauna and the grid connection during the operational phase. With the appropriate mitigation and avoidance, the impact of the power line on fauna is likely to be low. In terms of the options provided, *Alternative 4 is identified as the preferred alternative* as it is the shortest and also runs adjacent to the existing Kommagas-Sandveld 66kV line and as such is likely to generate the least additional disturbance of the Options. However, with appropriate mitigation, which includes a preconstruction walk-through, the preferred alternative Option 1 would also be acceptable

In terms of access, there is *no preferred alternative* because the roads have already impacted on the surrounding environment.

8.2.3 Implications for Project Implementation

» Overall the site is **not** considered to be **highly sensitive**, a large proportion if the listed fauna which occurs in the area is likely to be associated with the rocky outcrops.
» Rocky outcrops are highly restricted within the study area and amounts to less than 50 ha, including buffers. Given their limited extent, these areas would be easily avoided.
» The majority of the site consists of habitat of medium sensitivity. Although there are a number of listed species that would be likely to occur in this habitat such as Grant's Golden Mole, Desert Rain Frog and Namaqua Dwarf Adder.
» The affected habitat is relatively abundant in the area, and the amount of transformation required for the development is not significant when considered at the scale of the vegetation type.
» The development area however comprises almost 10% of the Namaqualand Coastal Duneveld vegetation type and the potential for the disruption of north-south connectivity for affected and sensitive fauna associated with this habitat is potentially more significant.
» Rehabilitation of cleared and disturbed areas would be an important mitigation measure at the site, especially given the high risk of wind erosion at the site.

8.3 Assessment of Potential Impacts on Avifauna

The findings of the pre-construction bird monitoring programme (undertaken between August 2013 and July 2014) have been incorporated into this section, supplementary to the avifaunal impact assessment. The purpose of the bird pre-construction monitoring programme was to characterise the bird community (baseline) at the Wind Energy Facility site and a control site and to inform the findings of the avifauna impact assessment in line with the Best Practice Guidelines for bird monitoring, and to ensure that appropriate mitigation measures are recommended. This approach also aimed to ensure that the DEA has sufficient information on which to make a decision. The monitoring programme was designed to include a minimum of 6 surveys across all four seasons to record data across all seasons. The baseline data from the bird monitoring programme has been considered in the avifaunal assessment to support the EIA field survey (refer to **Appendix F**).

The original EIA impact assessment for birds (Simmons 2012) found that the study area potentially held large number of red data species. This report, while based on only two visits, emphasised that Ludwig's Bustards, a highly collision-prone species, as well as Black Harriers, may be an issue of importance within the Wind Farm. Based on the re-construction monitoring, it was confirmed that **six red data** species occur in the area, including the Kori Bustard. Within the Wind Farm site up to 17 Ludwig's bustards congregate in some areas and the density increases

dramatically in winter when they enter the area for breeding. Bustards are considered highly prone to fatalities associated with collision with infrastructure such as power lines and are likely to be at risk of collision with wind turbines. The other main red-listed species of concern, the Black Harrier, was found to occur infrequently on the site and does not breed in the area. . This study has also revealed the regular presence of Jackal Buzzards and Black-chested Snake Eagles on the Wind Farm, both of which hover-hunt frequently within the blade swept area, putting them at high risk.

Target Species

Nature of the effect of the wind farm: Of the sea and shorebirds, 15 raptors and 44 endemics, 15 main species could be negatively affected by displacement, loss of habitat or direct mortality, i.e.: Pelican, Lesser and Greater Flamingo, three Cormorants, South African Shelduck, Secretarybird, Black Harrier, Martial Eagle, Chanting Goshawk, Lanner Falcon, Ludwig's and Kori Bustard, and Southern Black Korhaan. The gannet, both flamingos, Damara Tern and African Black Oystercatcher are however unlikely to pass through the site boundary (because it is too far from the coast) and these were therefore excluded from further analysis. To further refine the list all three cormorants were omitted as there are no inland water-bodies that they may fly to (and thus not pass through the wind farm). In addition the Martial Eagle (3%), and Secretarybird (1%) occur with such low probability that they are unlikely to be impacted and were therefore excluded. Thus target species considered for this study area included Ludwig's and Kori Bustard, the black korhaan, and among the raptors the Black Harrier, Lanner Falcon, Snake Eagle and Pale chanting goshawk.

Sensitivity mapping:

Three high risk zones in terms of collision were identified through the pre-construction monitoring (**Figure 8.3**), one in the north-west, one east of the substation and one centrally placed. In total 33 turbines of the 150 proposed are located in these areas, and should be relocated as they are likely to impacts on collision prone avifauna (either through direct mortality or displacement).

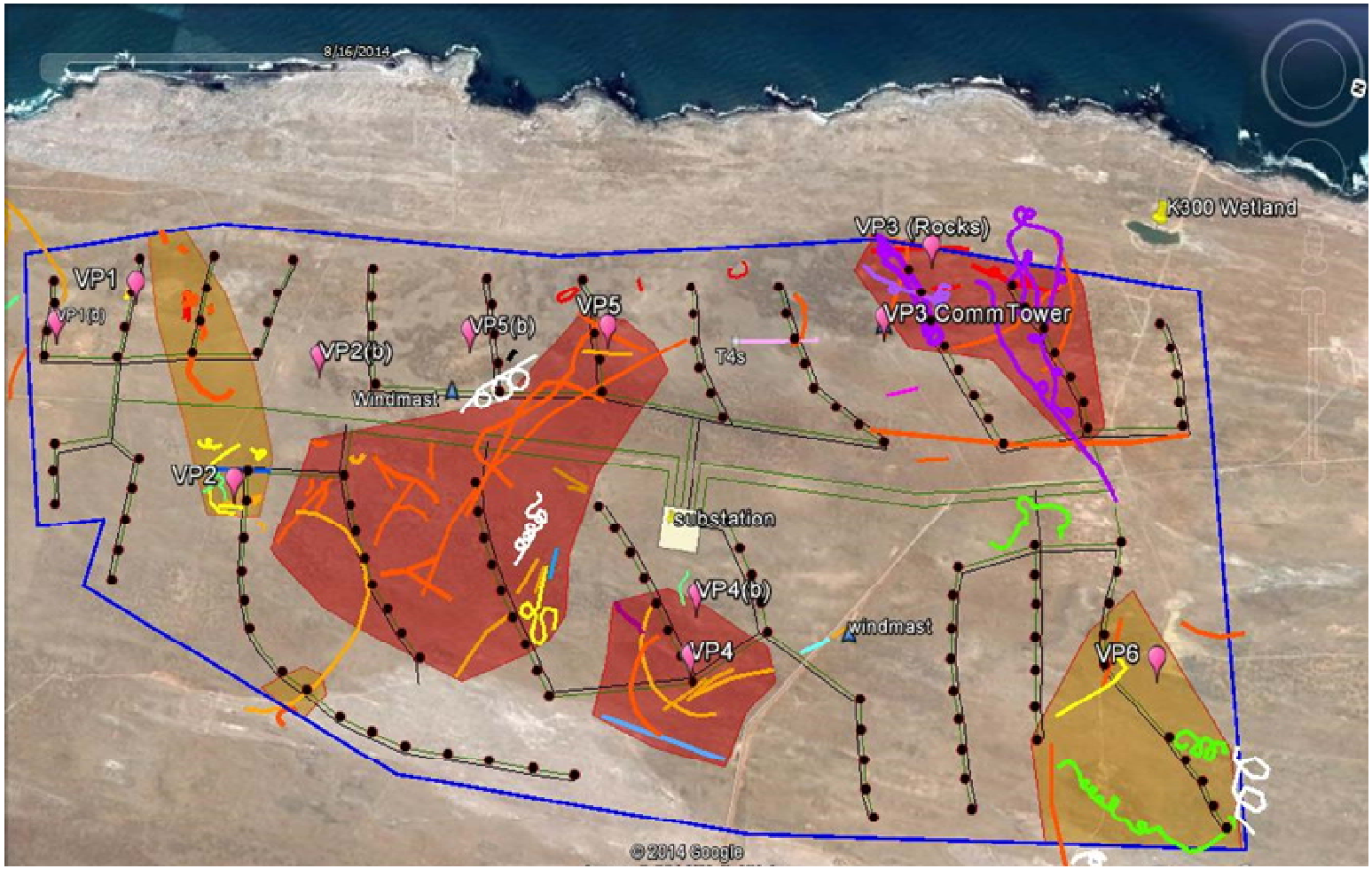

Figure 8.3: An overview of the High risk (red) and medium risk (orange) avifauna zones overlaid on the flight paths of the most collision-prone red-listed bird species occurring in the Kleinzee Wind Farm recorded over the period August 2013 – July 2014.

8.3.1. Impact Tables summarising impacts on birds

***Nature*:** Direct mortality, disturbance or avoidance of area around the wind farm for the bird groups identified as at risk above, due to disturbance, or impacts with turbine blades and overhead lines.

The Nature of the impact will be negative in that birds will either be: (i) displaced by habitat alteration, (ii) displaced by disturbance during or after construction; (iii) impacted by turbine blades directly; (iv) impacted by the existing and proposed 132 kV power lines.

(Raptors = R, Ludwig's + Kori Bustard = LKB, Southern Black Korhaan = SBK)

	Without mitigation	**With mitigation**
Extent	**2**(R) **3** (LKB,SBK)	**1**(R) **3** (LKB,SBK)
Duration	**5** (R, LKB, SBK)	**5** (R, LKB, SBK)
Magnitude	**4** (R, SBK) **6**(LKB)	**3** (R, SBK) **5**(LKB)
Probability	**4** (LKB, SBK), **3** (R)	**3**(LKB, SBK), **2** (R)
Significance	**M 36**(R)**, H 52**(SBK), **H 56** (LKB)	**L 18**(R)**, M 39** (LB,SBK)
Status (+ve or –ve)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of species?	Yes (particularly the bustards and Black Harrier)	Reduced
Can impacts be mitigated?		Partially

***Mitigation*:**

There are three classes of mitigation for birds around wind farms: (i) re-position the turbines to avoid impacts altogether on the birds; (ii) redesign the turbines to alter the present pattern/shape/size of the turbines so birds see them more readily and avoid contact; or (iii) close down turbines when collision-prone birds approach.

that the following is recommended in this instance:

» do not construct turbines in **high risk** areas where bustards and collision-prone raptors are shown to be common (refer to Figure 8.3)
» where possible orientate the turbine strings north-south so they do not present a barrier to north-south commuting birds.
» Paint one turbine blade with ultra-violet paint, readily seen by birds day and night.
» Affix all overhead power lines with nocturnal bird diverters to reduce bustard deaths
» Bury all internal power lines within the Wind farm.

***Cumulative impacts*:**

» Cumulative impacts (Masden et al. 2010) are those that may affect a species in a small area (e.g. a wind farm) yet have a wide-scale influence. If resident territorial birds are killed by turbines for example, then other individuals will be pulled in to take up the vacant territory.
» Thus for the large number of bustards that may reside in the area, the impact may be greater than just around the immediate vicinity of the wind farm. That they were found in the Kleinsee Blue site north of this wind energy facility indicates that bustards are widespread in the area and regularly move in and out in winter. A wide-spread population reduction may occur as a result of the wind energy facility acting as a sink.

» If several wind farms are developed in one area, displacing or killing a range-restricted species, then they may have a wide-spread influence cumulatively even if the individual wind farms do not have a major impact. Furthermore, if the wind farm is enlarged, or developed closer to the ocean, then bird movements may be influenced negatively. » Cumulative impacts for raptors such as the snake eagles and Secretarybirds may be present if the mortality brings other territorial birds to the area. Wind farms are also proposed for an area north of Kleinzee and this may have a cumulative impact on the species detailed above. The present study assumes that the land use in the study area will remain stable and no further mine excavations will be placed near the wind farm, which may attract wetland species.
***Residual impacts*:** After mitigation, direct mortality or area avoidance by the species identified above may still occur and further mitigation (e.g. micro-siting or turbine shut-down) will be needed.

8.3.2 Comparative Assessment of power line and Access Road Alternatives

Power line Alternative 1 crosses the Buffels River. As rivers are typically used by arid-zone birds for water and shelter and used by wetland birds to commute along, this alternative is not considered favourable. The shorter options (Alternatives 2, 3 and 4) are preferred to the longer ones simply because a longer line has more potential of impacting on threatened birds such as bustards than shorter lines. In this regard, *alternative 2, 3 & 4 are the preferred* alternatives from an avifaunal perspective.

In terms of access, there is *no preferred alternative* because the roads have already impacted on the surrounding environment.

8.3.3. Implications for Project Implementation

Several collision-prone and red-listed species have been confirmed to occur within the site proposed for the Kleinsee wind farm. These birds use the landscape in a regular way that allowed the identification of high risk and lower risk areas within the proposed wind farm. Three mitigation scenarios are proposed as follows:

1. That the turbines in the three high risk zones be moved out of these areas and positioned in low risk areas. This affects about 33 turbines. Those turbines in the medium risk areas should be and moved if possible. If this is difficult then the density of turbines should be reduced to reduce the risk to collision-prone birds in the area.
2. If mitigation is not feasible in the medium risk areas (**Figure 8.4**) then on-site mitigation measures will be required during the breeding season. These include the use of a bird detection system similar to the “DT bird” detection system developed by the Spanish to reduce direct impacts on birds at wind farms and

other facilities (refer to http://www.dtbird.com/index.php/en/ for more detail). This system automatically detects birds, up to 1.5 km away, heading for individual turbines and either dissuades the bird (by warning the bird as it nears a turbine) or for high risk situations, shuts the turbine down until the bird has gone. It can do so in 3-6 seconds and has the potential to reduce collisions altogether.

3. All overhead power lines require bird diverters. This should apply to any new overhead power lines associated with the project, and also the existing 132 kV infrastructure in the area that along which impacts on bustards have been recorded. Within the wind energy facility all power lines/cables between turbines should all be buried to reduce collisions.

It is concluded that the wind farm can be constructed in the medium and low risk areas and avoid bird displacement and direct mortality. A minimum 12 month programme of during- and post-construction bird monitoring is proposed to accurately determine the real impacts and understand the efficacy of the proposed mitigation measures. Where required, additional mitigation should be recommended and implemented.

8.4 Assessment of Impacts on Bats

Results of the Pre-Construction Bat Monitoring Programme

In order to characterise the bat community (baseline) of the site, a 12-month pre-construction bat monitoring programme was undertaken at the Kleinzee Wind Energy Facility site and at conspicuous control sites. This programme informed the assessment of the potential impacts of the wind energy facility on bats (refer to **Appendix G**). The results of the pre-construction bat monitoring confirmed that of the 14 potentially occurring bats, six (6) are present on the site. Of the 14 potentially occurring species, one species is considered as “vulnerable” and five considered as species of “least concern”. Two confirmed and seven potential bat roosts were located at and around the Kleinzee wind energy facility site according to the bat monitoring programme undertaken for this project.

In terms of the bat sensitivity map as shown in Figure 8.4, the following categories have been used for the no-go areas from a bat perspective:

» The High Sensitivity Areas were made up of confirmed roosts with a 1km buffer.
» The Medium-High Sensitivity Areas were made up as follows:
  * All FEPA wetlands & rivers with a 200m buffer.
  * Namaqualand Salt Pans
  * Namaqualand Seashore Vegetation with a 1km buffer.
  * Town of Kleinsee with a 3km buffer.

Figure 8.4: Bat Sensitivity Map

8.4.1 Impact Tables summarising impacts on bats

Nature: Roost disturbance and/or destruction due to construction activities

The only roosts identified building roosts. It is unlikely that turbines will be constructed near to these sites (closer than 500m). Therefore, this impact is considered as having a Low significance.

	Without mitigation	**With mitigation**
Extent	Low(1)	Low(1)
Duration	Short-term(1)	Short-term(1)
Magnitude	Low(4)	Minor(2)
Probability	Low(2)	Improbable(1)
Significance	**Low(12)**	**Low(4)**
Status (positive or negative)	Negative	Neutral
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible loss of breeding success	Unlikely
Can impacts be mitigated?	Yes	Yes

Mitigation Measures:

» Turbine placement must be planned only in areas of Low to Medium bat sensitivity. No part of any turbine, including the rotor swept zone is to be constructed within areas of Medium to High or High bat sensitivity.
» Clearing of natural and agricultural areas to be kept to a minimum.
» Blasting activities must not to occur within 2km of any known bat roosts.
» Any new roosts discovered should be reported and incorporated into the adaptive management plan.

Cumulative Impacts:

Compounding. With the exception of the town of Kleinsee, where several roosts occur, it is anticipated that the low occurrences of roosts is similar for the immediate surrounds of the site. However, where the habitat becomes more heterogeneous and rocky to the north, east and west, impacts on roosts due to construction activity could be greater. The impact on roosts due to the Kleinsee WEF alone is considered of Low significance, and because there are no major roosts surrounding Kleinsee and considering that other facilities will also avoid developing their turbines with 500m of buildings, the cumulative impact when considering other facilities within a 100km radius of the site is still considered to be of a Low significance.

Residual impacts:

Residual roost disturbance impacts after mitigation has been applied are unlikely to occur.

Nature**:** Disturbance to and displacement from foraging habitat due to wind turbine and infrastructure construction

Construction will involve vegetation clearance at the footprint of each turbine, along the road network and other office and sub-station building. This causes disturbance to bat foraging habitat. General dust and noise will increase in the area which may cause more sensitive species to disperse either temporarily or permanently.

	Without mitigation	**With mitigation**
Extent	Local (2)	Site (1)

Duration	Short-term (1)	Short-term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Medium (3)	Medium (3)
Significance	**Low (27)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible loss of breeding success	Unlikely
Can impacts be mitigated?	Partially	Partially

Mitigation:

» Turbine placement must be planned only in areas of Low to Medium bat sensitivity. No part of any turbine, including the rotor swept zone to be constructed within areas of Medium to High or High bat sensitivity.
» Clearing of natural and agricultural areas to be kept to a minimum.
» Minimize impacts to wetlands and water resources by following all applicable provisions of the National Water Act and keeping all turbines outside of No-Go areas.

Cumulative impacts:

Compounding. The greater the area to be disturbed by development, the greater the loss or disturbance to foraging land. Three other facilities, plus probable others are planned in addition the Kleinzee WEF. Therefore, a greater loss in foraging land.

Residual impacts:

Temporary or permanent displacement of foraging bats to alternate foraging areas.

Nature: Fragmentation of foraging habitat or migration routes due to the presence of the operating wind turbines – Operational Phase

The physical infrastructure and lights and noise can act as barriers and disturbance to bats during foraging and movement.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (5)	Low (2)
Probability	Low (4)	Low (4)
Significance	**Medium (44)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible population losses	Unlikely
Can impacts be mitigated?	Partially	Partially

Mitigation:

» Turbine placement must be planned only in areas of Low to Medium bat sensitivity. No part of any turbine, including the rotor swept zone to be constructed within areas of Medium to High or High bat sensitivity.
» Clearing of natural and agricultural areas to be kept to a minimum.
» Minimize impacts to wetlands and water resources by following all applicable provisions of the National Water Act and keeping all turbines outside of No-Go areas.
» Gaps of at least 3 turbine blade lengths must be left open between turbines, from blade

tip to blade tip.
» Keep road, turbine, and quarry and sub-station lighting to a minimum.
» With the exception of red aviation safety lights on the turbines and meteorological masts, lights should be hooded downward and directed to minimize horizontal and skyward illumination.
» Minimize use of high intensity lighting, steady-burning, or bright lights such as sodium vapour, quartz, halogen, or other bright spotlights.
» All internal turbine nacelle and tower lighting should be extinguished when unoccupied.

Cumulative impacts:

Compounding: The greater the area to be disturbed by development, the greater the loss or disturbance to foraging and migration lands.

***Residual impacts*:**

Bats may permanently need to find alternative foraging areas or change their migration routes. Bats not avoiding these areas, may suffer fatalities.

