ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED ABERDEEN 200MW WIND FARM & ASSOCIATED INFRASTRUCTURE, EASTERN CAPE PROVINCE

EASTERN CAPE PROVINCE
(DEA Ref: 12/12/20/2211)

DRAFT EIA REPORT FOR PUBLIC REVIEW

Prepared for:

Eskom Holdings SOC Limited
Megawatt Park,
Maxwell Drive,
Sandton,
Johannesburg

Prepared by:

Savannah Environmental Pty Ltd

UNIT 10, BUILDING 2,
5 WOODLANDS DRIVE OFFICE PARK
CNR WOODLANDS DRIVE &
WESTERN SERVICE ROAD,
WOODMEAD, GAUTENG
P.O. BOX 148, SUNNINGHILL, 2157
TELEPHONE: +27 (0)11 656 3237
FACSIMILE: +27 (0)86 684 0547
EMAIL : INFO@SAVANNAHSA.COM

Savannah
ENVIRONMENTAL (PTY) LTD

PROJECT DETAILS

DEA Reference No.	:	12/12/20/2211
Title	:	Environmental Impact Assessment Process Draft Environmental Assessment Report: Proposed Aberdeen 200MW Wind Energy Facility Near Aberdeen, Eastern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Sheila Muniongo and Jo-Anne Thomas
Sub-consultants	:	Simon Todd of Simon Todd Consulting Lourens Leeuwner of EWT Kate MacEwan of Inkululeko Wildlife Services Lourens du Plessis of MetroGIS Celeste Booth of the Department of Archaeology, Albany Museum Tony Barbour of Environmental Consulting and Research Iain Paton & Theodore Robertson of Outeniqua Geotechnical Services cc Morne de Jager of M2 Environmental Connections CC John Almond of Natura Viva cc
Project Developer	:	Eskom Holdings SOC (State Owned Company) Limited
Report Status	:	Draft Environmental Impact Assessment Report for public review
Review Period	:	27 February 2015 – 13 April 2015

When used as a reference this report should be cited as: Savannah Environmental (2015) Draft Environmental Management Plan: Proposed Aberdeen 200MW Wind Energy Facility near Aberdeen, Eastern 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 Aberdeen, in the Eastern 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 November 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 oil 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 N (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 E & F e) Refer to section 10.4 & 2.1 f) Refer to section 2.2 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 M

	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	i. The Plan of study for the EIA Phase was proposed to achieve the following: » Identify and recommend appropriate mitigation measures for potentially significant environmental impacts (Chapter 8 & 9) ii. Appendix C Iii & iv Proof of correspondence with stakeholder will be included in the Final EIA report
(f) a description of the need and desirability of the proposed activity;	Section 2.1
(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 2.4
(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 10.5 & 10.6
(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	All comments received during the comment period will be included in the Final EIA report
(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 E-K)
(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 M
(r) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix D-L
(s) any specific information that may be required by the competent authority.	Refer to Table 1 of the DEIR.

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 has been made available for public review and comment for a 40-day period at the following locations from **27 February 2015 – 13 April 2015:**

» Aberdeen Library- Andries Pretorius Street, Aberdeen
» Horse Shoe Library- Parsonage Street, Graaff Reinet, 6280

The report also available for download at:
» www.savannahSa.com

Please submit your comments to
Shawn Johnston of Sustainable Futures ZA PO Box 749, Rondebosch, Cape Town, 7701 Tel: 083 325 9965 Fax: 086 510 2537 E-mail: swjohnston@mweb.co.za
The due date for comments on the Draft Scoping Report is **13 April 2015**

Comments can be made as written submission via fax, post or e-mail.

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holdings SOC (State Owned Company) **Limited** is proposing to establish a commercial wind energy facility and associated infrastructure on a site located approximately 24 km west of the town of Aberdeen in the Eastern Cape Province, within the Camdeboo Local Municipality.

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 100 wind turbines
  - 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 (100 m x 100 m (including HV yard))
- An overhead power line (400kV) feeding into Eskom's electricity grid at the Droërivier Substation, approximately 140 km from the site
- Internal access roads between each wind turbines (permanent roads of approximately 6 m wide and 7m during construction)
- Borrow pits within the site for the construction of access roads
- Office/Workshop area for operations, maintenance and storage (approximately 100m x 100m).
- Information centre
- Ablution facilities and temporary water storage for construction and small storage for operation drinking water will be required at the site.

The site (~8 198 ha in extent in extent) includes the following farm portions (refer to Figure 1):

- RE of Portion 3 of Sambokdoorns 92
- RE of Portion 4 of Sambokdoorns 92
- RE of Sambokdoorns 92
- Portion 2 of Klipdrift 73
- Portion 2 of Farm 94, and
- RE of Portion 2 of Farm 94

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 Aberdeen 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 Draft 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 draft 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 100 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 Aberdeen 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 Aberdeen 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 Aberdeen 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:

» ***Ecology***: The larger drainage systems with associated floodplains fall within the Southern Karoo Riviere vegetation type. The drainage systems are considered to be ecologically significant and vulnerable to disturbance. As a result, the areas of Southern Karoo Riviere are considered sensitive ecosystems that should be avoided as far as possible. In terms of the layout assessed in the EIA, a number of turbines are located within these areas (i.e. T1, 3, 4, 5, 9, 10, 11, 26 and 52). It was recommended that these should be relocated to adjacent less sensitive plains.

Overall, the development would be likely to generate moderate ecological impacts during construction and low impacts during operation. There are no long-term impacts associated with the development that cannot be mitigated to a low level and no impacts which are likely to represent a fatal flaw or red flag for the development. Although the site is located within a CBA and this is certainly a significant concern for the development, the ultimate impact of the development on the CBA is not likely to compromise the overall ecological functioning of the CBA or impact on any features of high potential concern that warrant longer-term protection in order to retain biodiversity pattern.