***Nature*:** Bat fatalities due to collision or barotrauma while foraging – Operational Phase

Bats cover large distances to forage nightly (2 to more than 30km), as they require large quantities of insects nightly and fly at a variety of high to catch their prey and move around. This puts them at risk of fatality if there are operating turbines amongst their foraging lands

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (5)	Long-term (5)
Magnitude	Medium (6)	Low (2)
Probability	High (4)	Medium (3)
Significance	**Medium (52)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Partially	Partially

Mitigation:

» No part of any turbine, including the rotor swept zone to be constructed within areas of Medium to High or High bat sensitivity.
» It is recommended that a taller turbine with a shorter blade length be used, so that the rotor sweep does not reach below 40m.
» Turbine engineers must work with bat specialists to build in the necessary turbine adaptions needed for erecting bat detectors or deterrent devices on the turbines in the design phase, so there are no unexpected surprises or concerns after the turbines are built.

For areas of Low to Medium and Medium Sensitivity:

With the exception of when temperatures are below 11.4°C, barometric pressure is lower than 980kPa and higher than 994kPa:

» An initial cut-in speed of 5.2m/s (approximately 50% of bat activity occurs below this wind speed) is recommended from sunset to sunrise in the following months – December, January, February, March, April, August and September. Operational monitoring according to Aronson et al. (2014) or any more recent revisions to this document must commence as soon as the first turbines start to rotate and should

fatalities be discovered, the following tiered mitigation approach is recommended for the entire year.

» A mitigation strategy report is being compiled by SABAAP. The principles outlined in this upcoming report are to be implemented, should fatalities be discovered at the Kleinzee wind energy facility, despite the initial increased cut-in speed recommendation.
» Post-construction monitoring, reporting and adaptive management will be key to keeping the residual impact of the facility as low as possible. This data needs to be fed into the SANBI database to assist with enhancing the scientific knowledge base for information decision making and mitigation recommendations.
» Pre-construction and operational monitoring bat data to feed into the SANBI bird and bat toolkit. Monthly carcass searching reports to be submitted to the SABAAP.
» As new information becomes available with regard to successful mitigation strategies tested, this information should feed into the adaptive management plan.

***Cumulative impacts**:*

Compounding: There is no doubt that the greater the number of turbines, the higher the potential for fatalities during foraging. However, higher risk areas are associated with nightly foraging activity, such as water bodies, irrigational areas, etc.

Residual impacts:

Because bats are long-lived, slow reproducing animals, additional fatalities to the normal/ natural death rates may have population level impacts, with groups or populations being slow to recover from individual or mass fatalities. If the impact is too severe, local bat populations may not recover from the losses.

***Nature*:** Bat fatalities due to collision or barotrauma during migration

Internationally, migrating bats have been shown to be at risk of fatality due to wind turbines. Whilst the migrating bats in South Africa are different species and are not tree-roosting species, the long distances that they travel and the height at which they fly also puts them at risk of fatality.

	Without mitigation	**With mitigation**
Extent	National (4)	Regional (3)
Duration	Long-term (5)	Long-term (5)
Magnitude	Moderate-High (6)	Moderate (4)
Probability	Definite (4)	Probable (3)
Significance	**High (60)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Possible
Can impacts be mitigated?	Partially	Partially

Mitigation:

The same mitigation measures recommended above for foraging bats will be applicable to migrating bats.

***Cumulative impacts**:*

Compounding. There is no doubt that the greater the number of turbines, the higher the potential for fatalities during migration. However, higher risk areas are flight path areas/ movement corridors, such as coastlines and river valleys. With migrating bats, cumulative impacts could reach several populations across the country and neighbouring countries.

countries.

***Residual impacts**:*
Because bats are long-lived, slow reproducing animals, additional fatalities to the normal/ natural death rates may have population level impacts, with groups or populations being slow to recover from individual or mass fatalities. If the impact is too severe, local and distant bat populations may not recover from the losses. There may also be gene flow consequences between summer and winter roosts.

Nature: Disturbance or displacement of bats due to electromagnetic interference emitted from power lines

Whilst some laboratory studies have shown that electromagnetic radiation can have behavioural effects on bats and rats, it is uncertain that this would be the case outside of the lab in natural circumstances. No dead insectivorous bats, as likely to occur at Kleinsee have ever been reported to be killed by power lines.

	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Long-term (5)	Long-term (5)
Magnitude	Low (2)	Low (2)
Probability	Low (2)	Improbable (1)
Significance	**Low (18)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No	No

***Mitigation**:*
Due to the low level of certainty and the low significance of this impact, no mitigation, except for reporting any findings is recommended.

***Cumulative impacts**:*
Negligible. The greater the number of wind farms in the area, the greater the need for more transmission lines. However, the cumulative impact of more transmission lines is considered negligible until it is shown that there is more than a possible Low impact on bats due to electromagnetic interference.

***Residual impacts**:*
Low Significance. Any reported findings related to impacts due to transmission lines must be reported and considered for adaptive management.

8.4.2 Comparative Assessment of power line and Access Road Alternatives

There is no evidence to suggest that bats which are common to the area are affected by the transmission line in any way. For this reason, there is no preference between the four power line alternatives when considering the bat community.

There is no preference in terms of access route alternatives for bats as either option will result in similar impacts on bats.

8.4.3 Implications for Project Implementation

With the exception of the areas delineated with higher sensitivities, the Kleinzee wind energy facility is considered a low-medium bat sensitive site, with certain seasons considered as highly sensitive. As long the site specific mitigation/ fatality minimization recommendations are met and the cumulative impacts for the greater area are considered and addressed, it is recommended that the wind farm can proceed.

Of particular importance is the operational monitoring and adaptive mitigation. All bat monitoring data should be authorized to be fed in to the SANBI bird and bat toolkit. The monthly carcass search reports should be submitted to SABAAP.

8.5 Assessment of Potential Impacts on Soil, Land Use, Land Capability and Agricultural Potential

There are two land types present across the site (i.e. Ai13 & Hb80). These soils are predominantly deep, very sandy, light yellow to white coloured sands, with some shallow calcrete hard bank horizons, and even more rarely underlying clay. The aridity of the area is the major agricultural constraint. The land capability (on the 8 class scale) is classified across the entire site as class VII - Non-arable, low potential grazing land. The long term grazing capacity of the site is classified as 41-60 hectares per large stock unit. The soils are categorized as having a high susceptibility to wind erosion because of their sandy texture. Susceptibility to water erosion is low to moderate. No agriculturally sensitive areas occur within the proposed development footprint.

The components of the project that can impact on soils, agricultural resources and productivity are:

» Occupation of the site by infrastructure and roads
» Construction activities that denude the surface cover of vegetation, for example for lay down areas, and / or disturb the soil below surface, for example for levelling, excavations, borrow pits etc.
» Vehicle traffic on site
» Temporary disruptions to fences and stock watering infrastructure

8.5.1 Impact tables summarising impacts on Soils & Agricultural Potential

Impacts associated with all phases of the development - construction, operation, and decommissioning

Nature: Loss of agricultural land use Caused by direct occupation of land by footprint of wind farm infrastructure, including roads; and having the effect of: taking affected portions of land out of agricultural production. **NB**: The magnitude of this impact is small because the footprint only covers a small proportion of the agricultural land on site (<1%), and because the land has very low agricultural potential.		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Long term (4)	Long term (4)
Magnitude	Small (0)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (25)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Only to a limited extent	
Mitigation: Minimize footprint of new roads by using existing roads wherever possible.		
Cumulative impacts: The overall loss of agricultural land in the region due to other developments. The significance is low due to the small areas affected by the development compared to available land and due to the very low agricultural potential of the land.		
Residual impacts: Low		

Impacts associated with construction phase of the development

Nature: Soil Erosion Caused by: alteration of the land surface characteristics due to construction related land surface disturbance and vegetation removal, and having the effect of: loss and deterioration of soil resources.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (18)**
Status	Negative	Negative
Reversibility	Low	High

Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Minimize the extent of areas cleared of vegetation, and subdivide cleared areas if possible by leaving strips of undisturbed vegetation across them. » Use shade cloth fencing to stabilize soil against wind erosion for the rehabilitation of cleared areas, as is standard practice in mining rehabilitation in the area (NRI, undated).		
Cumulative impacts: None		
Residual impacts: Soil erosion issues in the area if impacts are not mitigated		

Nature: Degradation of vegetation Caused by: Trampling due to vehicle passage		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Short (2)	Short (2)
Magnitude	Minor (1)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	**Low (12)**	**Low (6)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Minimize road footprint and control vehicle access on roads only.		
Cumulative* impacts*: None		
Residual* impacts*: Low		

Nature: Loss of topsoil Caused by: poor topsoil management (burial, erosion, etc) during construction related soil profile disturbance (levelling, excavations, disposal of spoils from excavations etc.). And having the effect of: poor re-vegetation and failed restoration of disturbed areas. Subsurface material in this environment has high salinity and is not suitable for vegetation establishment. All areas that are to have vegetation cover after rehabilitation, will require a covering of topsoil		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	**Low (12)**	**Low (8)**
Status	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Strip and stockpile topsoil from all areas where soil will be disturbed. » After cessation of disturbance, re-spread topsoil over the surface. » Use shade cloth fencing to stabilize the re-spread topsoil against wind erosion, as is standard practice in mining rehabilitation in the area (NRI, undated). » Dispose of any sub surface spoils from excavations where they will not impact on vegetated areas, so for example into existing excavations such as the prospecting trenches.		
Cumulative impacts: Losses of topsoil due to mining in the area		
Residual impacts: None		

Nature: Temporary disturbance of livestock farming activity Caused by: constructional disturbance to fencing and stock watering system.		
	Without mitigation	**With mitigation**
Extent	Site (1)	Site (1)
Duration	Very short (1)	Very short (1)
Magnitude	Minor (1)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (9)**	**Low (6)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Minimize period of disturbance to stock farming infrastructure (fences and watering points).		
Cumulative impacts: None		
Residual impacts: None		

Nature: Infestation of alien vegetation Caused by: seed inputs from constructional materials and from disturbance of natural vegetation and soil, and having the effect of: reducing vegetation diversity and veld productivity.		
	Without mitigation	**With mitigation**
Extent	Low (1) - Site	Low (1) - Site
Duration	Long (4)	Long (4)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)
Significance	**Low (21)**	**Low (12)**

Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Monitor for and remove any alien vegetation establishment within and around disturbed areas.		
Cumulative impacts: None		
Residual impacts: Low		

8.5.2 Comparative Assessment of power line and Access Road Alternatives

There are no preferences regarding site-specific alternative access roads and power line given the uniformity of soil conditions and agricultural potential across the site and absence of steep slopes. Alternatives investigated have no agricultural impact and therefore *no differences* in alternatives.

8.5.3 Implications for Project Implementation

» Current and historical agricultural land use has only been low intensity grazing of sheep. This is the only possible agricultural land use, given the aridity constraints.
» The development will have very low (almost negligible) impact on agricultural resources and productivity, and agricultural activities will be able to continue virtually unchanged for the duration of and after the project.
» Impacts on soils should be of low significance if mitigations measures are implemented.
» Soil conditions and agricultural capability are largely uniform across the site, and therefore micro-siting of wind farm infrastructure does not vary agricultural impact.

8.6 Assessment of Potential Visual Impacts

The Visual Impact Assessment 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 from the National Geo-spatial Information data supplied by the Department: Rural Development and Land Reform.

Visual Exposure

The result of the preliminary viewshed analyses for the proposed facility is shown in **Figure 8.5**. The visibility analysis was undertaken from 150 wind turbine positions at an offset of 140m above average ground level (i.e. the maximum hub height of the proposed turbines) in order to simulate a worst case scenario.

Figure 8.5 also indicates areas from which any number of turbines (with a minimum of one turbine) could potentially be visible. The frequency of potential visual impact is also shown, with the darker, red zones indicating those areas from which many turbines (i.e. 136-150) may be visible. The lighter, yellow areas indicate a lower frequency of visual exposure (i.e. 1-15 turbines may be visible).

The following is evident from the viewshed analysis:

» The proposed facility will have a core area of potential visual exposure, with a high frequency of exposure on the development site itself, and within a 5km offset. Almost the entire area within 5km will be visually exposed to the wind energy facility. This core area includes the settlement of Melkbospunt and a number of settlements in close proximity, especially to the east. It also includes all the secondary roads and lies within the Namaqua National Park's Priority Natural Area.
» The extent of potential visual exposure decreases somewhat in the medium distance (i.e. between 5 and 10km), but the frequency of visual exposure remains high. Visually screened areas occurring in the north, east, south east and south. This visual screening is by virtue of local topography (i.e. the hills and incised river valleys). Receptors likely to be visually exposed within this distance include the town of Kleinzee, the settlement of Grootmis, a number of other settlements to the east of the wind energy facility, as well as users of the R355 and secondary roads. The southern two thirds of this visually exposed area still falls within the Namaqua National Park's Priority Natural Area.
» In the longer distance (i.e. between 10km and 20km), the extent of potential visual exposure remains moderately high with significant visually protected areas evident in the north, north east, east and south east. Visual receptors that may experience visual impact within this distance include users of the R355 and secondary roads and two isolated settlements in the far north. More than half of this visually exposed zone (to the south) lies within the Namaqua National Park's Priority Natural Area

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

Visual Impact

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed Kleinzee Wind Energy Facility and PV plant are displayed on **Figure 8.6**. Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, high frequency of visual exposure to the proposed facility, a high viewer incidence and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This aids 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 wind energy facility is further described as follows.

» The visual impact index map indicates a core zone of *moderate* visual impact within a 5 km radius of the proposed facility. Sensitive visual receptors within this zone include users of the secondary roads and homesteads and settlements on or adjacent to the proposed facility. These sensitive receptors, including *Melkbospunt, Gorab, Hondevlei, Rooivlei and "Die Houthoop" lodge at Steenvlei,* are likely to experience a high visual impact.

» The extent of potential visual impact remains high between the 5 km and 10 km radii, and is likely to be of *low* magnitude. Potentially sensitive receptors within this zone include residents on the outskirts of Kleinzee, users of the R355 and secondary roads and a number of settlements. The latter include Grootmis, Manelsvlei, Taaibosknop, Lewies-se-Duin, and Droevlei. Sensitive visual receptors within this zone are likely to experience *moderate* visual impact.

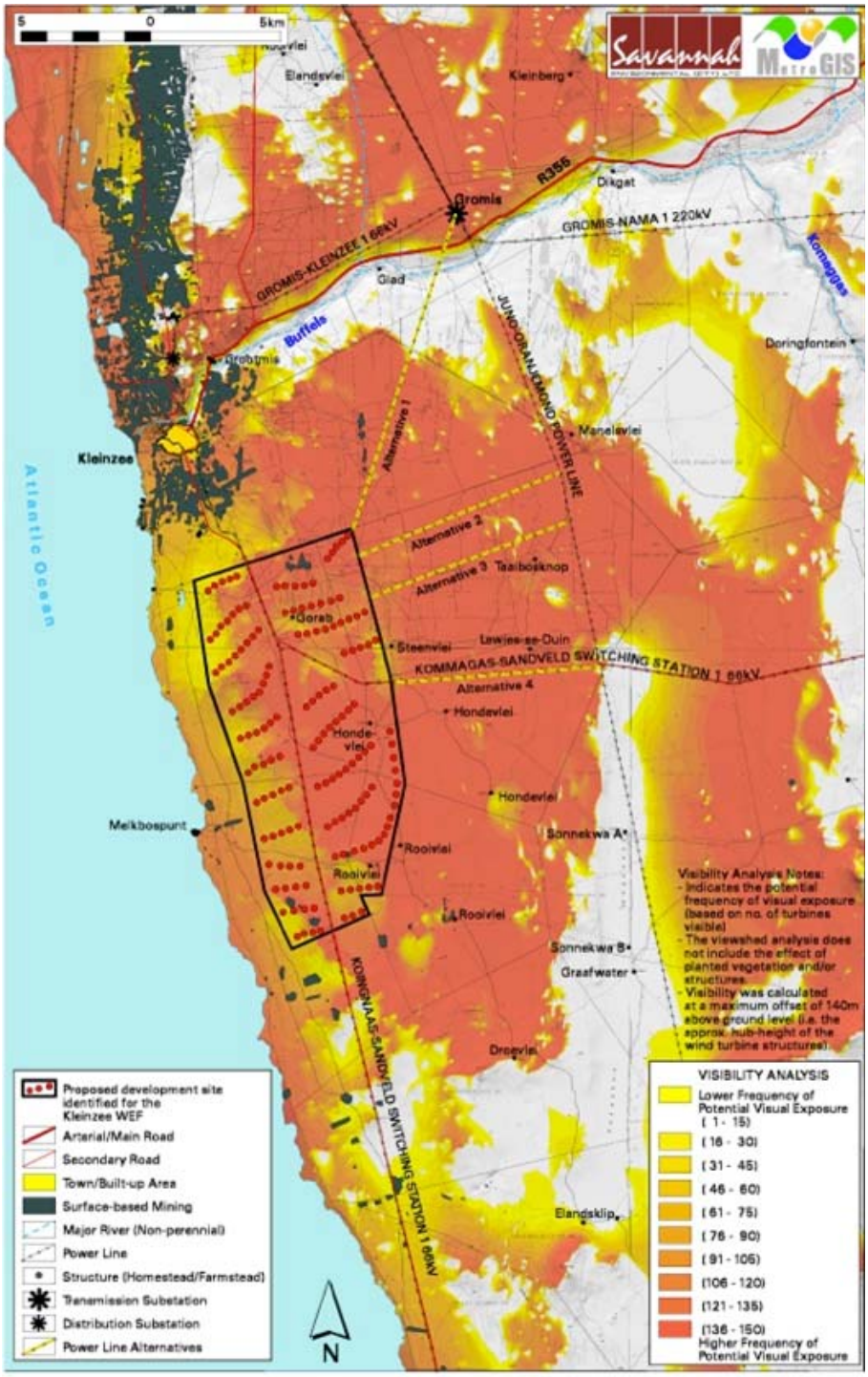

Figure 8.5: Viewer exposure for the Kleinzee Wind Energy Facility

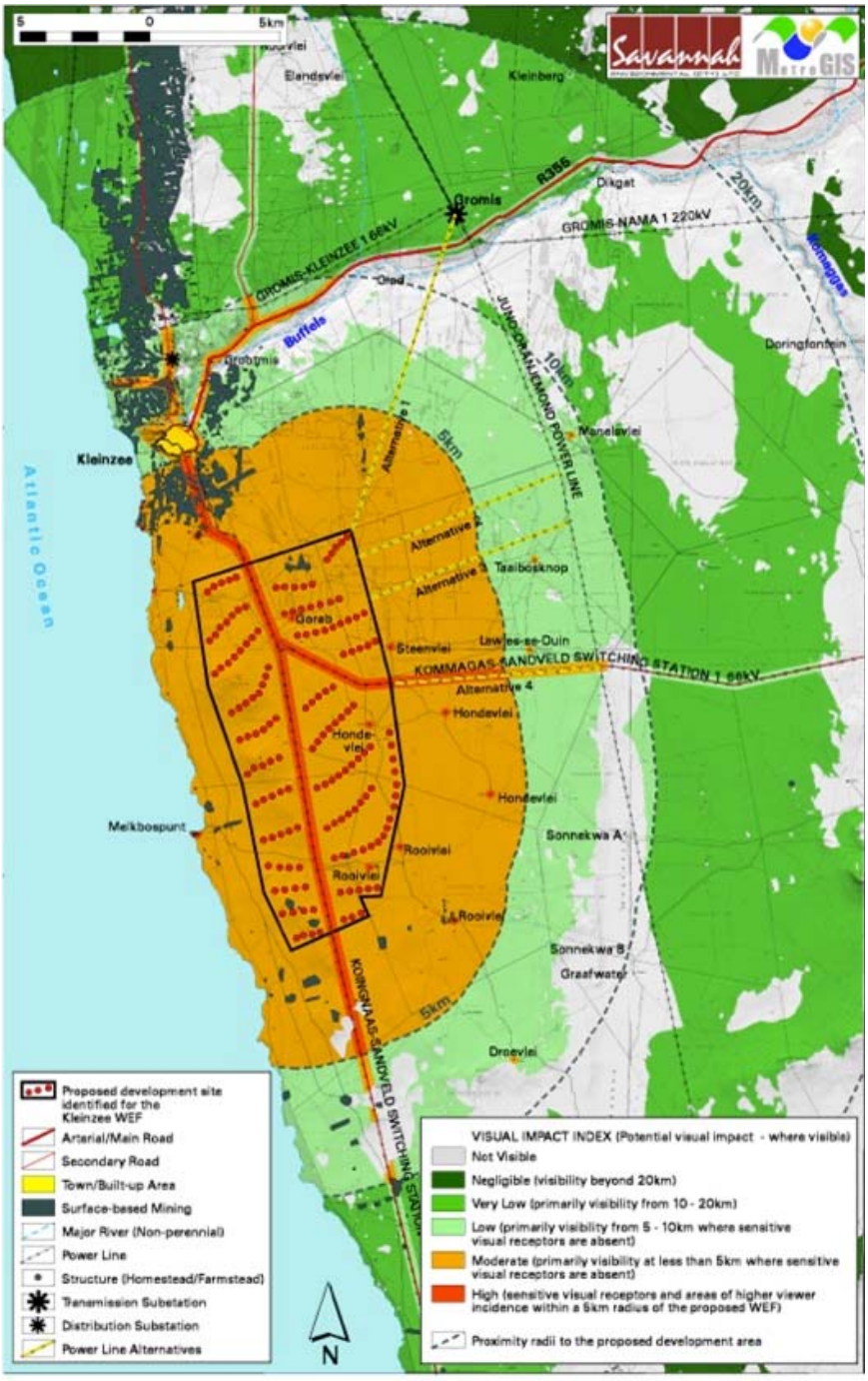

Figure 8.6: Visual impact index of the proposed Kleinzee Wind Energy Facility

» Between 10 km and 20 km, the extent of potential visual impact is reduced. Visual impacts within this zone are likely to be *very low*, with sensitive visual receptors (i.e. users of roads and residents of settlements) experiencing potentially *low* visual impact.
» Remaining impacts beyond the 20 km radius are expected to be *negligible*.