» ***Bird Habitat and Sensitive Areas –*** The proposed site was found to be moderately sensitive in terms of avifauna, with areas of high, medium and sensitivity being present on site and a large number of sightings of priority birds, specifically Bustards species and Blue Crane. The flight modelling and risk mapping undertaken as part of this monitoring should been used to guide the final positioning of the turbines. This will reduce the impact on bird species in the area. The proposed facility has the potential to significantly impact on avifauna in the area. Priority species were observed flying in the rotor swept area and where this has happened regularly, buffers have been indicated. This however does not mean that birds will collide with turbines as collision rates may vary from species to species. There are no foreseeable fatal flaws associated with the site, however the project should proceed in line with the recommendations and mitigations provided stating that the proposed turbine placements must be critically revised with the

key objectives of moving the Turbines located in area of High Avifaunal Sensitivity (i.e. T57-63, 8-11, 37-37 and 64-66) to an alternative location outside of high sensitivity areas.

» ***Bat sensitive areas -*** With the exception of the areas delineated with higher sensitivities (i.e. areas around T3-6, 8-11, 23, 46, 52, 53, 55, 56, 66, 67, 77-84, 94 and 95), the Aberdeen wind energy facility is considered a low-medium bat sensitive site, with certain seasons considered as highly sensitive. It has medium to high bat activity compared with other sites for the Nama 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 within the EIA report.

» ***Heritage artefacts -*** Eight large areas / sites comprising several cores and surface scatters of stone artefacts were identified on the site. These areas comprise several micro-sites that were difficult to determine individually, therefore the demarcation of the larger areas. Mainly isolated surface scatters of Middle Stone Age stone artefacts were observed distributed across the proposed development area. It is unlikely that the stone artefact surface scatters that occur on the exposed surface areas are positioned in situ; however, stone artefacts may occur between 50 – 80 cm below the surface. One stone walling farmstead complex was documented outside of the area proposed for the wind turbines, however, caution must be taken if the existing internal road farm will be upgraded for access to the turbines and associated infrastructure, and otherwise it is preferable that an alternative route be established. One collapsed circular stone walling feature with possible associated historical artefacts was documented near to the proposed positions of wind turbines, underground cabling, and access route. The appropriate mitigation measures should be implemented as outlined in the heritage report (refer to Appendix H) to protect and conserve the significant archaeological and historical heritage resources.

» ***Noise sensitive receptors -*** The input data as used this assessment indicated that the potential noise impact would be insignificant during the construction phase but there could be an impact of medium significance during the

operational phase considering the noise impact on NSD03. Noise measurements are recommended at NSD02, NSD03[1] and NSD04 over a period of at least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer. If a valid and reasonable noise complaint is registered relating to the operation of the facility additional noise monitoring should be conducted by an acoustic consultant during the quarterly noise measurements. Noise monitoring must be continued as long as noise complaints are registered. The developer should re-evaluate the layout if any wind turbines are added within 1,000 meters from any NSD.

» ***Visual receptor -*** The study area has a natural character and is located within a picturesque part of the country. The character of the landscape is one of undeveloped, wide open spaces and scenic topography in the form of the Camdeboo Mountains. The visual quality is generally considered to be high due to these factors. Potential visual exposure remains high in the core and medium distance (i.e. within 5 and 10km), this areas includes the R61, two secondary roads and a number of farms and homesteads. The south western tip of the Kamdeboo Mountains also lies within this zone, and the south western slopes will be visually exposed Even though the facility may appear to be quite prominent in the landscape, the facility would be considered to be acceptable from a visual perspective.

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

» A 1.5km buffer around an identified Blue Crane roost site as well as a 500m buffer around wetlands and/or farm dams.
» In terms of the 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.
» Development within the drainage lines and floodplain habitat should be minimised and while it may be necessary for roads to traverse some of these areas, no turbines should be located within these higher sensitivity areas.

These areas are indicated in Figure 10.1. The revised turbine layout presented in Figure 10.2, with **no turbines falling into any no-go areas** is nominated as the preferred alternative on the basis of the findings of this EIA.

[1] If relocated no noise monitoring is recommended for this receptor.

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 L must be implemented.
» The draft Environmental Management Programme (EMPr) as contained within Appendix M 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.
» 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.
» A monitoring program must be set up on post construction to monitor for the real impact the facility will have on birds. This should be done in accordance with the BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation impact mitigation at proposed wind energy development sites in southern Africa.
» Operational monitoring is to commence as soon as the first turbines start to rotate and should fatalities be discovered, mitigation approach is recommended for the entire year (refer to Appendix F – Bat Impact Assessment).
» Noise measurements are recommended at NSD02, NSD03[2] and NSD04 over a period of at

[2] If relocated no noise monitoring is recommended for this receptor.

least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer.

» Once the final 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. A representative sample of stone walling should be collected and during the route should be established to avoid negative impact to the stone walling complex (Ab HS1) during the construction and development phases. No development should occur within 50 m of stone walling features. No development should occur within 100 m of the areas marked Ab SW1 and Ab H1.

» 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.