In terms of viewer incidence, it is evident that visual impacts are likely to occur primarily on roads. It must be noted that all roads converge onto Kleinzee and that the duration of visual impact is likely to be high, particularly as one travels towards Kleinzee. The impact intensifies as the distance to the wind farm becomes less.

Figure 8.7 helps to place the above explanations in context, illustrating at what scale a turbine structure will be perceived at different viewing distances.

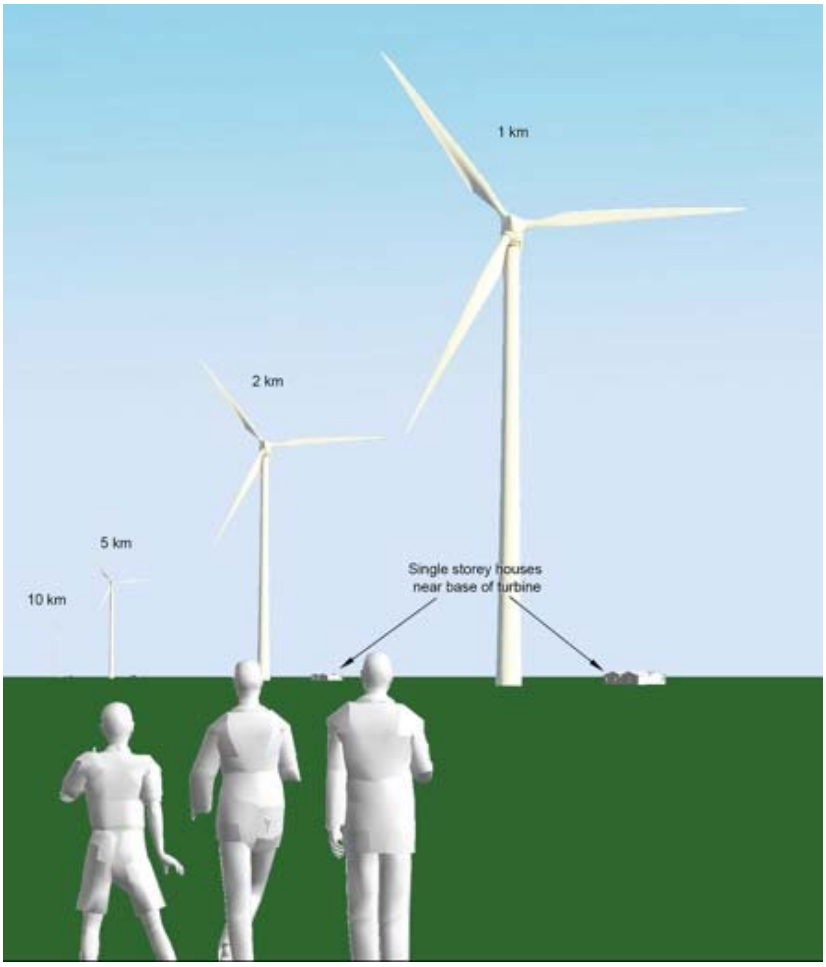

Figure 8.7: Visual experience of a wind turbine structure at a distance of 1km, 2km, 5km and 10km.

8.6.1 Impact Tables summarising visual impacts

Construction impacts

Nature of Impact: Potential visual impact of construction on visual receptors in close proximity to the proposed facility.

During the construction period, there will be a noticeable increase in heavy vehicles utilising the roads to the development site that may cause, at the very least, a visual nuisance to other road users and land owners in the area. .

	Without mitigation	**With mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Short term **(2)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Highly Probable **(4)**	Probable **(3)**
Significance	**Moderate (56)**	**Low (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
» Reduce the construction period through careful logistical planning and productive implementation of resources.
» Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
» Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
» Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works.

Cumulative impacts:

In context of the existing rural character and relative low activity rate, the construction phase of the wind energy facility will contribute to a regional increase in heavy vehicles on the roads in the region, with constructions activity distinctly noticeable.

Residual impacts:

None.

Nature: Potential visual impact of lighting at night on visual receptors in close proximity to the proposed wind energy facility

No security or after hours lighting will be used during the operational phase of the facility.

Therefore, glare from security lighting may be experienced during the construction phase only. This may have some significance for visual receptors in close proximity. The entire area of the proposed Wind farm and surroundings is demarcated as Priority Natural Area (Namaqua National Park Interface Zone), which is highly sensitive to lighting impacts. The table overleaf illustrates the assessment of this anticipated impact, which is likely to be of moderate significance, and may be mitigated to low.

	Without mitigation	**With mitigation**
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	High **(8)**	Moderate **(6)**
Probability	Probable **(3)**	Improbable **(2)**
Significance	**Moderate (48)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning & operation:

» Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
» Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
» Making use of minimum lumen or wattage in fixtures;
» Making use of down-lighters, or shielded fixtures;
» Making use of Low Pressure Sodium lighting or other types of low impact lighting.
» Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Cumulative impacts:

The existing town of Kleinzee already generates lighting impacts at night. The impact of the proposed wind energy facility during the construction phase will contribute to a regional increase in lighting impact.

Residual impacts:

The visual impact will be removed after construction, provided that no security or after hours lighting will be used during the operational phase. Failing this, the visual impact will remain.

Operational impacts

Nature of Impact: Potential visual impact *on observers travelling* along arterial and secondary roads in close proximity to the proposed *wind energy facility* (impact of limited duration) of the wind energy facility

Visual impacts on the R355 arterial road, being the major access route to Kleinzee, as well as the secondary roads from the south and east, are expected to be of moderate significance within a radius of 5 km from the facility. The duration of visual impact within this zone, at an average speed of 90km/h, will be about 10 minutes. This combined with

the relatively low number of potential receptors (i.e. road users) effectively reduces the probability of this impact occurring. No mitigation is possible[10].		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Probable **(3)**	N/a
Significance	**Moderate (48)**	**N/a**
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation: None.		
Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the mining and power line infrastructure already present in the area.		
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.		

Nature of Impact: Potential visual impact on the town of Kleinzee. Kleinzee is situated 5 km from the nearest boundary of the proposed facility. The potential for visual exposure is high on the outskirts of the town, but due to the existence of buildings and other structures within the built up area, the visual absorption capacity within is expected to be high, therefore limiting full exposure of the wind farm.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	High **(4)**	N/a
Significance	**Moderate (56)**	**N/a**
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	
Mitigation: None.		
Cumulative impacts: The construction of wind turbines together with the associated infrastructure will increase		

[10] It is possible to reduce the height or number of turbines, but as this constitutes a change in the structure and potential functionality of the proposed wind energy facility, it is not entertained as a viable possibility for mitigation. In this respect, it is assumed that the proposed turbines have been selected / designed to optimise the wind resource.

the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line and mining infrastructure already present in the area.
Residual impacts: The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Potential visual impact on homesteads and settlements in close proximity to the proposed facility

Residents of homesteads and settlements in close proximity to the proposed wind energy facility (i.e. within 5km) include *Melkbospunt to the west and Gorab, Hondevlei, Rooivlei and "Die Houthoop" lodge at Steenvlei* to the east.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	High **(4)**	N/a
Significance	**High (64)**	**N/a**
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation:
None.

Cumulative impacts:
The construction of 200 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as power lines and substations) within the region. One wind farm (Project Blue WEF) is authorised in the area.

Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Potential visual impact on the historical settlement of Grootmis.

Grootmis is situated about 8 km north of the nearest wind turbine of the proposed wind energy facility. Due to the large vertical dimensions of the turbines, they will break the regularity of the horizon to a significant extent. This will impact on the high quality of the sense of place around Grootmis, which is regarded as a place of historical importance.

	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	High **(4)**	N/a
Significance	**Moderate (52)**	**N/a**
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a

Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the mining and power line infrastructure already present in the area.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact: Potential visual impact of on site ancillary infrastructure on observers in close proximity to the proposed facility

Ancillary infrastructure associated with the wind energy facility includes the substation, the internal access roads, the borrow pits, the office / workshop and the visitor centre. This infrastructure may be visible to observers in close proximity to the facility.

Although they have no vertical dimension, the roads have the potential of manifesting as landscape scarring. Other infrastructure has the potential of creating visual clutter, contributing to cumulative impacts, therefore having the potential of visual impact within the viewshed areas.

This infrastructure will be located within the facility footprint, and will be of a much smaller scale than the turbines. The visibility of this infrastructure is therefore likely to fall within the viewshed of the primary infrastructure.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(1)**
Significance	**Low (24)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

» Plan ancillary buildings/structures in such a way to avoid/minimise clearing of vegetation.
» Consolidate ancillary infrastructure and favour already disturbed areas over undisturbed sites.
» Retain and maintain natural/cultivated vegetation in all areas outside of the development footprint.

Construction:

» Rehabilitate all construction areas.
» Ensure that vegetation is not cleared unnecessarily to make way for ancillary buildings.

Operation:

» Maintain ancillary buildings/substation structures.

Decommissioning:

» Remove infrastructure not required for post decommissioning use and rehabilitate all cleared footprint areas.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of the substation, the internal access roads, the borrow pits, the office / workshop and the visitor centre will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of existing roads and power lines already present in the area.

Residual impacts:

The visual impact will be removed after decommissioning, provided the access roads are removed and rehabilitated. Failing this, the visual impact will remain.

***Nature of Impact*:** Potential visual impact of the overhead power line on observers in close proximity thereto.

Figure 8.8 shows the four alternatives for connecting the wind farm to the Gromis substation to the north east. Although Alternative 4 has the highest visual impact index due to a high viewer incidence, it follows an existing power line route. From a visual impact perspective it is preferable to concentrate new impacts together with existing infrastructure of a similar nature as a form of mitigation.

	Without mitigation	**With mitigation**
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	High **(8)**	N/a
Probability	Highly Probable **(4)** – alternative 1-3 Probable **(3) –** alternative 4	N/a
Significance	**High (64)** **Moderate (48)**	**N/a**
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a

Can impacts be mitigated?	No
Mitigation / Management: Follow exiting infrastructure to consolidation visual impacts	
Cumulative impacts: The construction of towers together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region.	
Residual impacts: The visual impact will be removed after decommissioning, provided the ancillary infrastructure is removed. Failing this, the visual impact will remain.	

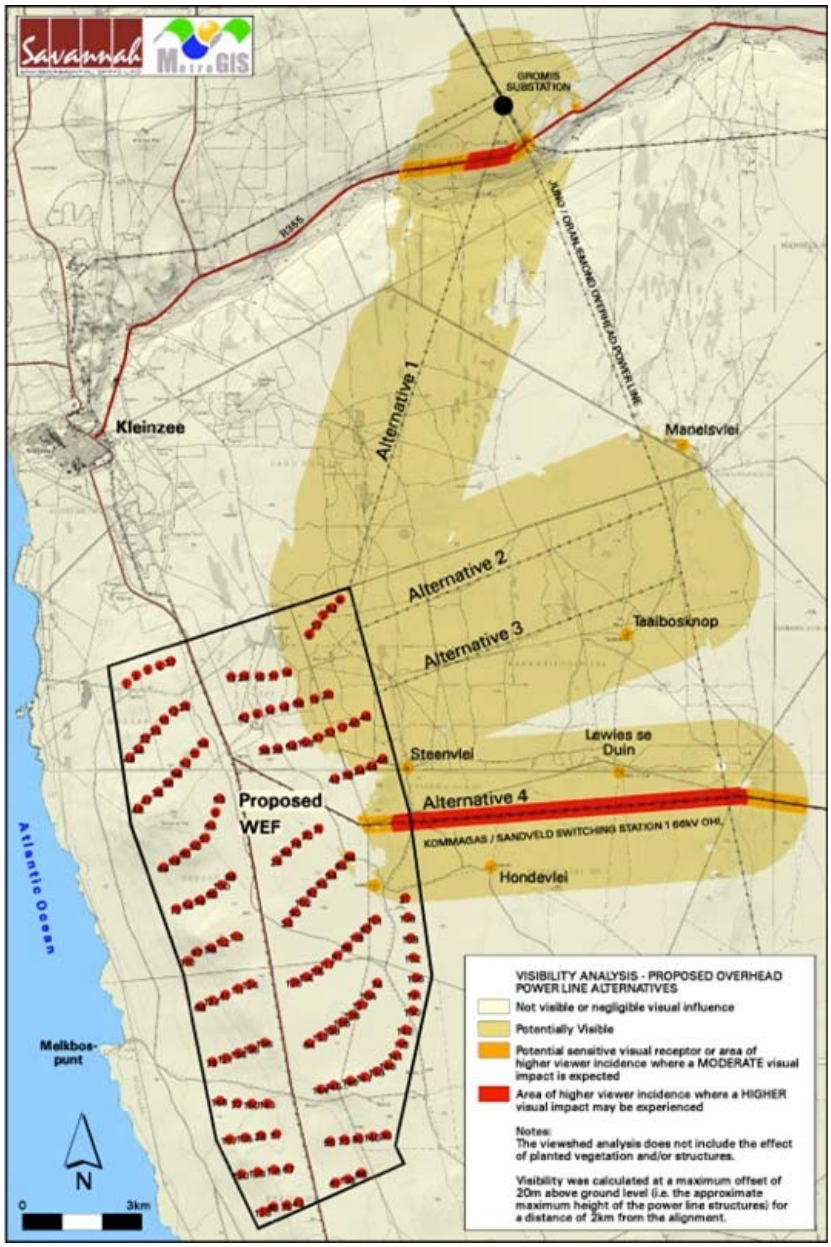

Figure 8.8: Visual impact index of overhead power line alternatives.

Nature of Impact:
Potential visual impact of shadow flicker on observers in close proximity to the proposed facility.

Shadow flicker (as a result of the turbines) 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 560m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.

Although homesteads and settlements occur on and in close proximity to the proposed WEF, all of these appear to be located more than 560m away from any turbine, with the exception of Gorab.

	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Very Improbable **(1)**	N/a
Significance	Low **(12)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:
None

Cumulative impacts:
The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region.

Residual impacts:
The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact:
Potential visual impact of the proposed facility on visual character and sense of place of the region

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), play a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the rural and undeveloped character of the area. A sense of remoteness is evident when travelling through the area.

Approaching Kleinzee and the mined areas, this sense of place is altered. The location of the proposed WEF close to Kleinzee can be regarded as a transition zone between a built-up and rural area, within which changes to the sense of place may be more acceptable to sensitive viewers.

Given the vastness of this region, where this particular sense of place is experienced widely, any change to it close to a disturbed area is likely to be of low significance. No mitigation is possible.

	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	Probable **(3)**	N/a
Significance	Low **(33)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the mining and power line infrastructure already present in the area.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact:

Potential visual impact of the proposed facility on the Namaqua National Park's Priority Natural Area

The Namaqua National Park lies approximately 45km to the south east and is therefore outside of the study area (and not shown on the maps). Of relevance, however, is the location of the proposed WEF within an area demarcated as a *Priority Natural Area* by the SANParks Planning Department.

Considerations in Priority Natural Areas are related to biodiversity and ecological connectivity rather than visual aspects. However, this zone represents a visual buffer for the National Park, and as such influences both the visual character and sense of place of the area and of the National Park.

Notwithstanding the vastness of the visual environment, and the distance to the National Park, the proposed WEF is proposed within the priority area, and as such will have an impact on this visual landscape. The significance of this visual impact on the function of the Priority Natural Area is determined to be **Moderate**. No mitigation is possible.

	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Low **(4)**	N/a
Probability	High **(4)**	N/a
Significance	Medium **(44)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the mining and power line infrastructure already present in the area.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

Nature of Impact:

Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourist potential of the region

The West Coast of the Northern Cape attracts tourists to the Koingnaas – Kleinzee tourist route, also referred to as the “Diamond Route”.

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

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

Lastly, "Die Houthoop" lodge at Steenvlei is well within the high visual prominence zone with the nearest turbine position being less than 1km from this establishment.

The region is therefore considered to have a relatively high tourism value and tourist potential, not to mention tourist destinations. In this respect, the visual impact on tourism is expected to be of moderate significance. No mitigation is possible.

	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/a
Duration	Long term **(4)**	N/a
Magnitude	Moderate **(6)**	N/a
Probability	High **(4)**	N/a
Significance	Moderate **(52)**	N/a
Status (positive or negative)	Negative	N/a
Reversibility	Recoverable **(3)**	N/a
Irreplaceable loss of resources?	No	N/a
Can impacts be mitigated?	No	

Mitigation / Management:

Planning:

» Retain / re-establish and maintain natural vegetation in all areas outside of the development footprint.

Operations:

» Maintain the general appearance of the facility as a whole.

Decommissioning:

» Remove infrastructure not required for the post-decommissioning use of the site.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Cumulative impacts:

The construction of wind turbines together with the associated infrastructure will increase the cumulative visual impact of industrial type infrastructure within the region. This is relevant in light of the power line infrastructure already present in the area.

Residual impacts:

The visual impact will be removed after decommissioning, provided the facility and ancillary infrastructure is removed. Failing this, the visual impact will remain.

8.6.2 Comparative Assessment of power line and Access Road Alternatives

Alternatives 1, 2, and 3 would present new visual impacts on an area already recognised for its sense of place, as well as disturb otherwise largely pristine vegetated areas with new servitude corridors. From a visual impact standpoint the *preferred option* for the overhead power line is thus *Alternative 4*. The significance of the potential visual impact of the preferred alternative (Alternative 4) on observers in close proximity thereto is expected to be *moderate*. The existing power line is expected to absorb the visual impact of the new power line to some extent, thus decreasing the probability of this impact occurring.

There is no preference in terms of access route alternatives for visual as either option will result in similar visual impacts.

8.6.3 Implications for Project Implementation

The geographic significance of this region is the unique West Coast coastline, and specifically the Koingnaas – Kleinzee tourist route, also referred to as the "Diamond Route", offering tourist facilities such as the Kleinzee Diamond Museum, diamond mine tours, hiking trail, 4x4 routes and visiting the largest seal colony on the west coast. The construction and operation of the proposed Kleinzee Wind Energy Facility and its associated infrastructure will have a visual impact on the study area, specifically within 5km of the proposed facility. The visual impact will differ amongst places, depending on the distance from the facility and the visual character of the immediate surroundings from where this new development is observed.

A number of mitigation measures have been proposed (**Appendix K** – VIA report). Mitigation will be effective in terms of lighting and construction. Other mitigation measures will not reduce the significance of the anticipated visual impacts, but they are considered to be good practice and should be implemented and maintained throughout the life span of the proposed facility.