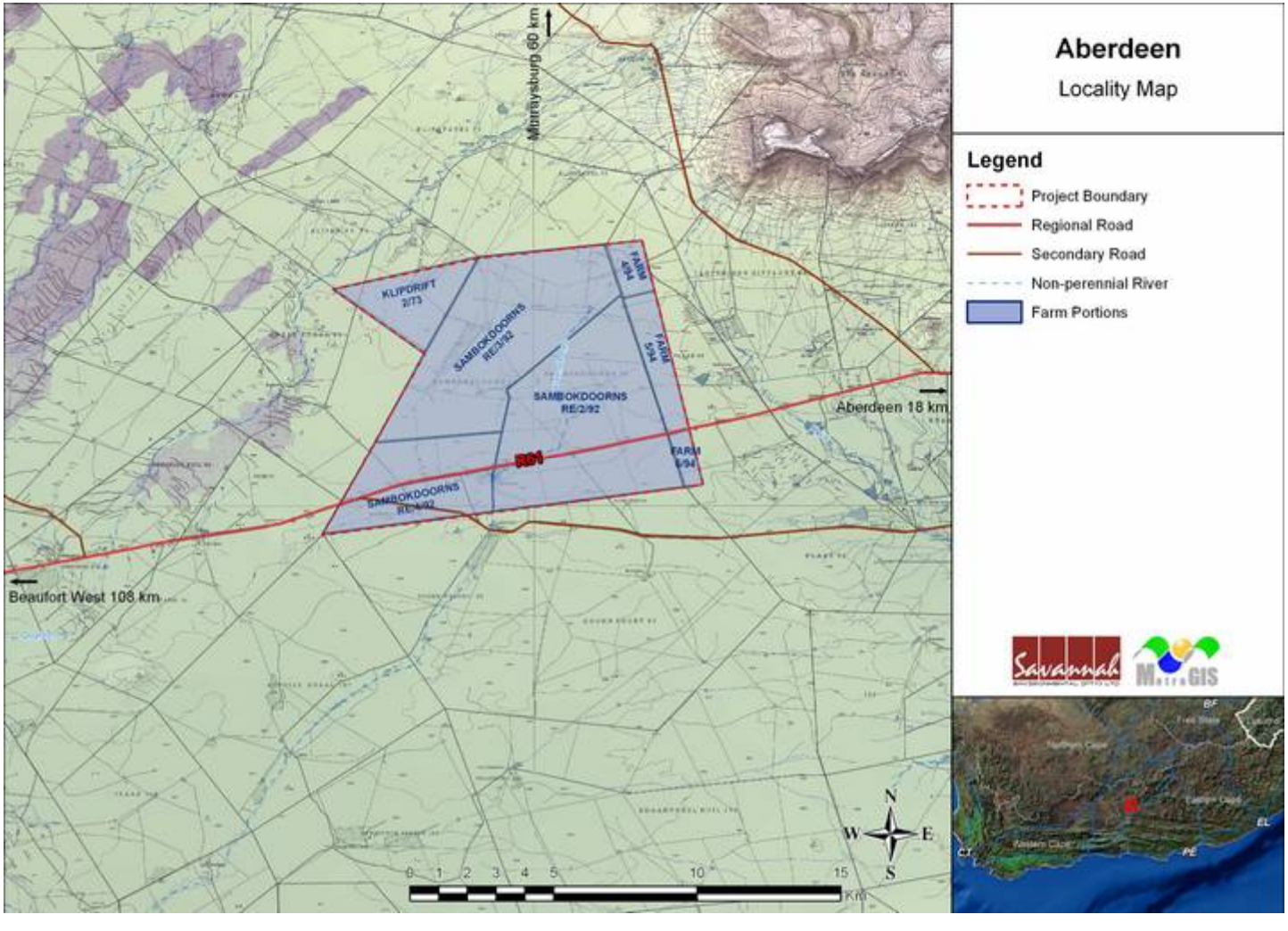


Figure 1: Locality map showing the farm portions and study area for the establishment of the Aberdeen Wind Energy Facility, Eastern Cape Province.

TABLE OF CONTENTS

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	Eastern 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 to establish a commercial wind energy facility and associated infrastructure on a site located approximately 24 km west of the town of Aberdeen in the Eastern Cape Province, within the Camdeboo Local Municipality. This proposed project will be referred to as the Aberdeen 200 MW Wind Farm. This development is proposed to comprise a cluster of up to 100 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed over an area of approximately 8 198 ha in extent.

The nature and extent of the Aberdeen Wind Energy Facility, as well as potential environmental impacts associated with the construction and operation of the facility are assessed in this 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 Aberdeen 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 Draft EIA report and specialist reports.

1.1. Project Overview

The site for the proposed Aberdeen Wind Energy Facility falls within the Camdeboo Local Municipality in the Eastern Cape Province. The broader area (~8 198ha in extent) comprises the following farm portions (refer to Figure 1.1):

» RE of Portion 3 of Sambokdoorns 92
» RE of Portion 4 of Sambokdoorns 92
» RE of Sambokdoorns 92
» Portion 2 of Klipdrift 73
» Portion 2 of Farm 94, and
» RE of Portion 2 of Farm 94

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 **100 wind turbines** to be constructed over an area of ~ **8 198 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 (100 m x 100 m (including HV yard))
» An overhead power line (400kV) feeding into Eskom's electricity grid at the Droërivier Substation, approximately 140 km from the site[3]

[3] The proposed power line is being assessed within a separate Basic Assessment process (DEA ref #:14/12/16/3/3/2/357) and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

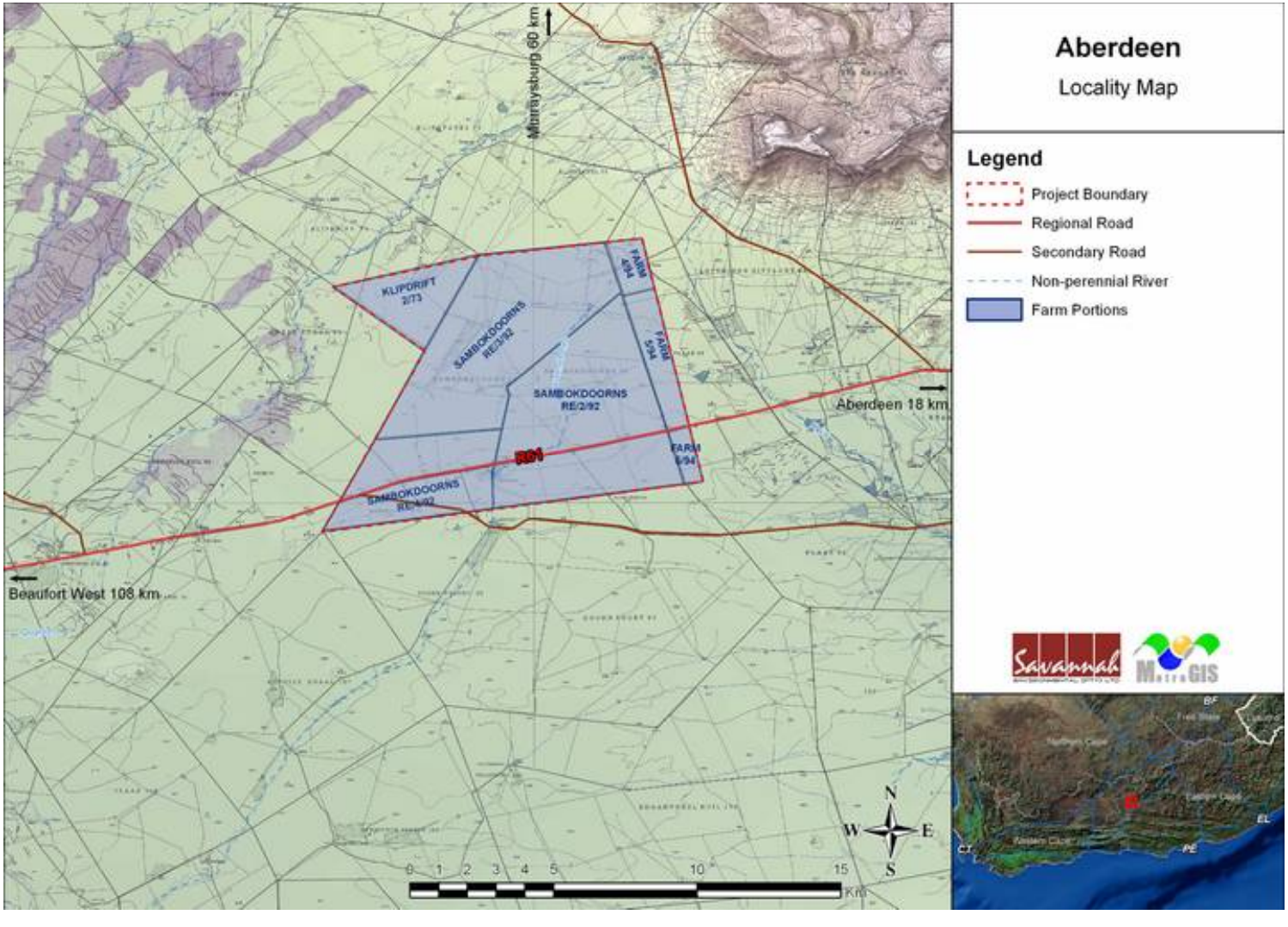


Figure 1.1: Locality map showing the farm portions and study area for the establishment of the Aberdeen Wind Energy Facility, Eastern Cape Province

- Internal **access roads** between each wind turbines (permanent roads of approximately 6 m wide and 7m during construction)
- **Borrow pits** within the site for the construction of access roads
- **Office/Workshop** area for operations, maintenance and storage (approximately 100m x 100m).
- **Information centre**
- Ablution facilities and temporary **water storage** for construction and small storage for operation drinking water will be required at the site.

Eskom will be considering various wind turbine technologies in order to maximise the capacity of the site. The capacity of the proposed Aberdeen 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 200MW.

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.

1.2. Environmental Sensitivities Identified during the Scoping Phase

A scoping study was conducted in order to identify and describe potential impacts associated with the proposed development. The Final Scoping Report was submitted to the Department of Environmental Affairs DEA in August 2012 and accepted in November 2012. 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. These sensitive areas are shown in **Figure 1.3** and include:

- Areas of visual exposure such as homesteads and observers travelling along major and gravel roads within (but not restricted to) 10 km of the proposed wind energy facility site
- Potentially sensitive noise receptors
- Areas of wetlands and watercourses depicted as high ecological sensitivity and conservation value
- Areas of bat sensitivity

The findings of the Scoping study identified portions of the proposed study site as being of "high sensitivity". No fatal flaws or no go areas were identified at this stage.

The scoping phase sensitivity map provides a rough scale estimate of sensitivity on the site, and 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.