8.7 Assessment of Potential Noise Impacts

Potentially Sensitive Receptors, defined as Noise-Sensitive Developments (NSDs – SANS 10103) were initially identified using Google Earth® during the scoping noise study, supported by a site visit to confirm the status of the identified dwellings. The purpose of the site visit, apart from measuring ambient sound levels, was to confirm the status of buildings on the site as there could be a number of derelict or abandoned dwellings that could be seen as a sensitive receptor, or small dwellings that could not be identified on the aerial image, or those that were built after the date of the aerial photograph. The function of the dwelling needs to be defined as well, as a building can serve as a residential, commercial or industrial housing. While there are a number of dwellings and structures in the area, the site assessment revealed that all of the structures within the boundary of the wind energy facility are derelict. The only potential receptor within 2,000 meters is the *Houthoop B & B* indicated as a potential receptor on **Figure 8.9**.

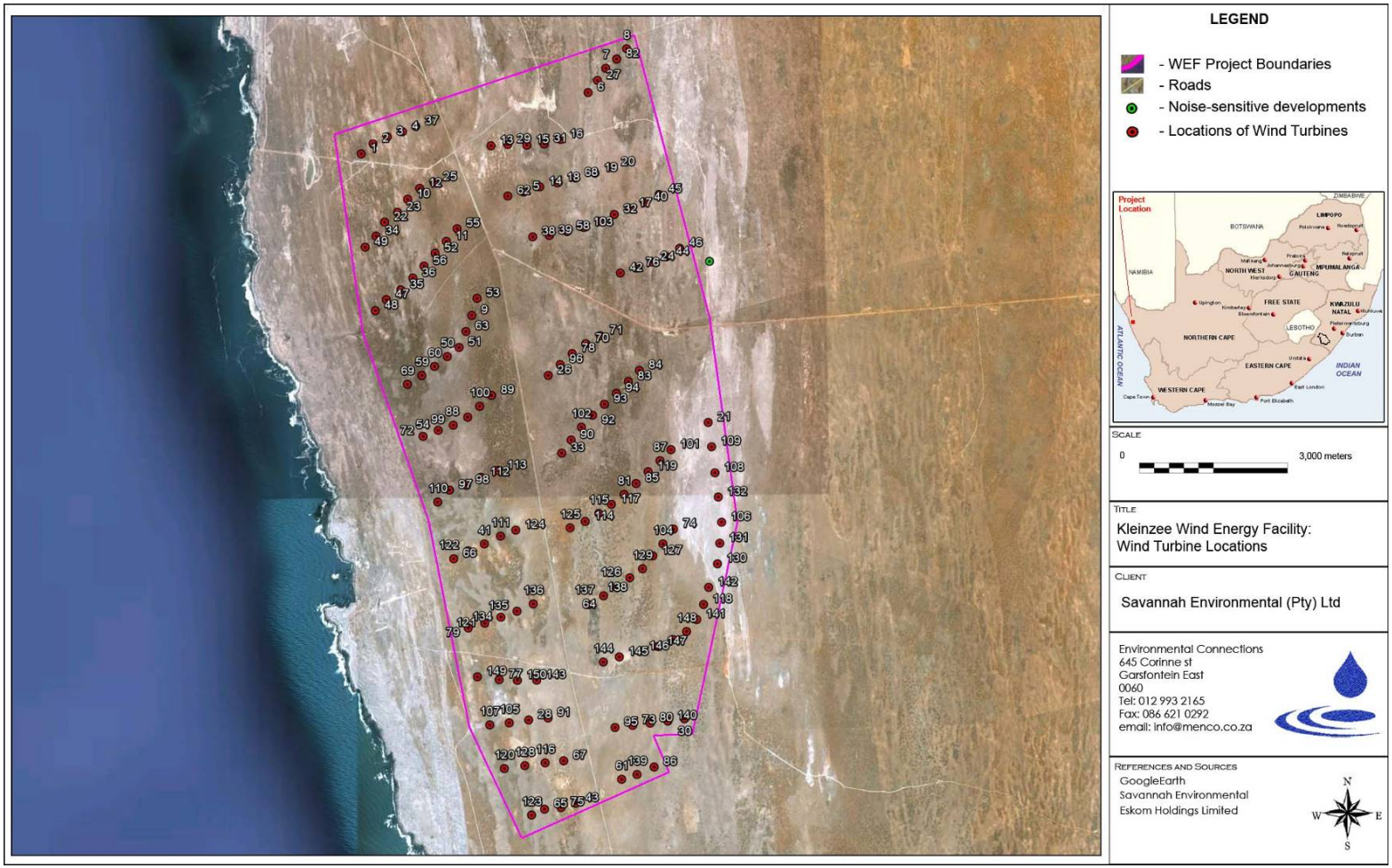

Figure 8.9: Aerial image indicating potential noise sensitive receptors (indicated by the green dot) and property boundaries for the Kleinzee Wind Energy Facility

8.7.1 Noise from Construction activities

Noise sources during construction include the following:

» **Construction equipment**
Construction equipment likely to be required will typically include excavator/graders, bulldozers, dump trucks, vibratory roller, bucket loader, rock breaker(s), drill rig, flat-bed truck(s), pile drivers, concrete trucks, cranes, fork lift(s) and various 4WD and service vehicles. Octave sound power levels typical for this equipment are presented in the Noise report.

» **Blasting**
Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting has not been considered during the EIA phase for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.
- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relative fast results in a higher acceptance of the noise. Note that with the selection of explosives and blasting methods, noise levels from blasting is relatively easy to control

» **Material supply: Concrete batching plants and use of Borrow Pits**
There exist three options for the supply of the concrete to the development site. These options are:

1. The transport of “ready-mix” concrete from the closest centre to the development.
2. The transport of aggregate and cement from the closest centre to the development, with the establishment of a small concrete batching plant close to the activities. This would most likely be a movable plant.
3. The establishment of a small quarrying activity, where aggregate will be mined, crushed and screened and used onsite. Cement will still be transported to the site, where there will be a small movable concrete batching plant.

For the purpose of the EIA, Option 2 was assumed as being the preferred option. Aggregate will be sourced from existing commercial borrow pits in the area. *However, should the developer select the development of borrow-pits onsite (option 3), the findings of this EIA will still be valid. This is because of the borrow-pit will not be operated 24 hours a day, it is generally a very temporary activity (a few weeks), and the likelihood that it may impact on a NSD (only one NSD within the site or up to 2 000 meters from the boundary of the site).*

» **Traffic due to construction vehicles**
A source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the wind turbine. Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

Results of Noise Modelling – Construction Noise

Only the calculated daytime ambient noise levels are presented, as construction activities that might impact on sensitive receptors should be limited to the 06:00 – 22:00 time period. The worst case scenario is presented with all activities taking place simultaneously at each proposed wind turbine location during wind-still conditions, in good sound propagation conditions (20°C and 80% humidity).

Even though construction activities are projected to take place only during day time, it might be required at times that construction activities take place during the night (particularly for a large project). Below is a list (and reasons) of construction activities that might occur during night time:

» Concrete pouring: Large portions of concrete do require pouring and vibrating to be completed once started, and work is sometimes required until the early hours of the morning to ensure a well-established concrete foundation. However the work force working at night for this work will be considerably smaller than during the day.
» Working late due to time constraints: Weather plays an important role in time management in construction. A period of bad weather can cause a construction project to fall behind its completion date. Therefore it is hard to judge beforehand if a construction team would be required to work late at night.

As it is unknown where the different activities may take place it was selected to model the impact of the noisiest activity (laying of foundation totalling 113.6 dBA

cumulative noise impact) at all locations (over the full daytime period of 16 hours) where wind turbines may be erected, calculating how this may impact on potential noise-sensitive developments as well as mapping this modelled construction activity over distance. Overall, noise impacts during construction will have a low impact on the identified potential noise-sensitive receptors.

Impact tables summarising the significance of noise impacts during Construction

Nature:	Numerous simultaneous construction activities that could impact on receptors.
Acceptable Rating Level	Rural district with little road traffic (excluding construction traffic): 45 dBA outside during day Use of $L_{Req,d}$ of 45 dBA for rural areas Ambient sound level = 28 dBA
Extent ($\Delta L_{Aeq,d}$>7dBA)	**Regional** – Change in ambient sound levels could extend further than 1,000 meters from activity **(3).**
Duration	**Temporary** – Noisy activities in the vicinity of the receptors would last a portion of the construction period **(1).**
Magnitude	Ambient noise levels < Rating Level, however change from Ambient sound levels detectable very high when construction activities takes place at turbine #46 and will be detectable at NSD01 **Very high (10).**
Probability	Due to change in ambient sound levels there is a possible probability that NSD01 may complain. Because the NSD is a guesthouse and camping area the probability as raised from unlikely to possible. **Possible (2).**
Significance	**Low (28).**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Comments	-
Can impacts be mitigated?	*Yes, though mitigation not required.*
Mitigation:	
Effectiveness of mitigation:	
Cumulative impacts:	
Residual Impacts:	

8.7.2 Noise Sources: Operational Phase

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources that are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources generally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise.

These types of noise are discussed in more detail in the Noise Impact Assessment report contained in **Appendix J**.

Figure 8.10 illustrates the projected noise levels due to the operation of the proposed wind farm, illustrating the cumulative impact of all wind turbines operating simultaneously. It does not consider potential cumulative impacts due to existing (increased) ambient sound levels.

Figure 8.10: Projected Noise Levels (ISO model) from wind turbines; Contours of constant sound levels for a 5 m/s wind

Impact tables summarising the significance of noise impacts (without mitigation) during the operational phase

Nature:	*Numerous turbines operating simultaneously during a period when a quiet environment is desirable.*
Acceptable Rating Level	Rural district with little road traffic.
Extent ($\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact will extend less than 1,000 meters from activity. **(2).**
Duration	**Long** – Facility will operate for a number of years **(4).**
Magnitude	**Medium (6)**
Probability	**Highly Likely (4)**
Significance	**48 (Medium)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Comments	-
Can impacts be mitigated?	Yes
Mitigation: » Use quieter wind turbines. It is important to note that this assessment made use of a worst-case scenario wind turbine that could generate relatively high noise levels. » Relocate the Houthoop NSD to an area with little to no impact. » Reduce the total number of wind turbines within a distance 1,000 meters from the closest NSDs as proposed; » Change the layout to apply a 1 000 meter buffer area around NSD01; » The developer can consider larger wind turbines which would require less wind turbines for the same power generation potential, but increase the buffer zone with an appropriate level.	
Cumulative impacts: This impact is cumulative with existing ambient background noises.	
Residual Impacts: This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.	

8.7.3 Comparative Assessment of power line and Access Road Alternatives

Transmission line noise (Corona noise) is considered of a lesser noise source in terms of the wind facility. In this regard, Eskom goes to great lengths to design power transmission equipment to minimise the formation of corona discharges. In addition, it is an infrequent occurrence with a relatively short duration compared to other operational noises. At the relatively low voltages proposed for this project, Corona noises would not be an issue. In addition, there are no NSDs located within close proximity of the power line.

There will be no differences in the significance of noise impacts for any of the alternative power line. Therefore any of the proposed alternatives are considered acceptable from a noise perspective.

There will also be no differences in the significance of noise impacts for either of the alternative access routes. Therefore any of the three proposed alternatives are considered acceptable from a noise perspective.

8.7.4 Implications for Project Implementation

» Noise impacts during construction are expected to be of low significance, and therefore no mitigation is required.
» With the current layout it is highly likely that the wind farm will have a noise impact on NSD01 during the operational phase. This is mainly due to the distance between the closest wind turbines and this NSD.
» As a result of the unknown noise emission characteristics of the proposed wind turbine, it is highly recommended that the developer re-evaluate the final layout once a wind turbine make and model are selected if:
    * Any wind turbines are within the 1 000 meter recommended buffer zone from NSD01;
    * If there are any wind turbines within 2 000 meters from NSD01 and the noise emission levels of the selected wind turbine is similar (within 5%) for the worst-case conceptual noise source selected, as presented in this report.

8.8 Assessment of Potential Impacts on Heritage - Archaeology

The proposed area for development will occur on the flat plains with several intermittent streams occurring within the proposed development area. The vegetation cover is sparse with several exposed areas making archaeological visibility relatively good throughout the surveyed area. In some instances bush clumps obscured archaeological visibility. The study area is relatively undisturbed except in areas where internal farm roads, farm fences, dams, and reservoirs have been constructed. Natural disturbances such as water movement and some erosion as well as grazing and trampling by domesticated animals may have impacted the original positions of surface scatters of stone artefacts.

The following archaeological findings are relevant for the site:

» **Stone Age archaeology**: Stone Age archaeological resources are widespread but of generally low importance. Impacts would occur during the construction phase. All sites recorded on the site can be easily mitigated where this is necessary.
» **Colonial period archaeology:** Colonial period archaeology is very rare on the landscape with the only significant site being a ruin which will not be impacted. Impacts would again be at construction phase only with no further impacts expected thereafter. No mitigation is required.

» **Built environment**: No direct impacts to built structures will occur. However, some erosion of context will occur through the introduction of large industrial structures to a remote, rural landscape with very isolated farm buildings. Due to the relatively low significance of the structures concerned and the fact that the impacts are indirect, the magnitude of impact has been considered minor.
» **Graves**: The only graves located are in a modern graveyard just outside of the study area. They will suffer a minor loss of context. Eskom must consider the likelihood of discovering unmarked pre-colonial graves anywhere in the project area. Such graves are relatively common along the coast in soft substrates. Impacts are thus at construction phase only since no new impacts would occur once all infrastructure is in place.
» **Cultural landscapes and scenic routes:** although impacts to the landscape will be high due to the size of the proposed turbine structures, there are no natural landscape features that are in direct conflict with the structures. This would encourage viewers to see past the turbines and still be able to appreciate the natural landscape. Its remoteness and rural sense of place will, nevertheless, be affected. No highly significant scenic routes are located within close proximity to the proposed wind farm facility. However, some local roads do carry limited tourist traffic at times resulting in an impact of low magnitude. No mitigation can be suggested since the topography does not allow for turbines to be 'hidden'. Cumulative impacts are of some concern, since the presence of wind farms on both the north and south sides of Kleinsee would result in impacts to the roads leading north to Port Nolloth, east to Springbok, east to Komaggas and south to Koiingnaas.

8.8.1. Impact Table – Impact on fossil heritage resources during the construction phase

***Nature*:** Damage and destruction of Stone Age archaeological during construction.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**Medium (45)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	
Mitigation: » Excavation, sampling, analysis and dating of archaeological sites as required to capture technological and subsistence data. » A permit from SAHRA may be required to be obtained prior to the undertaking of the recommended mitigation.		
***Cumulative impacts*:** Although many sites have been damaged by mining in the region, archaeological sites are		

so numerous that cumulative impacts are of very little concern.
***Residual impacts*:** Irreplaceable loss of archaeological heritage resources.

***Nature*:** Damage and destruction of colonial period archaeology during construction.		
	Without mitigation	**With mitigation**
Extent	Local (1)	-
Duration	Permanent (5)	-
Magnitude	Small (0)	-
Probability	Very improbable (2)	-
Significance	**Low (10)**	-
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes, but none is required.	
Mitigation: None required as significant resources will not be impacted.		
Cumulative impacts: Although many sites have been damaged by mining in the region, archaeological sites are so numerous that cumulative impacts are of very little concern.		
Residual impacts: Irreplaceable loss of archaeological heritage resources		

Nature: Erosion of remote, rural context of the various farm structures in the vicinity of the proposed wind energy facility.		
	Without mitigation	**With mitigation**
Extent	Local (2)	-
Duration	Long term (4)	-
Magnitude	Minor (2)	-
Probability	Definite (5)	-
Significance	**Medium (40)**	-
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: None possible		
Cumulative impacts: One other wind energy facility has been proposed nearby but this is about 10 km to the north. It will affect different structures and no cumulative impacts are expected here.		
***Residual impacts*:** Irreplaceable loss of archaeological heritage resources.		

Nature: Damage and destruction of human remains and their burial sites.

It should be noted that mitigation in the form of exhumation of pre-colonial graves cannot take place before construction. A very high magnitude would be experienced if graves are completely destroyed. However, with exhumation, the remains would be preserved and could be respectfully stored in an appropriate institution.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very high (10)	Low (4)
Probability	Improbable (2)	Very improbable (1)
Significance	**Medium (32)**	**Low (10)**
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Yes	

Mitigation:

Immediate in situ protection of any human remains upon discovery and subsequent exhumation by an archaeologist.

Cumulative impacts:

Although many human burials have been impacted through mining along the coast, the discovery of any further burials will not cause a cumulative impact of significance since the total proportion of burials disturbed in this way is likely very small.

Residual impacts:

None

Nature**:** Impact on the cultural landscapes and scenic routes		
	Without mitigation	**With mitigation**
Extent	Local (3)	-
Duration	Long term (4)	-
Magnitude	Low (4)	-
Probability	Definite (5)	-
Significance	**Medium (55)**	-
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	

Mitigation:

» Not possible

Cumulative impacts:

Another wind farm facility has been proposed some 10 km to the north. The presence of these facilities on both sides of Kleinsee would considerably incease the cumulative impacts to the general landscape since the immediate surroundings of all four alternative roads leading away from Kleinzee would be affected.

Residual impacts:

None

8.8.2. Comparative Assessment of power line and Access Road Alternatives

There will be no differences in the significance of archaeological impacts for any of the alternative power line routes. Therefore any of the proposed alternatives are considered acceptable.

There will also be no differences in the significance of archaeological impacts for either of the alternative access routes. Therefore any of the three proposed alternatives are considered acceptable from an archaeological impacts perspective.

8.8.3. Implications for Project Implementation

In general, there are no significant concerns over impacts to archaeological and heritage resources. Direct impacts to archaeological sites and human burial sites can be easily mitigated if the sites cannot be avoided.

8.9 Assessment of Potential Impacts on Palaeontology

Findings or Loss of Fossils during Construction

The proposed bulk earth works will affect the terrestrial deposits that blanket the area. These deposits comprise the loose, surficial coversands and the underlying, older, "dorbank" compact, clayey deposits that also are chiefly aeolian sands, with the soils and pedocretes that have formed in them. Fossil bones are sparsely distributed on the palaeosurfaces within these deposits, but are locally abundant in contexts such as interdune deposits, carnivore bone accumulations in burrows and buried Stone Age sites. Trace fossils are ubiquitous and important palaeo-environmental indicators.

The significance rating is low as a consequence of the low probability of finding fossils in the terrestrial deposits. Impact on paleontological heritage does not influence the decision to proceed with the project.

8.9.1 Impact Table – Impact on fossil heritage resources during the construction phase

Nature: Impact on Fossil Resource

Bulk earth works may result in a negative direct impact on the fossil content of the affected subsurface. Fossils and significant observations will be lost in the absence of management actions to mitigate such loss. This loss of the opportunity to recover them and their contexts when exposed at a particular site is irreversible.

Conversely, bulk earth works furnish the "windows" into the coastal plain depository that would not otherwise exist and thereby provide access to the hidden fossils. The impact is

positive for palaeontology, provided that efforts are made to watch out for and rescue the fossils. There remains a medium to high risk of valuable fossils being lost in spite of management actions to mitigate such loss.

The cumulative impact of bulk earth works associated with ongoing various developments is the permanent loss of fossil heritage, or with effective mitigation, the capture and preservation of some fraction of the valuable specimens for posterity.

	Without mitigation	**With mitigation**
Extent	3-5 (regional-international)	3-5 (regional-international)
Duration	5 (permanent loss)	5 (part loss, part gain, perm.)
Magnitude	6 (moderate)	4 (partly rescued)
Probability	2 (improbable)	2 (improbable)
Significance	**Low-Medium (28-32)**	**Low (24-28)**
Status (positive or negative)	Negative	Positive
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Possible loss	Possible gain
Can impacts be mitigated?	Partly	

Mitigation:

» Monitoring of all substantial bedrock excavations for fossil remains by EO/a specialist, with reporting of substantial new paleontological finds (notably fossil vertebrate bones & teeth) to SAHRA for possible specialist mitigation.
» An EO/a specialist should photograph and record the position of fossiliferous material when exposed during construction. If the fossiliferous material is going to be damaged during construction, the EO/a specialist could make an attempt to salvage it and store it safely in order for a professional appointed palaeontologist to collect it at his or her earliest convenience. If however the fossil is part of a skeleton or too big or delicate to remove, paleontological assistance should be called for immediately. Little harm will come to a fossil if it could be collected simply by picking it up (as long as it is numbered and the locality is recorded by means of GPS), but actual excavations should be left to a professional palaeontologist.
» A professional palaeontologist should be appointed to salvage and collect fossiliferous material from the site which may exposed during construction.
» The excavations and collection of fossils should be performed by a qualified palaeontologist and with a permit from the Heritage Western Cape.