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

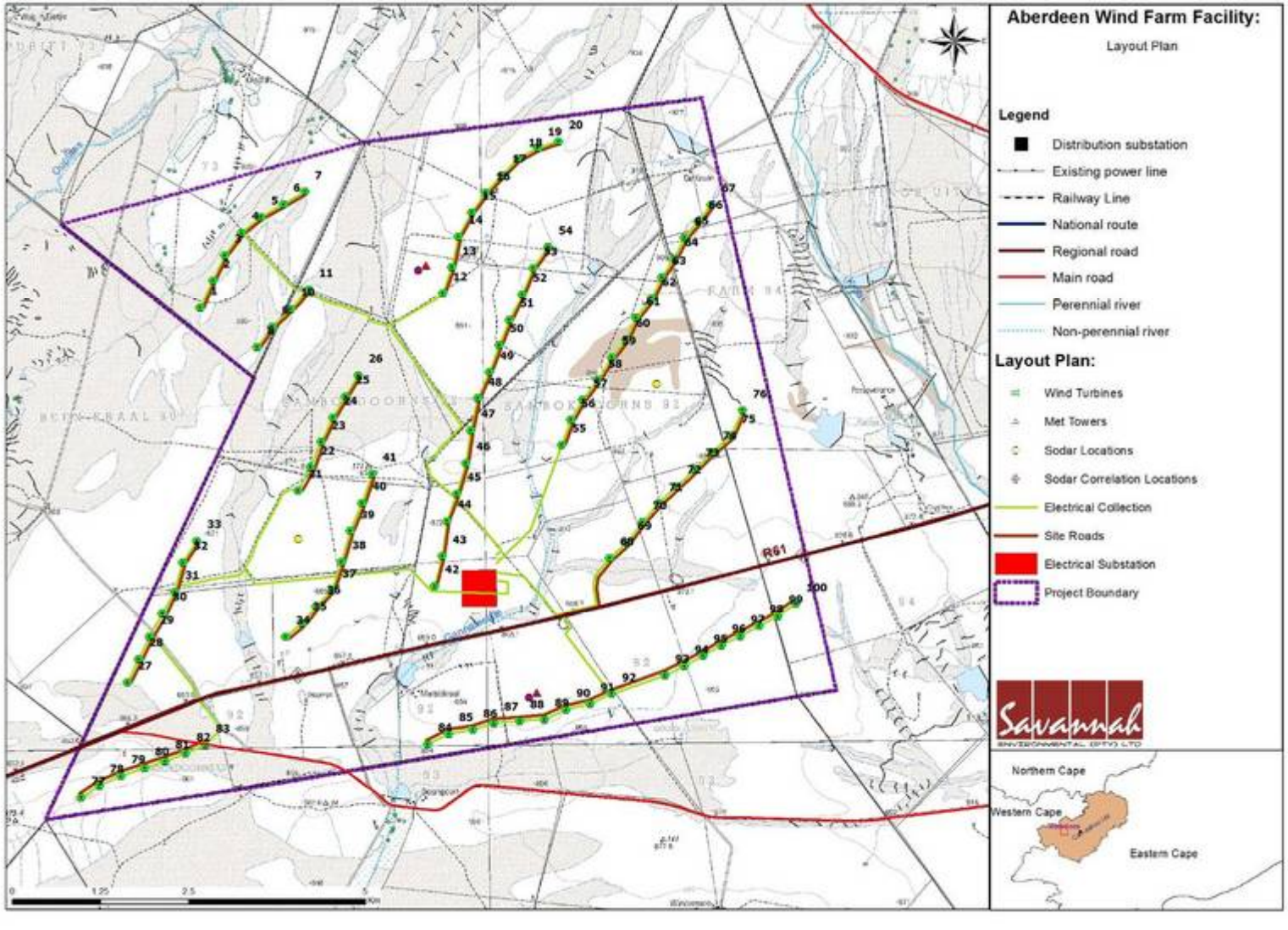


Figure 1.2: Layout map showing the technical design and layout of the Aberdeen Wind Energy Facility, Eastern Cape Province

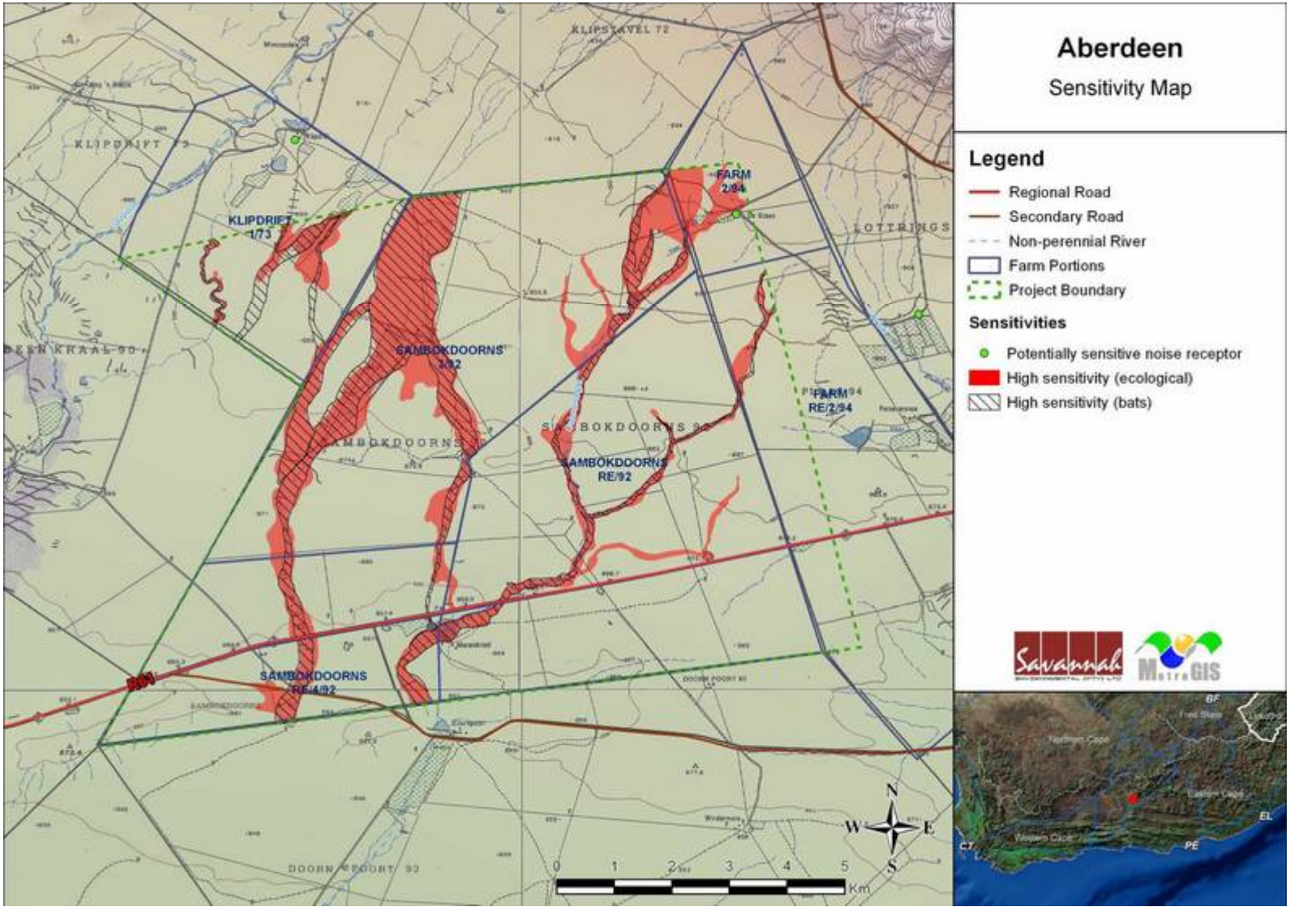


Figure 1.3: Scoping study desktop environmental sensitivity map for the proposed Aberdeen Wind Energy Facility