Cumulative impacts:
Loss of local fossil heritage. Low.

Residual impacts:
Negative impacts due to loss of local fossil heritage will be partially offset by *positive* impacts resulting from mitigation (*i.e.* improved paleontological database).

8.9.2 Comparative Assessment of power line and Access Road Alternatives

There will be no differences in the significance of impacts on fossils for any of the alternative power line routes. Therefore any of the proposed alternatives are considered acceptable.

There will also be no differences in the significance of impacts on fossils for either of the alternative access routes. Therefore any of the three proposed alternatives are considered acceptable from a fossil impacts perspective.

8.9.3 Implications for Project Implementation

» The potential impact has a low-moderate influence upon the proposed development, consisting of implemented recommended mitigation measures , to be followed during the construction phase.
» As outlined above, the potential for finding important fossils, although low, is not altogether lacking. Interventions are particularly required if bones are uncvered during excavation. These are rare and valuable and every effort should be made to record them and effect rescue of them.
» In the event of possible fossil finds, this must be reported to SAHRA

8.10 Assessment of Potential Social and Economic Impacts

Potential social and economic impacts associated with the proposed wind energy facility are expected during both the construction and operational phases of the development.

The key social and economic issues associated with the **construction phase** are the following as discussed below:

Potential positive impacts:
» Creation of employment and business opportunities, and opportunity for skills development and on-site training.

Potential negative impacts:

» Impacts associated with the presence of construction workers on local communities;
» Increased risks to stock, crops, grazing and farming infrastructure associated with the presence of construction workers;
» Impact of heavy vehicles on local roads;
» Loss of agricultural land associated with construction related activities

8.10.1 Impact Tables - Impacts during the Construction Phase

Based on information provided by Eskom the construction phase will extend over a period of 18-28 months and generate between 200 and 400 (peak) employment opportunities. Of this total approximately 30 % (90) will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 40 % (120) to semi-skilled personnel (drivers, equipment operators), and ~ 30% (90) to low skilled personnel (construction labourers, security staff).

It is likely that the bulk of the skilled labour opportunities are likely to be filled by the staff of subcontractors from outside the study area. The bulk of unskilled and some semi-skilled opportunities would however be available to members from local communities. Members from the local community are likely to be in a position to qualify for the majority of the low skilled and some of the semi-skilled employment opportunities associated with the proposed wind energy facility. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the closure of the Kleinzee mine and the resultant high unemployment levels and limited job opportunities in the area, this will represent an important social benefit.

The total wage bill with the construction of a 300MW wind energy facility (300 employees X 24 months) is estimated to be in the region of R 110 million. This is based on the assumption that the average monthly salary for low, semi and skilled workers is R 5 000, R 12 000 and R 30 000 respectively. A portion of this total will be spent in the local economy which will benefit local businesses.

The sector of the local economy that is most likely to benefit from the proposed development is the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. In terms of accessibility the majority of the construction workers from outside the area are likely to be accommodated in Kleinzee.

The local hospitality industry will also benefit from the accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to onsite construction workers but also to consultants and product representatives associated with the project.

	Without Mitigation	**With Enhancement**
Extent	Local – Regional (2) (Rated as 2 due to potential opportunities for local communities and businesses)	Local – Regional (3) (Rated as 3 due to potential opportunities for local communities and businesses)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Moderate (6)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (44)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	

Enhancement:

Employment

» Where reasonable and practical, Eskom should appoint local contractors and implement a 'locals first' policy, especially for semi and low-skilled job categories;

» Prior to commencement of the construction phase, Eskom should meet with representatives from the **Nama Khoi Local Municipality** (refer to as NKLM hereafter) to establish the existence of skills and unemployment databases for the relevant

municipal areas. If such databases exists, they should be made available to the appointed contractors;
» The local authorities, community representatives and organisations on the interested and affected party database should be informed of the final decision regarding the project and the potential job opportunities for locals and the employment procedures which Eskom intends to implement during the construction phase;
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.

Business
» Eskom should develop a database of local companies, specifically companies that qualify as BBBEE companies, which qualify as potential service providers (e.g. construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;
» Where possible, Eskom should assist local BBBEE companies to complete and submit the required tender forms and associated information;
» The NKLM, in conjunction with representatives from the local hospitality and retail industries, should identify strategies aimed at maximising the potential benefits associated with the project.

Cumulative impacts:
Opportunity to up-grade and improve skills levels in the area. However, due to relatively small number of local employment opportunities and limited skills range, this benefit is likely to be limited.

Residual impacts:
Improved pool of skills and experience in the local area. However, due to relatively small number of local employment and skills-transfer opportunities this benefit is likely to be limited.

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour of male construction workers, including:
» An increase in alcohol and drug use;
» An increase in crime levels;
» An increase in teenage and unwanted pregnancies;
» An increase in prostitution; and
» An increase in sexually transmitted diseases (STDs).

The construction of the proposed 300 MW Kleinzee wind energy facility will create approximately 300 employment opportunities. The findings of the SIA indicate that the potential impact of outside construction workers on the local community is an issue of

concern. In this regard problems were experienced with construction workers housed in or near Kommagas/ Buffelsrivier during the tarring of R355 from Springbok to Buffelsrivier and the construction of the Eskom substation near Kommagas.

The potential risk to local residents in the area could potentially be mitigated by implementing a local employment policy, specifically for the low and semi-skilled employment opportunities associated with the construction phase. Employing members from the local community to fill the low-skilled job categories would reduce the risk and mitigate the potential impacts on the local communities. These workers will be from the local community and form part of the local family and social network and, as such, the potential impact will be low. However, due to the potential mismatch of skills and low education levels, the potential employment opportunities for the members from these local communities may be low.

Eskom has indicated that construction workers will not be accommodated on site and will be transported to and from the site on a daily basis. The findings of the SIA indicate that non-local workers can be accommodated in the DBC hostels in Kleinzee which are currently vacant. There are a total of 384 rooms and DBC would like to see these facilities used. This issue would need to be discussed with the NKLM who are currently in the process of taking over the running of these and other services from DBC.

The potential risks posed by construction workers to the local community can be reduced to low by employing members from the local community. While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

	Without Mitigation	***With Mitigation***
Extent	Local (3) (Rated as 3 due to potential severity of impact on local communities)	Local (1) (Rated as 1 due to potential severity of impact on local communities)
Duration	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)	Short term for community as a whole (2) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Low for community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Low for the community as a whole (27)** **Moderate-High for specific individuals who may be affected by STDs etc. (54)**	**Low for the community as a whole (21)** **Moderate-High for specific individuals who may be affected by STDs etc. (48)**

Status	Negative	Negative
Reversibility	No in case of HIV	No in case of HIV
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

Mitigation:

» Where possible, Eskom should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks.

» The proponent and the contractor should develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation.

» Eskom and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase.

» The movement of construction workers on and off the site, specifically construction workers from outside the area, should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting non-local workers to and from site on a daily basis.

» The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the construction phase. This would reduce the risk posed by construction workers from outside the area on local family structures and social networks.

» It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Cumulative impacts:

Impacts on family and community relations that may, in some cases, persist for a long period of time. Where unplanned / unwanted pregnancies occur, or members of the community are infected by an STD, specifically HIV, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

***Residual impacts*:**

Community members affected by STDs etc. and associated impact on local community and burden services etc.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site

The movement of construction workers on and off the site poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Stock losses may also result from gates along access roads being left open and/or fences being damaged. The

issue of trespassing, stock theft and illegal hunting were raised as concerns by commercial farmers and Kleinzee Farmers Union. In this regard the majority of commercial farms are located to the south of the Buffels River, near the proposed Eskom wind energy facility site. The local farmers interviewed indicated that stock theft was increasingly becoming an issue on commercial farms, especially since De Beers Consolidated (DBC) had closed down Kleinzee its operations. Illegal hunting of small antelope, etc. (mainly with dogs, but also small calibre rifles) and removal of tortoises was also reported as a growing problem in area. The area is also rich in rare succulents which have a high value on the black market.

All of the parties interviewed indicated that no construction workers should be accommodated on the site. The findings of the assessment indicate that the risk to livestock and game with mitigation is Low Negative. The potential risks can therefore be effectively mitigated.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Medium Term (3)	Medium Term (3)
Magnitude	Moderate (6) (Due to reliance on agriculture and livestock for maintaining livelihoods)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes

Mitigation:

The mitigation measures that can be considered to address the potential impact on livestock, game, and farm infrastructure include:

» Eskom should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be proven to be associated with construction workers. This should be contained in tender documents for contractors and the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover losses and costs associated with fires caused by construction workers or construction related activities (see below).

» The EMPr must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.

» Contractors appointed by Eskom should ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.

» Contractors appointed by Eskom should ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure should be charged as per the conditions contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation;

» The housing of construction workers on the site should be limited to security personnel.

***Cumulative impacts*:**
None***,*** provided losses are compensated for
Residual impacts:
Not applicable if losses are compensated for

***Nature*:** Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of veld fires

The presence of construction workers and construction-related activities on the site can poses an increased risk of veld fires that in turn pose a threat to the natural vegetation, farmsteads, livestock and wildlife in the area. In the process, farm and tourism infrastructure may also be damaged or destroyed and human lives threatened. The issue of fire has been raised as a key concern by most farmers in the area. In the case of the proposed Kleinzee wind energy facility site the sparse, succulent vegetation on the site is not prone to veld fires. In addition, none of the famers interviewed indicated that this was an issue of concern.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (21)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

» Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas;
» No smoking on the site, except in designated areas should be permitted;
» Contractor should ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy winter months;
» Contractor should provide adequate fire fighting equipment on-site.
» Contractor should provide fire-fighting training to selected construction staff.
» As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

» The landowners and Eskom should also ensure that they join the local fire protection agency.
***Cumulative impacts*:** No, provided losses are compensated for.
***Residual impacts*:** Potential loss of income and impact on livelihoods and economic viability of affected farms.

Nature: Potential impacts to road surfaces and road safety associated with the movement of construction related traffic to and from the site

The establishment of a wind energy facility requires abnormal loads associated with the transport of turbine components onto site. These will include abnormally long loads associated with ~ 60 m rigid turbine blades, as well as abnormally heavy loads associated with ~ 80 tonne nacelles. In addition, a crawler crane (~ 750 t) and assembly cranes will also need to be transported onto and off the sites. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc. At the time of undertaking the SIA no detailed information was available on the number of heavy vehicle trips associated with the construction phase.

Access to the site is likely to be via the R355 Springbok-Buffelsrivier Road This road provides access to small scale mines along road, De Beers land, and communal grazing areas around Kommagas and Buffelsrivier. Potential delays associated with abnormal loads may develop along the road due to the mountainous terrain and at the Spektakel Pass. These delays would impact on other road users, including tourists. The local traffic authorities should therefore be informed of the dates and times of abnormal load trips. In addition, trips during peak tourism season periods, namely the Easter weekend, flower season (August-September) and December holidays should be avoided. Traffic related impacts are also likely to occur along sections of the N7, specifically the section between Piketburg and Vredendal. This section of the N7 includes the Pikeneiers Pass and is narrow, with limited overtaking sections. The potential for delays is therefore significant. The timing of abnormal loads along this section of the N7 will need to be carefully planned to minimize the impact on other road users.

	Without Mitigation	**With Mitigation**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

***Mitigation*:**
Potential impacts on roads can be effectively mitigated. Detailed mitigation measures should

be outlined in the EMPr, and should include:

» The timing of abnormal loads along the N7, specifically the section between Piketburg and Vredendal will need to be co-ordinated with local and provincial traffic authorities. This section of the N7 is narrow, with limited overtaking sections. The potential for delays is therefore significant. The movement of heavy vehicle traffic should therefore, where possible, be planned to avoid the peak tourist season periods (Easter weekend, flower season (August-September) and December holidays).
» Movement of construction traffic should be limited to weekdays. In addition, the movement of heavy vehicles on the local roads, specifically the N7, R355 and Kommagas gravel road should not be permitted after 13h00 on Friday afternoons and before 09h00 on Monday mornings as these are times that are likely to impact on weekend visitors to the area.
» The contractor should inform local farmers and representatives from the NKLM and Tourism Sector of dates and times when abnormal loads will be undertaken.
» The contractor should ensure that damage caused to roads by construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the developer.
» All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Cumulative impacts:

If damage to roads due to construction activities is not repaired then this will impact on the farming activities in the area and also result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.

Residual impacts:

Degraded quality of road surfaces and impact on road users.

Nature: The activities associated with the construction phase, such as establishment of access/haul roads, the movement of heavy vehicles, the establishment of lay-down areas and foundations for the wind turbines, substations and power lines will potentially damage top-soils and vegetation and result in losses of the grazing resource.

Activities such as the establishment of access roads, the movement of heavy vehicles, the establishment of lay-down areas and foundations for the wind turbines, as well as the establishment of substations and power lines will impact on farmland and the natural vegetation. Eskom has indicated that workers will not be accommodated on site. As such no construction camps will be established.

The nature of the impact on farmland and natural vegetation associated with the construction of each phase of the project will essentially be the same. However, the area affected will be larger. However, the use of the land is for grazing is limited due to its low carrying capacity. The findings of the assessment indicate that the impact on farmland and the potential loss of grazing with mitigation is Low Negative. The potential risks can therefore be effectively mitigated.

The impacts associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase. Recommended

mitigation measures are outlined below. In addition Trans Hex is in the process of purchasing the land with a view to possible future diamond mining.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long term-permanent if disturbed areas are not rehabilitated (5)	Short term if damaged areas are rehabilitated (1)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (18)**
Status	Negative	Negative
Reversibility	Yes, but long period required	Yes, but long period required
Irreplaceable loss of resources?	No. Affected land can be restored, provided appropriate rehabilitation is implemented. Due to the aridity of the area, effective rehabilitation may however take long to achieve, and may prove costly.	
Can impact be mitigated?	Yes, provided efficient site rehabilitation is carried out.	

***Mitigation*:**

The potential impacts associated with damage to and loss of farmland can be effectively mitigated. The aspects that should be covered include:

» The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.
» An Environmental Control Officer (ECO) should be appointed to monitor the construction phase.
» All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.
» The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up a suitably qualified ecologist.
» The implementation of the Rehabilitation Programme should be monitored by the ECO

Cumulative impacts:

Overall loss of farmland could impact on the livelihoods of the affected workers on the farms and their families. However, disturbed areas can be rehabilitated. In addition, carrying capacity of the area is low.

Residual impacts:

With mitigation, the potential impacts on farming activities and livelihoods as a result of damage to and or loss of farmland are assessed to be of low significance due to the relatively small are of land likely to be affected

The key social issues associated with the **Operation phase** are the followings as discussed below:

Potential positive impacts

» Creation of employment and business opportunities. The operational phase will also create opportunities for skills development and training.
» Benefits associated with the establishment of a Community Trust.
» The establishment of renewable energy infrastructure.

Potential negative impacts

» The visual impacts and associated impact on sense of place and the character of the landscape.
» Potential impact on tourism.

8.10.2 Impact Tables: Impacts during operation

Based on information from other wind energy facilities the establishment of a 300 MW wind energy facility will create approximately 10-15 permanent employment opportunities over the operational phase is expected to last 20 years. Of these totals approximately 20% will be available to skilled personnel and 80% to semi and low skilled personnel. The employment opportunities associated with the operational phase are therefore limited.

Members from the local community are likely to be in a position to qualify for the majority of the low skilled and some of the semi-skilled employment opportunities associated with the proposed wind energy facility. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community.

Due to the need for specialised skills it may be necessary to import the required operational and maintenance skills from other parts of South Africa or even overseas. However, it will be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the Namaqua District Municipality (NDM) and NKLM IDP. The NDM and NKLM IDP Managers and Ward 8 councillor all indicated that Kommagas and Buffelsrivier should benefit from employment and meaningful skills development and training associated with the proposed project. In this regard Eskom has indicated that they are committed to local employment and the implementation of a training and skills development programme for members from the local community.

Given the location of the proposed wind energy facility the majority of permanent staff is likely to reside Kleinzee. In terms of accommodation options, a percentage of the new permanent employees may purchase houses in Kleinzee while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the annual wage bill earned by permanent staff would be spent in the regional and local economy. This will benefit local businesses in the local towns in the area. The benefits to the local economy will extend over the 20-year operational lifespan of the project. The local hospitality industry is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

	Without Mitigation	**With Enhancement**
Extent	Local and Regional (2)	Local and Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (30)**	**Medium (52)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:

The enhancement measures listed in Section 8.10.1 for construction phase to enhance local employment and business opportunities during the construction phase, also apply to the operational phase. In addition:

» Eskom should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of people from local communities and the broader NKLM area employed during the operational phase of the project.

Cumulative impacts:

Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area

Residual impacts:

Creation of pool of people with experience in field of wind energy facilities who are economically mobile

***Nature*:** Promotion of clean, renewable energy

South Africa currently relies on coal-fired power stations to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions. The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively moderate. However, the 200 MW produced will help to offset the total carbon emissions associated with energy generation in South Africa.

	Without Mitigation	**With Mitigation**
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (56)**	**Medium (56)**

Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	

***Enhancement*:**

In order to maximise the benefits of the proposed project, Eskom should:

» Use the project to promote and increase the contribution of renewable energy to the national energy supply.

» Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.

***Cumulative impacts*:**

Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.

***Residual impacts*:**

Increased awareness of and acceptance of renewable energy supply options

***Nature*:** Visual impact associated with the proposed wind facility and the potential impact on the areas rural sense of place.

The site is located in a region that has been disturbed by diamond mining. In addition the development area is roughly bisected from south to north by the DBC Koiingnaas-Kommagas tar road. An existing 66 kV line and a Telkom line (in places) are currently aligned along the road. A number of borrow pits are also located adjacent to the road. A small Eskom substation is also located adjacent to the road (near Kommagas gravel road turnoff). The northern portion of the development area is traversed by the DBC Kommagas gravel road ("rooipad"). The Namaqua National Park (NNP) is located ~30 km to the south-east of the proposed Kleinzee wind energy facility development. The bulk of the proposed development area appears to be located just outside the NNP's demarcated Priority Natural Area, although some turbines in the extreme south and east may not be.

The potential visual impacts associated with the proposed wind energy facility, specifically the wind energy facility component, were not identified as a key issue by any IA&Ps (including residents and Kleinzee tourism interest). On the contrary, the establishment of the proposed wind energy facility was seen as an opportunity to attract tourists to the area (see tourism below). The property that is most likely to be affected by the proposed wind energy facility is Steenvlei and the Die Houthoop Guest Farm on the property. A cluster of 5 turbines are proposed ~600 m – 1.7 km west of Die Houthoop. Power line Alternatives 3 and 4 are located <2 km to the north and south of the residential/ accommodation cluster on Die Houthoop. The nearest other inhabited residential structures in relation to the proposed turbines and power lines are on Rooivlei (Engelbrecht), ~3 km from the nearest turbines.