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 Draft 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 Draft 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: 12/12/20/2211). Through the decision-making process, the DEA will be supported by the Eastern Cape Department of Economic Development,

Environmental Affairs and Tourism (Eastern Cape DEDEAT), 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 Aberdeen 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**
Simon Todd of Simon Todd Consulting	Ecology
Lourens Leeuwner of EWT	Avifauna pre-construction monitoring and impact assessment
Kate MacEwan of Inkululeko Wildlife Services	Bat pre-construction monitoring and impact assessment
Lourens du Plessis of MetroGIS	Visual impacts
Celeste Booth of the Department of	Heritage

Specialist	Area of Expertise
Archaeology, Albany Museum	
Tony Barbour of Environmental Consulting and Research	Social
Iain Paton & Theodore Robertson of Outeniqua Geotechnical Services cc	Soils, erosion and agricultural potential
Morne de Jager of M2 Environmental Connections CC	Noise
John Almond of Natura Viva cc,	Palaeontology

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

2.1 Description of the Project and Site

The proposed project entails the development of the Aberdeen Wind Energy Facility on a site near Aberdeen. The site falls within the Camdeboo Local Municipality in the Eastern Cape Province. The purpose of the proposed wind energy facility will be to generate electricity to be fed into the National electricity grid. Table 2.1 below provides details of the proposed project, including the main infrastructure and services. (Refer to **Appendix N** for an A3 map).

Table 2.1: Details of the proposed project

Component	Description/ Dimensions
Location of the site	» RE of Portion 3 of Sambokdoorns 92 » RE of Portion 4 of Sambokdoorns 92 » RE of Sambokdoorns 92 » Portion 2 of Klipdrift 73 » Portion 2 of Farm 94, and » RE of Portion 2 of Farm 94
Municipal Jurisdiction	Camdeboo Local Municipality
Electricity Generating capacity	200MW
Details of turbines	» Up to 100 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	81.98 km^2 in extent
Internal access	Gravel roads of ~45 km in extent, 6m wide
Site access	Access to the site is directly from the R61.
Grid connection	» 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 at the Droërivier Substation, approximately 140 km from the site[4]
Operations and service building area	» Office/Workshop area for operations, maintenance and storage » Information centre

[4] The above-mentioned proposed power line is being assessed within a separate Basic Assessment process and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

Component	Description/ Dimensions
	» Ablution facilities » 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 Aberdeen 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, 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. . » Water could be sourced from the following options: o Bore hole on site o Trucking water to site » 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. 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 Aberdeen 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.

As an initial step in determining areas for development of additional wind energy facilities, 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 [5]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 Aberdeen Wind Farm on a site near Aberdeen in the Eastern Cape Province (the subject of this report) and the proposed Kleinzee 300MW Wind Farm south of Kleinsee on the West Coast of the Northern Cape (assessed within a separate EIA process).

[5] 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 west of Aberdeen, 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 Kleinzee 300MW Wind Farm in the Northern Cape (DEA Ref no. 12/12/20/2212)[6].

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. .

[6] The Draft EIA Report for this project has been submitted to DEA in February 2012