	Without Mitigation	**With Mitigation**
Extent	Local and regional (3)	Local and regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)

Significance	**Moderate (33)**	**Moderate (30)**
Status	Negative	Negative
Reversibility	Yes. Wind turbines and other infrastructure can be removed.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	No	
***Mitigation*:** None		
Cumulative impacts: Potential impact on current rural sense of place due to numerous developments in the area.		
Residual impacts: Alteration of areas sense of place from a rural landscape to a more industrialised landscape. Alteration would not be permanent if turbines and infrastructure are removed during decommissioning		

Nature: Potential impact of the Wind facility on local tourism

The impact on tourism is linked to the visual impact of the wind turbines on the areas sense of place and landscape character. The findings of the SIA indicate that the Garies-Kleinzee route (and then either R355 or Kommagas Road to Springbok) has been identified as a potential tourism development corridor/ scenic circular route in Kamiesberg SDF. However, no decision has been taken by the NKLM on this matter as yet. The development of the route is therefore unlikely in medium term. The findings of the SIA also indicate that the local tourism sector and I&APs in the area did not believe that wind turbines would impact negatively on the tourism potential of the area. Wind turbines were not viewed as being incompatible with local landscape and the areas sense of place. Representatives from the local authority also indicated that the promotion of the local "green" tourism growth strategy may benefit, and tie-in with other "greening" projects in the area, such as the DBCs dune veld rehabilitation south of Kleinzee).

As indicated above, the potential visual impacts associated with the proposed project, specifically the wind energy facility component, were not identified as an issue by any IA&Ps. The local tourist representatives also indicated that the proposed wind energy facility could be used to attract tourists to the area. The proposed wind energy facility may impact negatively on the experience of visitors to the Die Houthoop Guest Farm. A cluster of 5 turbines are proposed ~600 m – 1.7 km west of Die Houthoop. Power line Alternatives 3 and 4 located <2 km to the north and south of the residential/ accommodation cluster on Die Houthoop. In terms of the Namaqua National Park (NNP), the bulk of the proposed development area appears to be located just outside the NNP's demarcated Priority Natural Area, although some turbines in the extreme south and east may not be. These turbines may need to be relocated.

No designated scenic routes are located in the study area. The Kamiesberg LM SDF does, however, propose the development of a tourism corridor between Koiingnaas and Kleinzee in the medium term or longer. At present the road is DBC property, and the NKDM has not made any policy decision with regard to the proposed tourism development route (Hartley – pers. comm).

	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local–Regional (1)	Local–Regional (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (27)
Status	Negative Positive	Negative Positive
Reversibility	Yes, turbines and PV panels can be removed	Yes, turbines and PV panels can be removed
Irreplaceable loss of resources?	No, turbines can be removed	No, turbines can be removed
Can impact be enhanced?	Yes	
***Enhancement*:** » The above impact cannot be mitigated fully; however Eskom should liaise with representatives from the NKLM and local tourism representatives to raise awareness of the proposed facility. » Eskom is proposing a visitor centre within he wind facility, the centre should include a viewing area where passing visitors can stop and view the site.		
***Cumulative impacts*:** The wind energy facility has the potential to impact on the experience of tourist and the tourism potential of the area in general in both a negative and positive manner		
***Residual impacts*:** Alteration of areas sense of place from a rural landscape to a more industrialised landscape, which in turn may impact on tourism. Alteration would not be permanent if turbines and infrastructure are removed during decommissioning		

8.10.3 Comparative Assessment of power line and Access Road Alternatives

The findings of the visual impact assessment (Section 8.6) indicate that although Alternative 4 has the highest visual impact index due to a high viewer incidence, it follows an existing power line route. From a visual impact perspective it is preferable to concentrate new impacts together with existing infrastructure of a similar nature as a form of mitigation. Alternatives 1, 2, and 3 would present new visual impacts on an area already recognised for its sense of place, as well as disturb otherwise largely pristine vegetated areas with new servitude corridors. From a visual impact standpoint the preferred option for the overhead power line is thus Alternative 4, based on the findings of the VIA, *Alternative 4 is supported by the SIA*.

There will be no differences in the significance of social impacts for any of the alternative access roads. Therefore any of the proposed alternatives are considered acceptable from a social perspective.

8.10.4 Implications for Project Implementation

The findings of the SIA indicate that the development of the proposed Kleinzee wind energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project. This represents a significant social benefit for an area where there are limited opportunities due to the recent closure of the Kleinzee Mine.

In terms of potential visual impacts, the proposed Kleinzee wind energy facility is located in an area that has been disturbed by diamond mining and is traversed by an existing 66 kV line and a Telkom line. A number of borrow pits are also located adjacent to the road. The Namaqua National Park (NNP) is located ~30 km to the south-east of the proposed Kleinzee wind energy facility development. The bulk of the proposed development area is located outside the NNP's demarcated Priority Natural Area, although some turbines in the extreme south and east may need to be relocated. The potential visual impact on the areas sense of place is therefore not regarded as a key issue. This was confirmed by the comments from the key stakeholders interviewed as part of the SIA. The area is therefore regarded as a suitable site for the establishment of a wind energy facility from a social perspective.

The proposed development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

8.11 The No Go Option

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions.

The No-Development option would represent a lost opportunity for South Africa to supplement its current energy needs with clean, renewable energy. Given South Africa's position as one of the highest per capita producer of carbon emissions in the world, this would represent a negative environmental and social cost.

In addition, the No-Development option would not contribute to the objectives of the NKLM IDP and LED to create employment and support economic development.

However, at a provincial and national level, it should be noted that the Kleinzee wind energy facility is not unique. In that regard, a significant number of wind energy facility developments are currently proposed in the Northern Cape Provinces. Foregoing the proposed Kleinzee wind energy facility would therefore not necessarily compromise the development of renewable energy facilities in the Northern Cape or South Africa. However, the benefits to the NKLM and the Kleinzee communities would be lost should the facility not be developed.

The generation of electricity from renewable energy resources in South Africa offers a number of socio-economic and environmental benefits. These benefits are explored in further by NERSA (March 2009), and include:

» **Increased energy security:** The current electricity crisis in South Africa highlights the significant role that renewable energy can play in terms of supplementing the power available. In addition, given that renewables can often be deployed in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality, while reducing expensive transmission and distribution losses.
» **Resource saving:** Conventional coal fired plants are major consumers of water during their requisite cooling processes. It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres, when compared with wet cooled conventional power stations. This translates into revenue saving of R26.6 million. As an already water stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly as the detrimental effects of climate change on water availability are experienced in the future.
» **Exploitation of our significant renewable energy resource:** At present, valuable national resources (including biomass by-products, solar insulation and wind) remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio.
» **Pollution reduction:** The releases of by-products of fossil fuel burning for electricity generation have a particularly hazardous impact on human health, and contribute to ecosystem degradation.
» **Climate friendly development:** The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner, contributing to the mitigation of climate change through the reduction of greenhouse gas emissions. South Africa as a nation is estimated to be responsible for 1% of global GHG emissions and is currently ranked 9th worldwide in terms of per capita CO_2 emissions.
» **Support for international agreements and enhanced status within the international community:** The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its

international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

» **Employment creation:** The sale, development, installation, maintenance and management of renewable energy facilities have significant potential for job creation in South Africa.
» **Acceptability to society:** Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.
» **Support to a new industry sector:** The development of renewable energy offers an opportunity to establish a new industry within the South African economy.
» **Protecting the natural foundations of life for future generations:** Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission power lines on an on-going basis. With current energy and electricity demands within the country projected to continue increasing, new investments in electricity generation and transmission capacity are required. Eskom is currently expanding its electricity generation, transmission and distribution capacity through the construction of additional power stations and power lines and associated infrastructure. In addition to these, other clean electricity generation projects are being investigated. Since the capacity expansion programme started in 2005, an additional 4453.5 MW has already been commissioned. The plan is to deliver an additional 16 304MW in power station capacity by 2017. Ultimately Eskom will double its capacity to 80 000MW by 2026 (www.eskom.co.za). In line with Government's targets for renewable energy, Eskom plans to include at least 1600MW of renewable energy (wind and solar) within the electricity generation mix (*extract from Eskom's Climate Change Commitment - The 6 Point Plan*).

Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (GN R543) as meaning "the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area".

Due to the growth in interest in renewable energy developments in South Africa, it is important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts are considered and minimised where required and possible. This chapter considers whether the proposed wind energy facility project's potential impacts become more significant when considered in combination with the other approved or proposed wind energy facility projects within the area.

9.1 Approach Taken to Assess Cumulative Impacts

The cumulative effect or impacts are presented in terms of impacts potentially occurring due to the cumulative effects of the Kleinzee Wind Energy Facility together with other renewable energy facilities proposed to be constructed within the region. These impacts will be registered throughout the broader region requiring mitigation through planning at a regional level.

Significant cumulative impacts that could occur due to the development of the wind energy facility and its associated infrastructure in proximity to other facilities include impacts such as:

» Visual impacts;
» Socio impacts;
» Loss of vegetation and impacts on ecology;
» Impact on bats;
» Impact on birds;
» Impacts to soil;
» Impacts on heritage and paleontological resources.

9.2 Cumulative Impacts of Renewable Energy Facilities in the Kleinzee area

A number of renewable energy developments have been proposed within less than 40km of the proposed Kleinzee Wind Energy Facility, as described in Table 9.1 and indicated on Figure 9.1.

Table 9.1: Renewable wind energy facilities within the broader region based on (information available at the time of compiling this report)

Project Name	Distance from the proposed site	Project Status (based on most recent data available)
Kleinzee Wind Energy Facility	Subject of this report	In process
Project Blue wind energy facility	10km north	Authorised
Koingnaas Wind Energy Facility	35km south	Authorised
Kannikwa Vlakte Wind Energy Facility	40km north	Authorised

As there is uncertainty as to whether all the above-mentioned developments will be implemented, it is also difficult to quantitatively assess the potential cumulative impacts. It is, however, important to explore the potential cumulative impacts qualitatively as this will lead to a better understanding of these impacts and the possible mitigation that may be required. As these cumulative impacts are explored in more detail the trade-offs between promoting renewable energy (and the associated benefits in terms of reduction in CO_2 emissions – a national interest) versus the local and regional environmental and social impacts and benefits (i.e. landscape, ecology, tourism, , employment etc.) will become evident. It is only when these trade-offs are fully understood, that the true benefits of renewable energy can be assessed.

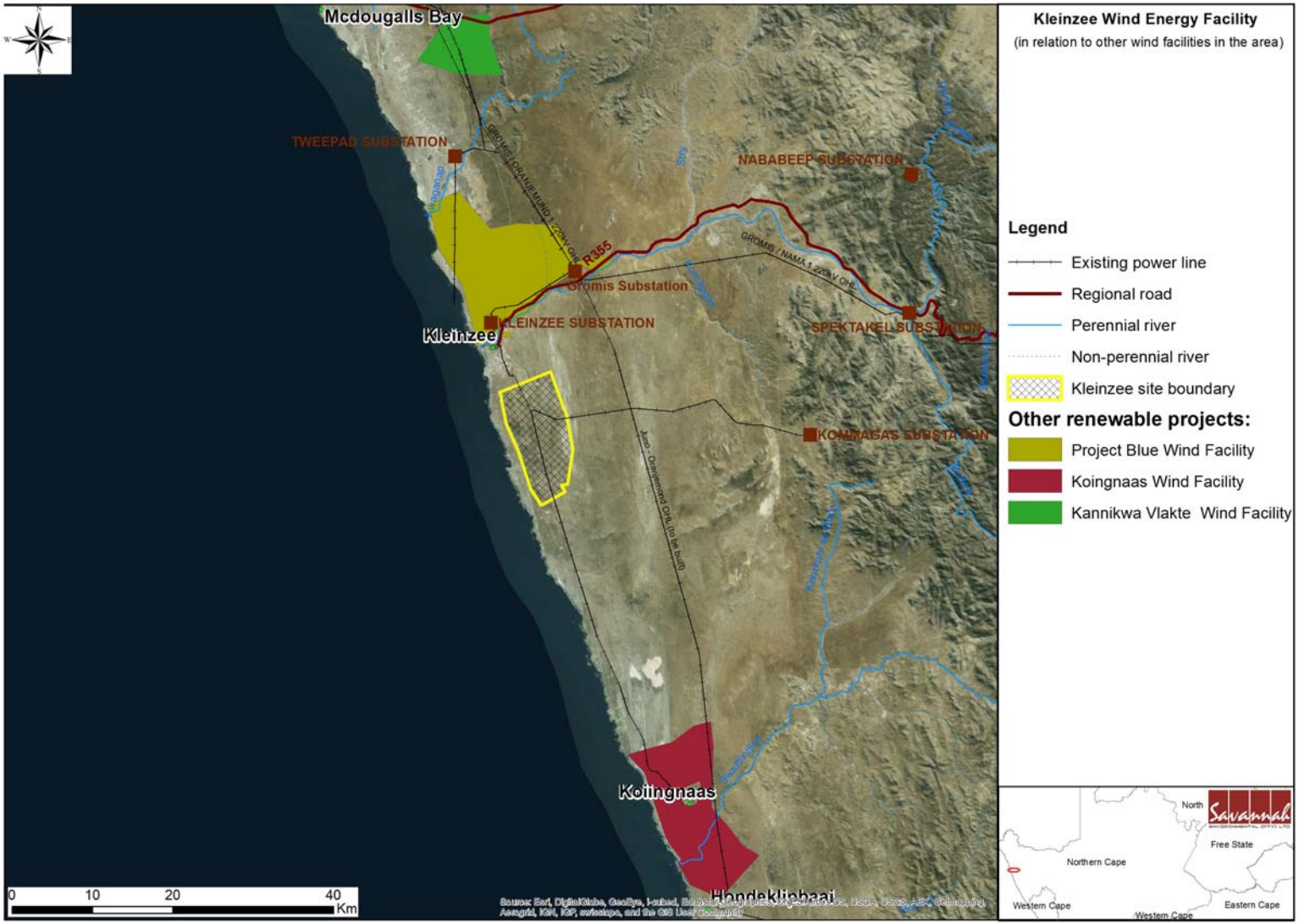

Figure 9.1: Map showing other wind projects within 40km of the Kleinzee Wind Energy Facility

9.2.1 Cumulative Impacts on Ecological Processes

The major cumulative impact from an ecological perspective would be the contribution to loss of Namaqualand Coastal Duneveld. This vegetation type is 'least threatened' and occurs over wide expanses. In terms of the other wind energy facilities proposed in the region, the Koingnaas Wind Energy Facility is located within a highly disturbed mining area whereas the other two are located in Namaqualand Strandveld. The Kleinzee Wind Farm is proposed in an area of both Namaqualand Coastal Duneveld and Namaqualand Strandveld. The overall cumulative impacts that the Kleinzee Wind Farm would contribute to loss of Namaqualand Coastal Duneveld are anticipated to be *low* as neither of the other facilities in the region impact on this vegetation type.

Cumulative impacts of developments on population viability of species can be reduced significantly if new developments are kept as close as possible to existing developed and/or transformed areas or, where such is not possible, different sections of a development are kept as close together as possible. New power lines for example, should follow routes of existing servitudes if such exist; renewable energy facilities should be constructed as close as possible to existing infrastructure or substations. In the case of the Kleinzee wind energy facility, sensitivities have been considered within the revised layout in Figure 10.2 in order to minimise impacts as far as possible.

9.2.2 Cumulative Impacts on Avifauna

If resident territorial birds are impacted by turbines for example, then other individuals could migrate into the area to take up the vacant territory. Thus for the large number of bustards that may reside in the area, the impact may be greater than just around the immediate vicinity of the wind farm. That they were found in the Project Blue site north of this project indicates that bustards are widespread in the area and regularly move in and out in winter. A wide-spread population reduction may occur as a result of the wind facility acting as a sink.

If several wind farms are developed in one area, resulting in displacement and/or mortality of a range-restricted species, then they may have a wide-spread influence cumulatively even if the individual wind farms do not have a major impact. Furthermore, if the wind farm is enlarged, or developed closer to the ocean, then bird movements may be influenced negatively. Cumulative impacts for raptors such as the snake eagles and Secretarybirds may be present if the mortality results in other territorial birds moving into the area. The other wind farms proposed in the area may have a cumulative impact on the species detailed above. However, with the appropriate pre- and post-construction monitoring, potential impacts can be mitigated through correct turbine and overhead line placement and design.

9.2.3 Cumulative Impacts on Bats

With the exception of the town of Kleinsee, where several bat roosts occur, it is anticipated that the low occurrences of roosts is similar for the immediate surrounds of the site However, where the habitat becomes more heterogeneous and rocky to the north, east and west, impacts on roosts due to construction activity could be greater. The impact on roosts due to the Kleinsee Wind Farm Facility alone is considered of Low significance, and as there are no major roosts surrounding Kleinsee and considering that other facilities will also avoid developing their turbines with 500m of buildings, the cumulative impact when considering other facilities within a 40km radius of the site is still considered to be of a Low significance.

The evidence of seasonal migration is particularly important in terms of cumulative impacts. Whilst there are no publications yet to support this, there are discussions amongst bat biologists in SA that it is very possible that bats use the coastlines as migratory routes up and down the coastline areas. If this is true, then the cumulative impact of several wind farms along the west coast, as planned north and south of Kleinzee, could be devastating on migratory species populations, such as Miniopterus natalensis. These impacts could have far reaching consequences, not only locally, but regionally too. Isotope studies in Europe have revealed that wind farms may kill bats from populations more than 1,000km away (Voigt *et al*. 2012). Fatality of bats from potentially large geographic areas could have a devastating, long-term impact on species.

9.2.4 Cumulative Impacts on Soil, Geology and Agricultural Resources

The cumulative impact on soils and agricultural potential of multiple projects in the region is offset by major limitations to agriculture in the area due to the aridity and lack of access to water, as well as the shallow soils prevailing within the region. The potential loss of agricultural land will be very low as a result of the construction of numerous facilities at a regional level. Future possible developments of this nature may occur due to the favourable wind resource in the area and will have an increasing impact on the geological and hydrological environment. However, each case must be assessed on an individual basis to weigh the costs against the benefits. With the implementation of appropriate mitigation measures, impacts in this regard would be minimised. The cumulative impact on soils and agricultural potential is therefore expected to be low. At a broader scale, renewable energy sources are more sustainable than conventional mineral-based sources and can have a significant long term positive effect on the geological environment in South Africa.

9.2.5 Cumulative Heritage Impacts

Archaeological sites are non-renewable and impacts on any archaeological context or material will be permanent and destructive. The proposed development would have negative implications on the archaeological heritage remains documented within the immediate proposed area, mainly during construction. The negative implications include the destruction of the surface scatters of stone artefacts and stone walling features and associated historical artefacts, as well as further occurrences that are not immediately visible. The recommendations in the heritage report (**Appendix H**) must be considered as appropriate mitigation measures to protect and conserve the archaeological heritage remains observed within the proposed development area and further archaeological remains that may occur and are not immediately visible on the surface. Therefore, the contribution of the proposed facility to the cumulative impact in this regard is expected to be of medium significance due to the irreplaceable loss of archaeological heritage resources in the region.

In the absence of comprehensive data on paleontological heritage studies for alternative energy or other developments in the Kleinzee area, it is impossible to realistically assess cumulative impacts on fossil heritage resources. No desktop or field-based paleontological studies are represented on the SAHRIS database for the Kleinzee area. The potentially fossiliferous sedimentary rock units represented within the present study area (*e.g.* Hoedemaker Member, alluvium, calcretes, surface gravels) are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impact on fossil heritage resources posed by potential alternative energy developments in the region is *low*.

9.2.6 Cumulative Visual Impacts

From a visual perspective, the terrain surrounding the proposed site is generally flat, sloping gently westwards towards the shore. It is evident from the viewshed that the facility will have a large core area of potential visual exposure within a 5km offset. It is envisaged that the turbine structures would be highly visible to limited numbers of observers (i.e. people travelling along roads and residing in Kleinzee, Melkbospunt and Grootmis) and would constitute a high visual prominence, especially within a 10km radius, potentially resulting in visual impact. The construction of wind turbines together with other proposed project in the area will increase the cumulative visual impact of industrial type infrastructure within the region. Therefore, in terms of cumulative impact, the proposed Kleinzee Wind Energy Facility will result in an increased visual impact

9.2.7 Cumulative Noise Impacts

The impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noise as well as other noisy activities conducted in the same area. Noise impacts during construction are however not expected to be significant due largely to the short-term duration of these activities.

Noise modelling of the Kleinzee wind energy facility revealed that the projected cumulative noise levels due to the operation of the wind turbines is not significant when considering the ambient sound levels as measured on site. The significance of the cumulative noise impact from the wind turbine will be low. The cumulative noise impact associated with all the wind energy facility has also been assessed to be of low significance based on the fact that there are few noise sensitive areas nearby and no authorised similar developments in close proximity of the site.