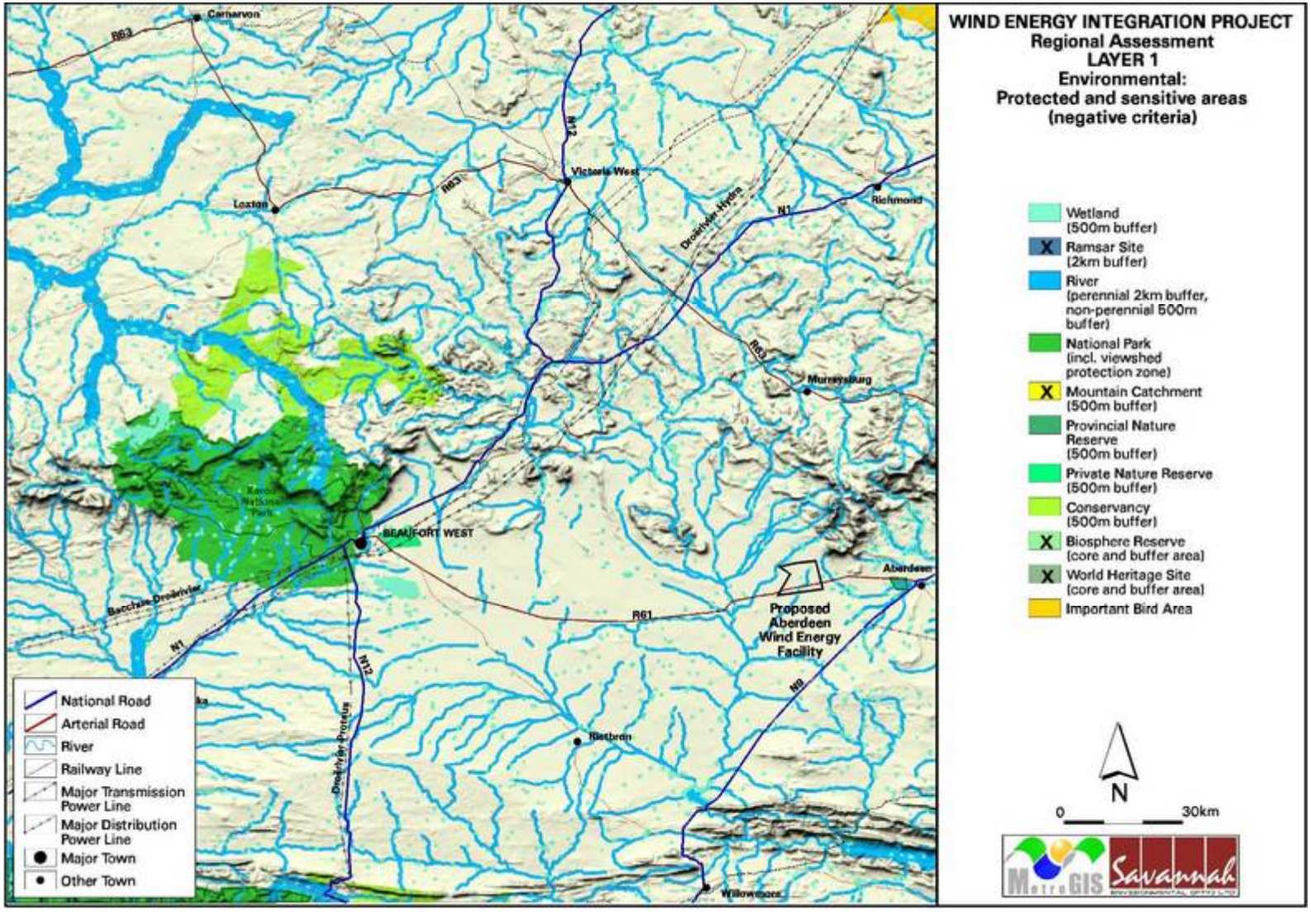
2.2.3 Approach in Determining Areas Considered Acceptable for the Development of a Wind Energy Facility within the Identified Study Area

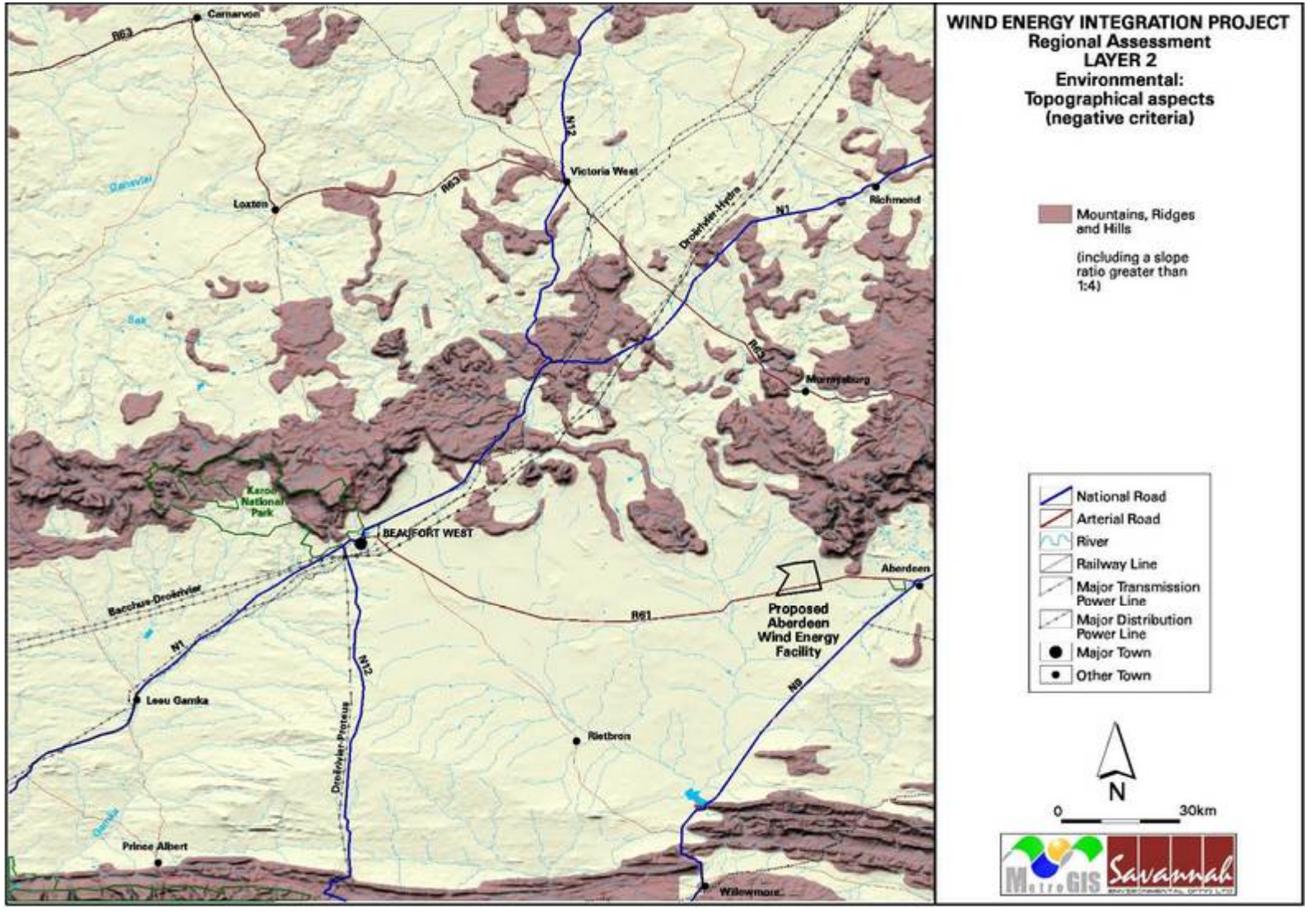
Results of the Regional Assessment

The following maps provide the results of the Regional Assessment undertaken for the Aberdeen area. 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 area of investigation in the Regional Assessment phase of the process.