9.2.8 Cumulative Socio-Economic Impacts

Negative impacts on the social environment as a result of the establishment of a number of renewable energy facilities in the region is largely related to the impact on the visual character of the region, and will impact negatively on the landscape and the area's rural sense of place and character. The construction of the proposed wind energy facility will increase the cumulative visual impact of wind energy infrastructure within the region, should all proposed facilities be constructed.

The development of large-scale renewable energy projects in the region will likely draw a large number of labour, businesses and jobseekers. If the local labour force cannot be sourced locally or the local labour pool is inadequate for the wind energy projects, outside labour will likely move to the area to fill the available positions. The area may experience an influx of new residents who may move to the area looking for job opportunities; which will have effects on the existing population during the construction period and could entail problems of housing, sanitation, water usage and solid waste disposal. Employment at a wind energy facility peaks during construction and significantly declines during operation; since relatively few workers while in operation. Though there may be an influx of workers during construction, these workers are largely temporary. Rapid population growth is a common experience in rural towns near new large development projects. Towns with larger populations (greater than 1000 individuals) and with developed services will likely experience greater rates of population growth than areas without developed services. If more than one facility is constructed at one time, these impacts would be compounded, adding to the potential significance of the impact.

The establishment of the proposed Kleinzee wind facility and other similar facilities in the region has the potential to create a number of socio-economic opportunities

for the local municipality and district municipality, which, in turn, will result in a positive social benefit. This could result in positive permanent impacts on the economy, business development, stimulation of the local property market, employment and education as well as creation of downstream business opportunities in the region and the province. The cumulative impacts are likely to have significant positive impacts on the local economy. The significance of this impact is rated as a high positive with enhancement.

Although it is considered unlikely that all projects will be constructed simultaneously with the Kleinzee wind facility, the construction of more than one project simultaneously could potentially lead to an exacerbation or compounding of potential negative social impacts identified due to the intensity of such impacts, including:

» Degradation of access roads - Apart from main access road through the area, there is little development of a similar nature in the area. The current development would add 70km of roads within a concentrated area giving rise to a significant cumulative impact from roads.
» Traffic congestion
» Nuisance impact on adjacent landowners
» Impact on farming practices
» Security issues
» Labour unrest

9.3 Conclusion regarding Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities within 40km of the study area. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. Although there is little other transformation in the vicinity of the development, the area further north around Kleinsee has been heavily impacted by diamond mining activities. The development would therefore contribute to cumulative habitat loss in the wider area. The habitats affected are however somewhat different as the mining is concentrated in the coastal plain, while the wind farm development is further inland. In addition, the limited footprint of the wind energy facility will limit this impact.

The alignment of renewable energy developments with South Africa's National Integrated Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kleinzee Wind Energy Facility have been summarised below:

Cumulative impacts	Significance rating
Visual impact	High
Noise impact	Low
Social impact- positive impact (social and economical value)	High
Social Impact- negative impacts (visual, sense of place, noise and disturbance during construction)	Medium
Ecological Impact	Medium
Impact on soil and agricultural potential	Low
Impact on Bats	Medium
Impact on Birds	Medium
Heritage impact	Medium
Paleontological impact	Low

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kleinzee wind facility will be acceptable and of **moderate significance** provided that environmental impacts are mitigated to suitable standards by strict control and implementation of EMPrs for the project.

It is important to note that it is unlikely that all proposed renewable energy facilities located in the 40km radius will be constructed in the short to medium term (i.e. in the next five years) due to capacity constraints on the Eskom grid and the limits placed on renewable energy targets by the DoE. This will reduce the potential cumulative impacts of the proposed Kleinzee Wind Energy Facility.

CONCLUSIONS AND RECOMMENDATION CHAPTER 10

Eskom Holdings SOC (State Owned Company) **Limited** is proposing the establishment of a wind farm and associated infrastructure on an identified site which is located approximately 6 km south of the mining town of Kleinsee within the Nama Khoi Local Municipality of the Northern Cape Province. This proposed project will be referred to as the **Kleinzee 300 MW Wind Farm**. This development is proposed to comprise a cluster of up to 200 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed over an area of approximately 8 682 ha in extent.

The site is proposed on the following farm portions:

» RE of Brazil 329
» RE of Goraap 323,
» RE of Honde Vlei 325,
» RE of Kannabieduin 324,
» Portion 4 of Rooivlei 327

The project will include the following infrastructure:

» A cluster of up to **200 wind turbines** to be constructed over an area of ~ **8 682 ha** in extent
  * Installed capacity of each turbine up to 3 MW
  * Hub height up to 140 m
  * Rotor Diameter up to 140 m
  * Maximum length of blades is 70 m
» **Concrete foundations** to support the turbine towers (22m wide x 22m length x 3m deep)
» **Mounting area** for erecting of each turbine (also referred to as a laydown area - 40m x 40 m)
» **Cabling** between the turbines to be lain underground where practical
» An on-site **substation** to facilitate the connection between the facility and the electricity grid (100 m x 100 m (including HV yard))
» An **overhead power line** (400kV) feeding into Eskom's electricity grid. Two options are being considered:
  * Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  * Option 2: Turning into the Juno - Gromis power line located to the east of the site[11].

[11] The loop-in lines options has three sub-options referred to as alternative 2-4 in Figure 1.2

» Internal **access roads** between each wind turbine (permanent roads of approximately 7 m wide during construction)
» **Borrow pits** within the site for the construction of access roads
» **Office/Workshop** area for operations, maintenance and storage
» **Information centre** and associated billboards
» **Water supply pipeline** and **Water storage** reservoir and tanks

The environmental impact assessment (EIA) for the proposed Aberdeen Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 33306, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998) and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed development forward as part of the project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

10.1 Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within **Appendices D - M** provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Final EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility and the associated infrastructure, including the substation and overhead power line. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The assessment of potential environmental impacts presented in this report is based on a layout of the turbines and associated infrastructure provided by Eskom. This layout includes 200 wind turbines as well as all associated infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However, a number of impacts of medium to high significance were identified which require mitigation (thereafter the impacts can be reduced to

medium – low significance). Mitigation to avoid impacts are primarily associated with the relocation of certain turbine positions of concern, as well as measures to be utilised during the construction phase to prevent negative impacts from occurring. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented to mitigate the impact. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Programme **(EMPr)** included within **Appendix N**.

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

10.1.1 Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process in terms of the layout of 200 turbines and associated infrastructure, Table 10.1 indicates the significance ratings for the potential environmental and social impacts associated with the project.

As indicated in Chapter 5, the significance weightings for potential impact have been rated as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

Table 10.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Flora		
Loss of vegetation and habitat due to construction of wind turbines, transformers and crane hard-standings	High	Medium
Loss of Namaqualand Salt Pans due to construction of wind turbines, transformers and crane hard-standings.	High	High
Loss of vegetation and habitat due to construction of internal roads and underground cables.	High	Medium
Loss of vegetation and habitat due to	High	Medium

Nature	Without mitigation	With mitigation
construction of overhead transmission lines		
Impacts on Fauna		
Habitat loss for fauna.	Medium-High	Medium
Reduced landscape connectivity	Medium	Medium
Direct Faunal Impacts	Medium	Low
Increased erosion risk.	Medium	Low
Impacts on Avifauna		
Direct mortality, disturbance or avoidance of area around the wind farm for the bird groups identified as at risk, due to disturbance, or impacts with turbine blades and overhead lines (Raptors = R, Ludwig's + Kori Bustard = LKB, Southern Black Korhaan = SBK)	Medium (R), High (SBK,LKB)	Low (R), Medium (LB,SBK)
Impacts on Bats		
Disturbance and/or destruction of bat roosts due to construction activities	Low	Low
Disturbance to and displacement from foraging habitat due to wind turbine and infrastructure construction	Low	Low
Fragmentation of foraging habitat or migration routes due to the presence of the operating wind turbines	Medium	Low
Bat fatalities due to collision or barotrauma while foraging	Medium	Low
Bat fatalities due to collision or barotrauma during migration	High	Medium
Disturbance or displacement of bats due to electromagnetic interference emitted from power lines	Low	Low
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of agricultural land use	Low	Low
Soil Erosion	Medium	Low
Degradation of vegetation	Low	Low
Loss of topsoil	Low	Low
Temporary disturbance of livestock farming activity	Low	Low
Infestation of alien vegetation	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction	Medium	Medium

Nature	Without mitigation	With mitigation
Phase (Positive Impact)		
Potential impacts on family structures and social networks associated with the presence of construction workers	Low	Low
Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site	Medium	Low
Increased risk of fires during construction	Low	Low
Increases traffic on roads due to construction	Low	Low
Damage to and loss of farmland during construction	Medium	Low
Creation of employment and business opportunities (positive impact). The operational phase will also create opportunities for skills development and training	Medium	Medium
Establishment of a community trust funded by revenue generated from the sale of energy. The revenue can be used to fund local community development (positive impact)	Medium	High
Promotion of clean, renewable energy	Medium	Medium
Impact of the wind energy facility on tourism in the region	Low	Low
Visual Impacts		
Visual impact on sensitive visual receptors within the region	Medium	Low
Potential visual impact of lighting at night on visual receptors in close proximity to the proposed wind energy facility	Medium	Low
Potential visual impact on users of arterial and secondary roads in close proximity to the proposed facility.	Medium	N/A
Potential visual impact on the town of Kleinzee.	Medium	N/A
Potential visual impact on homesteads and settlements in close proximity to the proposed facility	High	N/A
Potential visual impact on the historical settlement of Grootmis.	Medium	N/A
Potential visual impact of on site ancillary infrastructure on observers in close	Low	Low

Nature	Without mitigation	With mitigation
proximity to the proposed facility		
Potential visual impact of the overhead power line on observers in close proximity thereto.	Medium	N/A
Potential visual impact on the visual character of the landscape and sense of place of the region.	Medium	N/A
Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourist potential of the region	Medium	N/A
Potential visual impact of the proposed facility on the Namaqua National Park's Priority Natural Area	Low	N/A
Noise Impacts		
Numerous simultaneous construction activities that could impact on receptors.	Medium	Low
Numerous turbines operating simultaneously during a period when a quiet environment is desirable.	High	Medium
Impacts on Heritage Artefacts		
Damage and destruction of Stone Age archaeological during construction.	Medium	Low
Damage and destruction of colonial period archaeology during construction.	Low	N/A
Erosion of remote, rural context of the various farm structures in the vicinity of the proposed wind energy facility.	Medium	N/A
Damage and destruction of human remains and their burial sites.	Medium	Low
Impact on the cultural landscapes and scenic routes	Medium	N/A
Potential Impacts on Palaeontology		
Disturbance, damage, destruction or sealing-in of fossil remains	Medium	Low

10.1.2 Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat, fatalities birds and bats, visual impacts, and impacts on soils. A wind energy facility is, however, dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 8 682 ha was considered for the facility, of which ~0.7% will be

utilised for the development footprint of the proposed wind energy facility, and will be permanently transformed (refer to the table below). The bulk of the development site would not suffer any level of disturbance as a result of the required activities on site and the limited extent of the facility footprint. This is explained further below.

Based on the preferred layout for implementation presented in Figure 10.2, permanently affected areas comprise 117 turbine footprints (117 foundation areas of 22m x 22m), access roads (up to 7m in width for permanent roads), one on-site substation footprint (100 m x 100 m), and an operations and service building area (100m x 100m). It should be noted that the site currently has several access roads which are used for farming activities. The layout of the facility has utilised these existing roads in the facility layout to reduce the need for new roadways. It is planned that where existing access roads are able to be utilised within the development footprint, these are utilised, widened and upgraded where possible. The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
117 turbine footprints (each 22m x 22m)	56 628
Permanent access roads within the site (7m width and 75 000m in length)	525 000
One on-substation footprint (100m x 100m)	10000
Operations and service building area (100m x 100m)	10000
TOTAL	601 628 m^2 (of a total area of 86 820 000 m^2) **i.e. 0.7%of site**

Approximately 0.7% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation of the Kleinzee Wind Energy Facility.

It should also be noted that the areas of permanent disturbance calculated above does not include the power line (which is a linear activity of up to ~16 km for alternative 1, and ~12 km in length for alternative 2, 3 and 4). Therefore the calculation above plus the power line will make up the total area of permanent disturbance.

Temporarily affected areas during the construction phase comprise 117 laydown areas for turbines (each laydown area assumed to have a footprint of 40m x 40m) and a temporary crane travel track and construction access roads utilising the same route as the permanent access road (an additional 7m in width to the permanent road of 7 m (i.e. taking the total roadway to be used during construction to 14m in width). The area of temporary disturbance is as follows:

Facility component - temporary	Approximate area/extent (in m^2)
117 turbine laydown areas (40m x 40m per turbine)	187 200
Temporary crane travel track and construction access roads utilising the same route as the permanent access road (additional 7m in width) and 75 000m in length	525 000
TOTAL	712 200 (of a total area of 86 820 000 m^2) = **~0.8% of site**

Therefore, ~0.8% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Kleinzee Wind Energy Facility.

Considering permanent and temporary footprints, approximately 1.5 % of the total extent of the 8 682 ha will be disturbed by the construction and operation phases of the project.

10.2 Comparative Assessment of Grid Connection Alternatives (Power Line) and Access road to site

10.2.1. Power Line

A 400kV power line will be required from the Kleinzee on-site substation to connect the facility to the National grid. Two power line alignment options have been considered as follows:

» Option 1: Directly to the Gromis substation from the on-site substation (Length of proposed power line: approximately 16 km). This is indicated as Alternative 1 in Figures 10.1 and 10.2)
» Option 2: Turning into the Juno - Gromis power line located to the east of the site. (Length of proposed power line: approximately 8 km for each sub-option). Three sub-alternatives have been identified for this option, referred to as Alternative 2, 3 and 4 in Figures 10.1 and 10.2.

In summary, the impacts of the power line include:

» Flora: It is recommended that the overhead power line should avoid any areas of Namaqualand Salt Pan. *Alternative 1* is the most preferred option in this regard as this would avoid impact on the salt pans which are ecologically fragile.
» Fauna: Impacts will be reduced for *alternative 4* due to a shorter length of power line which will generate the least disturbances. However, with

appropriate mitigation (i.e. a preconstruction walk-through to limit impacts on sensitive habitat), the technically preferred Alternative 1 would also be acceptable

» Avifauna: The shorter options (*Alternatives 2, 3 and 4*) are preferred to the longer one (Alternative 1). A longer line has more potential of impacting on threatened birds such as bustards than shorter lines.
» Visual: *Alternative 4* is the preferred option from a visual perspective as it will follow an existing power line therefore reducing new visual impacts on an area.

All four power line alternatives are deemed to be environmentally appropriate within the context of the receiving environment so long that the appropriate mitigation as outlined in the specialists reports (Appendix D-M) are implemented. From an environmental perspective Alternative 4 (shortest power line alternative) is selected as the preferred alternative as many of the impacts can be mitigated if the loop in – loop out grid connection configuration is implemented. It is noted however that the selection of the technically preferred power line alternative will be need to be selected by Eskom based on consideration of grid requirements.

10.2.2. Access Road

Three possible access routes have been assessed for the proposed Kleinzee Wind Project as follows:

» R355, via Springbok (~97 km). This constitutes the most direct tarred route to Kleinsee.
» Kommagas gravel road off the R355. This would constitute the shortest route from the N7 to Kleinsee and the proposed wind energy facility site.
» Combination of (mainly gravel) roads from Garies (off the N7), via Hondelikpbaai and Koingnaas. This constitutes the most direct road link to the harbours of Cape Town and Saldanha via the N7. Garies is located approximately 176 km south-east of Kleinsee (by road).

There are *no preferences* regarding access from an environmental perspective since all three alternatives utilise existing roads.

10.3 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Kleinzee Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 10.1 and A3 map in Appendix O**). The section below summarises the conclusions of the specialist studies, the following sensitive areas/environmental features have been identified on the site and are mapped where possible:

» ***Floral sensitivity***: The area of the Namaqualand coast between Hondeklip Bay in the south and Kleinzee in the north has been poorly explored and documented botanically due to restricted access over many years. However, a limited number of botanical studies have shown that apart from some localized 'special' plant communities, large areas are covered by one or a few types of vegetation. This is true in the Kleinzee WEF study area where the vegetation is mainly Namaqualand Coastal Duneveld with limited areas of Namaqualand Strandveld and Namaqualand Salt Pans on the inland boundary. Certain plant communities and plant species within the general vegetation matrix are considered to be sensitive. These plant communities and species are described in the report and areas of sensitivity are indicated on Figure 10.1. It is essential that these are noted and that the recommended mitigation measures are implemented as per the EMPr. It was recommended that the layout should be altered to remove all roads and turbines around **Turbines 21, 106, 108, 109, 130-132** from areas of Namaqualand Salt Pans. If this is undertaken, then the impacts on the vegetation and flora can be reduced from potentially High negative to **Medium** negative and the proposed wind farm then becomes acceptable within the described botanical context.

» ***Faunal sensitivity***: Overall the site is not considered to be highly sensitive from a faunal perspective. A large proportion of the listed fauna which occurs in the area is likely to be associated with the rocky outcrops. This habitat is highly restricted within the study area and amounts to less than 50 ha, including buffers. Given their limited extent, these areas would be easily avoided. The majority of the site consists of habitat of medium sensitivity. Although there are a number of listed species that would be likely to occur in this habitat such as Grant's Golden Mole, Desert Rain Frog and Namaqua Dwarf Adder. The affected habitat is relatively abundant in the area, and the amount of transformation required for the development is not significant when considered at the scale of the vegetation type and faunal habitat available. The development area however comprises almost 10% of the Namaqualand Coastal Duneveld vegetation type and the potential for the disruption of north-south connectivity for affected and sensitive fauna associated with this habitat is potentially more significant. Rehabilitation of cleared and disturbed areas would be an important mitigation measure at the site, especially given the high risk of wind erosion at the site. Such rehabilitation should be supervised or conducted by someone with experience in local rehabilitation practices.

The actual amount of transformation that will be required would however amount to approximately 1.5% of the total area, which is not highly significant when considered at the landscape scale. It is therefore concluded that the majority of impacts on faunal species associated with the development would be local in nature. Although there are some impacts that may be of wider significance, such as the disruption of landscape connectivity, these impacts are

difficult to quantify and the number of species affected is also uncertain, but likely to be low. Overall, the terrestrial faunal impacts associated with the development of the site are assessed as being of **low to moderate significance** and largely local in nature. With the appropriate mitigation, these impacts would be reduced to an acceptable level.

» ***Bird Habitat and Sensitive Areas –*** the proposed wind farm holds several collision-prone and red-listed bird species. These birds use the landscape in a regular way that allowed the identification of high risk and lower risk areas on the site (refer to Figure 10.1). By proposing three mitigation scenarios, it is found that the wind farm can be constructed in the medium and low risk areas and avoid bird displacement and direct mortality. These mitigation measures include:

- Relocation of turbines in the three **high risk zones** to low risk areas. This affects about 33 turbines (**i.e. T10, 12, 22, 23, 25, 34-36, 47-49, 64, 74, 81,83-85, 93, 94, 98, 104, 112-115, 117, 124-126, 129, 137, 138**).
- Those turbines in the medium risk areas (i.e. **T6-8, 16, 27, 28, 31, 82, 91, 108, 144-145**) should be and relocated if possible. If this is difficult then the density of turbines should be reduced to reduce the risk to collision-prone birds in the area. If mitigation is not feasible in the medium risk areas on-site mitigation measures will be required during the breeding season. These include the use of a bird detection system similar to or identical to the "**DT bird**" detection system developed by the Spanish to reduce direct impacts by birds at wind farms and other facilities. http://www.dtbird.com/index.php/en/.
- All overhead power lines require bird diverters for the full length of the power line.
- A minimum 12-month programme of during- and post-construction bird monitoring is proposed to accurately determine the real impacts and understand the efficacy of the proposed mitigation measures.

» ***Bat sensitive areas -*** With the exception of the areas delineated with higher sensitivities (i.e. areas around **T21, 83, 84, 87, 95, 101, 106, 108, 109, 130-132**), the Kleinzee wind energy facility is considered a low-medium bat sensitive site, with certain seasons considered as having higher sensitivity. The area has a medium to high bat activity compared with other sites for the Succulent Karoo, but lower activity compared with sites in the coastal Lowland Fynbos or Coastal Forest. The potential impacts of key significance for this site would be associated with bat fatalities due to collision with or barotrauma from wind turbines. The significance of this can be reduced if areas of Medium-High and High sensitivity are avoided for development. A tiered adaptive operational mitigation approach is recommended based on the findings of the operational monitoring; this is outlined in the Bat Impact Report (**Appendix G**).

» ***Heritage artefacts -*** There are no significant concerns over impacts to heritage resources as a result of the proposed project. Direct impacts to archaeological sites and human burials can be easily mitigated if the sites cannot be avoided. Mitigation would consist of excavation and possibly dating of the affected sites so as to create a record of the sites which is stored in perpetuity to allow future researchers access to the material. In this way scientific data pertaining to those sites is not lost. Given the scale of the development and the general density of archaeological sites identified during the survey, the final layout should be examined on the ground to confirm that no further archaeological sites will be impacted. It is envisaged that, given the information at hand, only a few more sensitive areas will need a final inspection. These would be in areas where sites are under direct threat from the proposed development (within 20 m of proposed infrastructure and/or between the turbine and road alignments), highlighted as "heritage sites" on Figure 10.1, these site are deemed to be of archaeological significance.

In terms of fossils, the significance rating is low as a consequence of the low probability of finding fossils in the upper terrestrial deposits.

» ***Noise sensitive receptors -*** With the proposed layout assessed it is considered highly likely that the wind farm will have a noise impact on NSD01 during the operational phase. This is mainly due to the distance between the closest wind turbines and this NSD. This may result in a noise impact of medium significance. It should be noted that the noise impact was determined based on the outcome of a regression analysis that indicated that the likely long-term ambient sound levels could be significant during periods when wind speeds exceeds 4 m/s. The regression analysis is based on a number of measurements taken at various sites during periods when the wind was blowing, but when there were little other noise sources.

» ***Visual impacts -*** The visual environment surrounding the site will be visually impacted upon for the anticipated operational lifespan of the development (i.e. 20 - 30 years). Visual impacts on homesteads and settlements in close proximity (within 5km) to the proposed facility are expected to be of **highest** significance. The post mitigation significance of anticipated visual impacts are of moderate to low levels, with the exception of that on homesteads and settlements in close proximity. This impact is, however, not considered to be a fatal flaw for the proposed project. It is therefore recommended that the development of the facility as proposed be supported, subject to the implementation of the recommended mitigation measures.

» ***Social impacts -*** The development of the proposed Kleinzee Wind Energy Facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The proposed

development also represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

» ***Cumulative Impacts*** - Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site specific developments. This however, is beyond the scope of this study. The alignment of renewable energy developments with South Africa's National Integrated Response Plan and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

Considering the findings of the specialist assessments undertaken for the project, the cumulative impacts for the proposed Kleinzee wind facility will be of moderate significance provided that environmental impacts are mitigated to suitable standards by strict control and implementation of the EMPr for the project.

Final turbine positioning and placement of associated infrastructure should take cognisance of sensitive areas (as indicated on **Figure 10.1**). Should recommendations made in this EIA and mitigation measures in the EMPr be adhered to, impacts on the identified sensitive areas can be adequately managed.

10.4 Micro-siting of turbines

From the conclusions of the EIA studies undertaken, it was concluded that the following areas identified as 'no go' areas for the construction of infrastructure (including turbines) must be considered in the final layout of the facility:

» Areas of *Namaqualand Salt Pans* and all areas where there are sensitive micro-habitats (e.g. granite outcrops and where endemic and rare plant species such as *Wooleya farinosa* occur) must be **avoided**.
» Three high-risk avifauna zones overlaid on the flight paths of the most collision-prone red-listed species (i.e. Ludwig's and Kori Bustards) recorded within the wind farm. 33 turbines in these areas must be moved and positioned in low risk areas.
» In terms of bats, it is recommended that the high and high - medium sensitive areas remain undeveloped and that no part of the turbine, including the full rotor sweep encroaches into these areas.

Figure 10.2 provides a revised layout where the turbine placement has been shifted to areas of lower sensitivity through a micro-siting exercise to avoid these identified areas of environmental sensitivity. This revision of the layout has resulted in 117 turbines being proposed and has considered this assessment as well as technical aspects of the project. Eskom has confirmed this layout as technically and economically feasible.

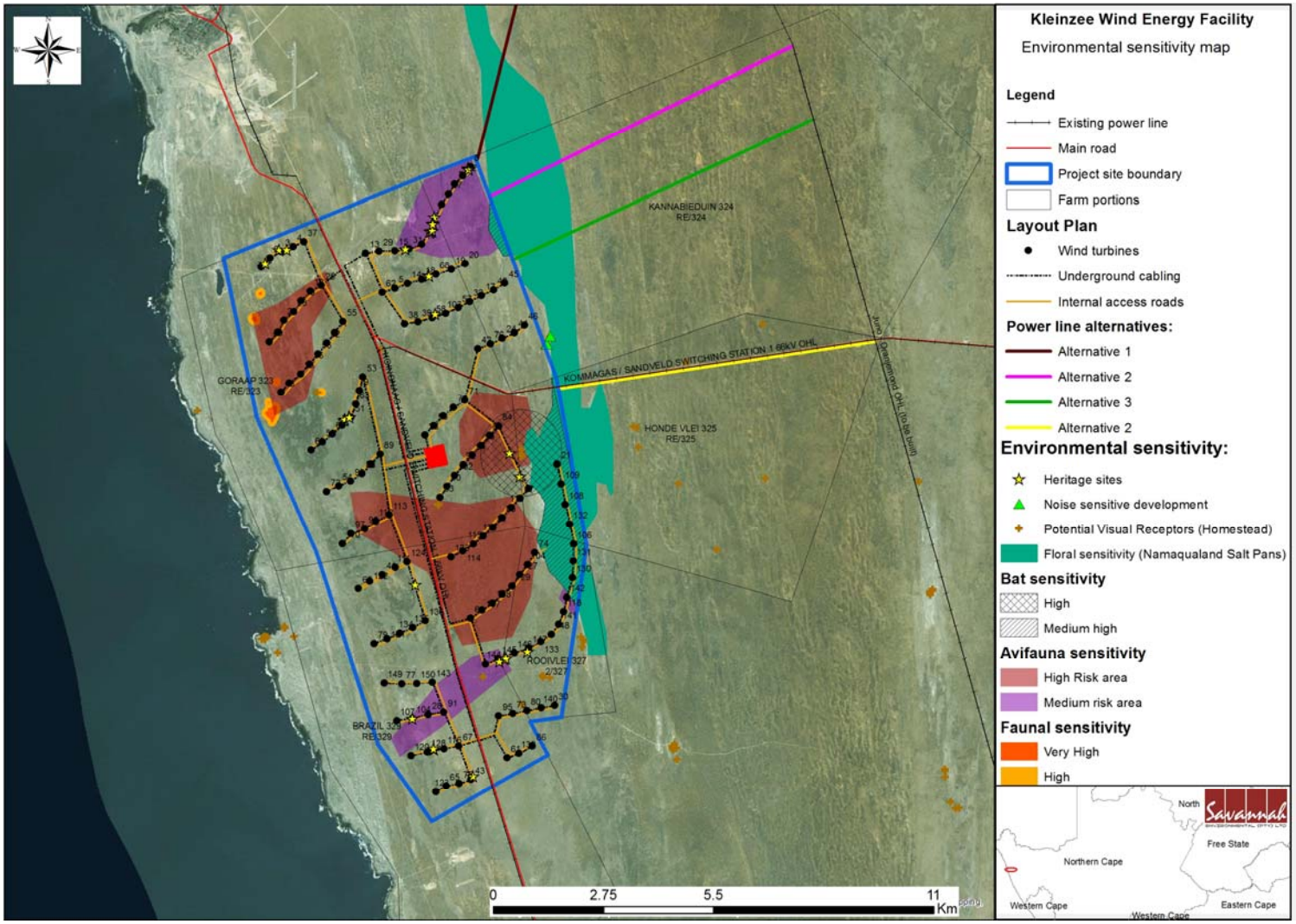

Figure 10.1: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed **original development footprint** for the Kleinzee Wind Energy Facility **(Appendix O contains A3 map)**

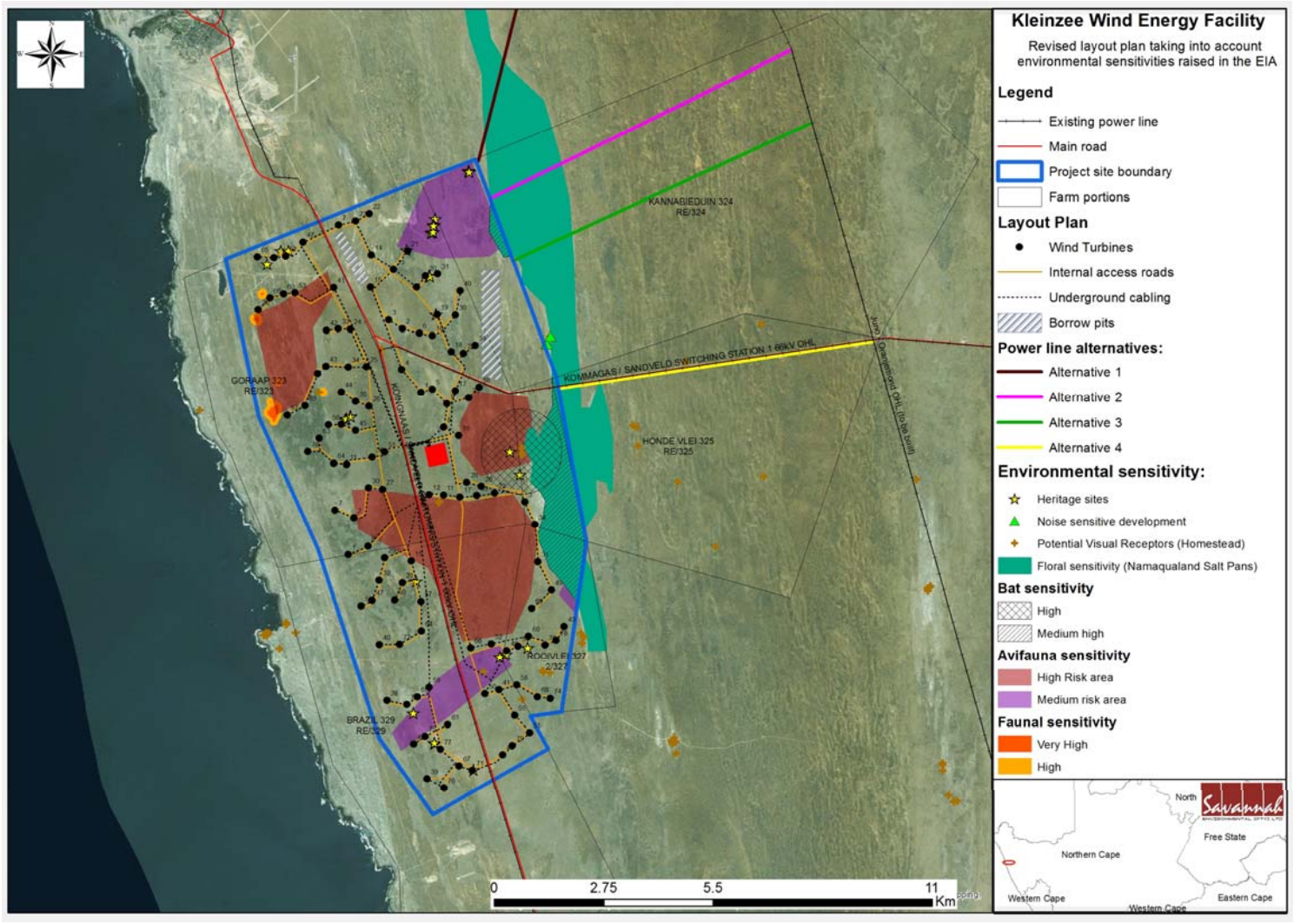

Figure 10.2: Map indicating revised layout to avoid placement of turbines and infrastructure in areas of high sensitivity **(Appendix O contains an A3 map)**

In terms of this revised layout, the following changes have been made:

1. Turbines T21, 106, 108, 109, 130-132 have been removed from areas of Namaqualand Salt Pans, which are considered to be ecologically significant and vulnerable to disturbance.
2. 33 turbines (i.e.T10, 12, 22, 23, 25, 34-36, 47-49, 64, 74, 81,83-85, 93, 94, 98, 104, 112-115, 117, 124-126, 129, 137, 138) located within high risk avifauna zones have been relocated to lower sensitivity areas. Additionally, turbines located within the medium risk avifauna zones have been relocated to the lower sensitivity areas based on the outcome of the 12 month bird monitoring programme undertaken for the project.
3. Turbines located in the areas of higher bat sensitivities (i.e. T21, 83, 84, 87, 95, 101, 106, 108, 109, 130-132) have been shifted or relocated to lower bat sensitive areas based on the outcome of the 12 month bat monitoring programme undertaken for the project.

This revised layout, as indicated in Figure 10.2 is the preferred layout for implementation.

10.5 Environmental Costs of the Project versus Benefits of the Project

A number of costs and benefits are expected to arise from the proposed project. Environmental (natural environment, economic and social) costs can be expected to arise as a result of the project proceeding. This could include:

» Direct loss of biodiversity, flora, fauna and soils due to the clearing of land for the construction and utilisation of land for the wind energy facility (which is limited to the development footprint). The cost of loss of biodiversity has been minimised through the careful location of the development to avoid key areas of sensitivity.
» Visual impacts associated with the wind energy facility. The cost of loss of visual quality to the area is reduced due to the area already being visually impacted to some extent by power lines and mining activities, as well as the limited number of sensitive receptors located close to the development site.
» Change in land-use and loss of land available for grazing on the development footprint. The cost in this regard is expected to be limited due to the limited footprint of the facility, the low agricultural potential and carrying capacity of the property and the fact that current agricultural activities can continue on the remainder of the property during construction and operation.

These costs are expected to occur at a local and site level (except for visual impacts that are more regional) and are considered acceptable provided the mitigation measures as outlined in this EIA and the EMPr are implemented.

Benefits of the project include the following:

» The project will result in important economic benefits at the local and regional scale through job creation, procurement of materials and provision of services and other associated downstream economic development. These will persist during the preconstruction, construction and operational phases of the project.
» The project contributes towards the national goals for renewable energy, as well as towards Provincial and Local goals for the development of renewable energy as outlined in the respective SDFs and IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa by addition of wind energy to the mix.
» South Africa's per capita greenhouse gas emissions are amongst the highest in the world due to reliance on fossil fuels. The proposed project will contribute to South Africa achieving goals for implementation of renewable energy and 'green' energy. Greenhouse gas emission load is estimated to reduce by 0.86% for a 500MW coal-fired power station compared to a similar MW renewable energy project.

The benefits of the project are expected to occur at a national, regional and local level. As the economic costs to the environment have been largely limited through the appropriate placement of infrastructure on the site within lower sensitivity areas, the expected benefits of the project will partially offset the localised environmental costs of the project.

10.6 Overall Conclusion (Impact Statement)

The global demand for energy combined with the significant increase in fossil-based power generation costs in recent times have led to an increased worldwide need to utilize renewable energy sources. This is further encouraged by the changes on climate due to global warming that alternative source of energy from renewable need to be harness for future generation.

Eskom's Project Development Department (PDD) is mandated to develop up to 500 MW of wind energy as part of the mix of generation technologies being implemented by Eskom. Through pre-feasibility assessments and research, the technical viability of establishing the Kleinzee Wind Energy Facility in the Northern Cape has been established by Eskom. The positive implications of establishing the Kleinzee Wind Energy Facility on the demarcated site include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good coastal wind energy resources on this site would be realised.

» The National electricity grid in the Northern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the potential benefits and negative impacts anticipated as a result of the proposed project concludes that:

» There are **no environmental fatal flaws** that would prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.
» The proposed development represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.
» The Kleinzee Wind Energy Facility site is located a few kilometres south of the proposed Project Blue Wind Facility (to be developed by an independent power producer). The proximity of the two facilities could be considered as a renewable energy development zone, and consolidates impacts in a single node with a proven wind resource. The development of facilities in viable nodes presents some benefits to the environment through minimisation of the extent of impacts.

Through the micro-siting process, the preferred layout has been designed to avoid areas of high sensitivity identified through the EIA process thereby effectively avoiding impacts in these areas. The significance levels of the majority of remaining negative impacts can be reduced to acceptable levels by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

10.7 Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation and power line, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Kleinzee Wind Energy Facility and associated infrastructure can be implemented, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design of the project.

The following infrastructure would be included within an authorisation issued for the project:

- The site is proposed to accommodate up to 200 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity. The capacity of the facility will be up to 300MW. In terms of the preferred layout indicated in Figure 10.2, 117 wind turbines are proposed.
- Each wind turbine is expected to consist of a concrete foundation (22m x 22m x 3m), a tower, a hub (up to 140m above ground level, depending on the turbine size selected) and three blades (each up to 70m in length).
- Permanent internal and access roads (up to 7 m in width and including turning circles where required) linking the wind turbines and other infrastructure on the site. Existing farm roads will be utilised, widened and upgraded where possible.
- Workshop area / office for control, maintenance and storage (approximately 100m x 100m).
- An on-site substation (100 m x 100 m) to facilitate grid connection.
- An overhead power line (400kV) feeding into Eskom's electricity grid. Two options are being considered:
  - Option 1: Directly to the Gromis substation from the on-site substation (Gromis Substation is situated approximately 16 km from the proposed site)
  - Option 2[12]: Turning into the Juno - Gromis power line located to the east of the site. Alternative 4 is nominated as the preferred option from an environmental perspective
- Borrow pits within the site for the construction of access roads.
- Office/Workshop area for operations, maintenance and storage.
- Information centre and associated billboards.
- Water supply pipeline and Water storage reservoir and tanks.

The following conditions would be required to be included within an environmental authorisation issued for the project:

- All mitigation measures detailed within this report and the specialist reports contained within Appendices D to M must be implemented.
- The draft Environmental Management Programme (EMPr) as contained within **Appendix N** of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.
- The preferred layout for implementation is indicated in Figure 10.2.
- The preferred power line is Alternative 4.

[12] The loop-in lines options has three sub-options referred to as alternative 2-4 in Figure 1.2

- Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.
- A comprehensive search for protected plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure is known.
- Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
- The final location of the wind turbines and associated infrastructure (including power lines) within identified sensitive areas must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMPr to be compiled for the project.
- Once the layout has been finalised, an archaeological ground-truthing should be conducted and further recommendations be made to protect the archaeological heritage within the area proposed for development.
- An independent Environmental Control Officer (ECO) must be appointed by the project developer prior to the commencement of any authorised activities.
- All infrastructures, including access roads and other on-site infrastructure must be planned so that the clearing of vegetation is minimised.
- Establish an on-going monitoring programme to detect, quantify and manage any alien plant species that may become established as a result of disturbance.
- Bird and bat monitoring programmes, in line with the latest version of the South African best practice bird and bat monitoring guidelines, should be commissioned during the operational phase to determine the actual impacts of the project on bird and bat communities. Where necessary, additional mitigation measures should be implemented to minimise impacts on these communities.
- Disturbed areas during construction should be kept to a minimum and rehabilitated as quickly as possible.
- Compile a comprehensive storm-water management method statement, as part of the final design of the project and implement during construction and operation. Adequate storm-water management measures to be put in place as the soils on the site are prone to erosion.
- Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads).
- Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
- Use of fire prevention and fire management strategies for the wind energy facility, to reduce risks to landowners.
- Construction managers/foremen should be informed before construction starts on the possible types of heritage sites that may be encountered and the procedures to follow should they encounter subsurface heritage artefacts/ sites (as detailed in the EMPr).

- All other relevant and required permits must be obtained by Eskom prior to the commencement of construction.
- Once the facility has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated. An ecologist should be consulted to provide input into rehabilitation specifications.

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