Criteria Based Assessment Data Layers

The maps which follow indicate the environmental and planning criteria considered within the Regional Assessment.


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 1
Environmental:
Protected and sensitive areas
(negative criteria)
Wetland (500m buffer)
Ramsar Site (2km buffer)
River (perennial 2km buffer, non-perennial 500m buffer)
National Park (incl. viewshed protection zone)
Mountain Catchment (500m buffer)
Provincial Nature Reserve (500m buffer)
Private Nature Reserve (500m buffer)
Conservancy (500m buffer)
Biosphere Reserve (core and buffer area)
World Heritage Site (core and buffer area)
Important Bird Area
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Rietbron
Willowmore
R63
N12
N1
R61
N9
0
30km
N


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 2
Environmental:
Topographical aspects
(negative criteria)
Mountains, Ridges and Hills
(including a slope ratio greater than 1:4)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
Aberdeen
BEAUFORT WEST
Karoo National Park
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
N9
Gamka
Dwyka

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 Layer 1 map that a river crosses the proposed site west of Aberdeen. This is mapped as a sensitive area.

» *Topographical (Layer 2)*

Layer 2 illustrates topographical information that are negatively constraining 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 Layer 2 map that **no constraints** in terms of topography were identified for the proposed site to the west of Aberdeen.

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 Layer 3 map that **there are no constraints or positive buffers** associated with the proposed site to the west of Aberdeen.

» *Coastal Buffer Area (Layer 4)*

Layer 4 relates to a coastal buffer area. As the proposed site is located inland, this layer is not relevant and is therefore not included.

Infrastructural Criteria

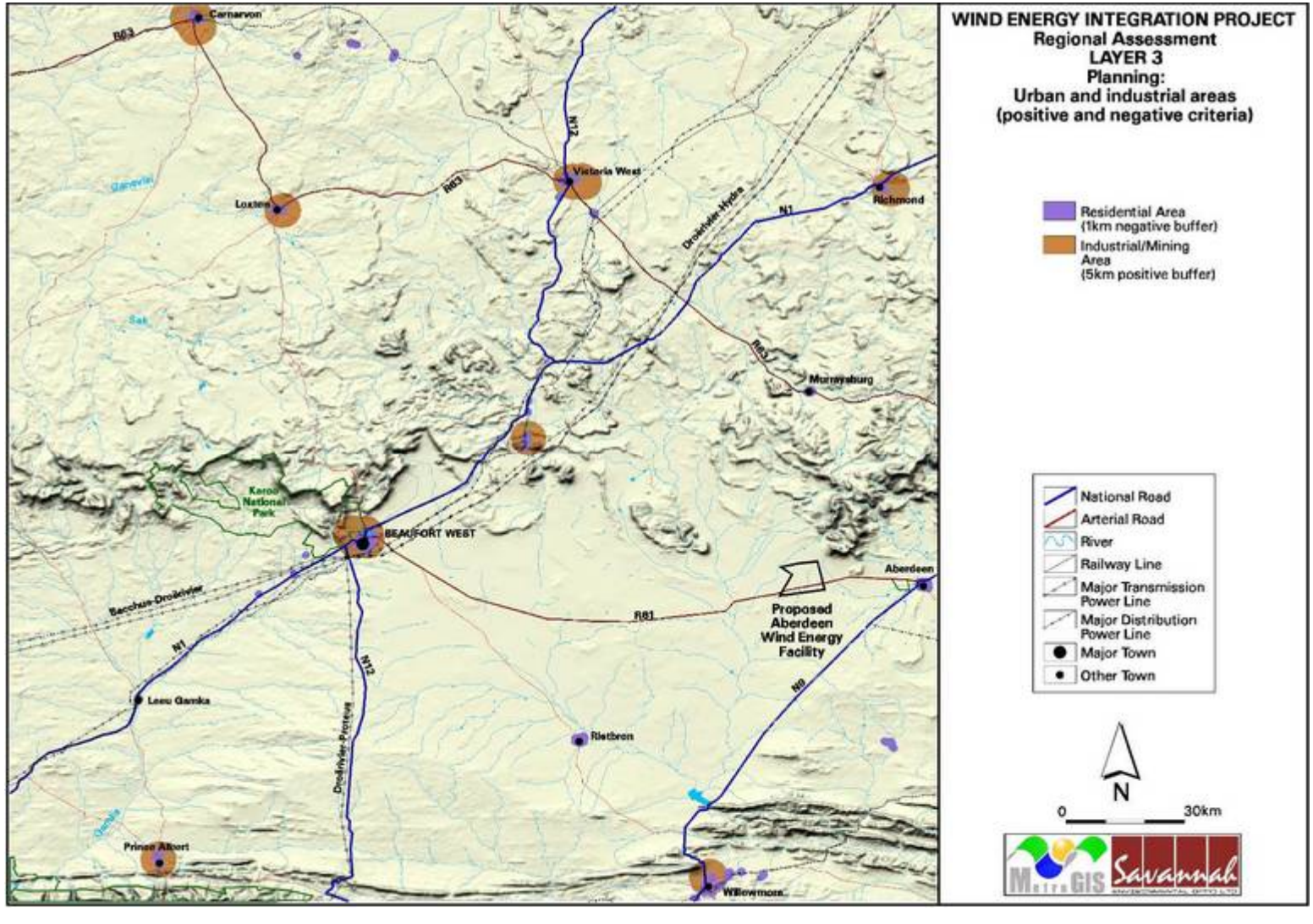
» *Airports and Security Sites (Layer 5)*

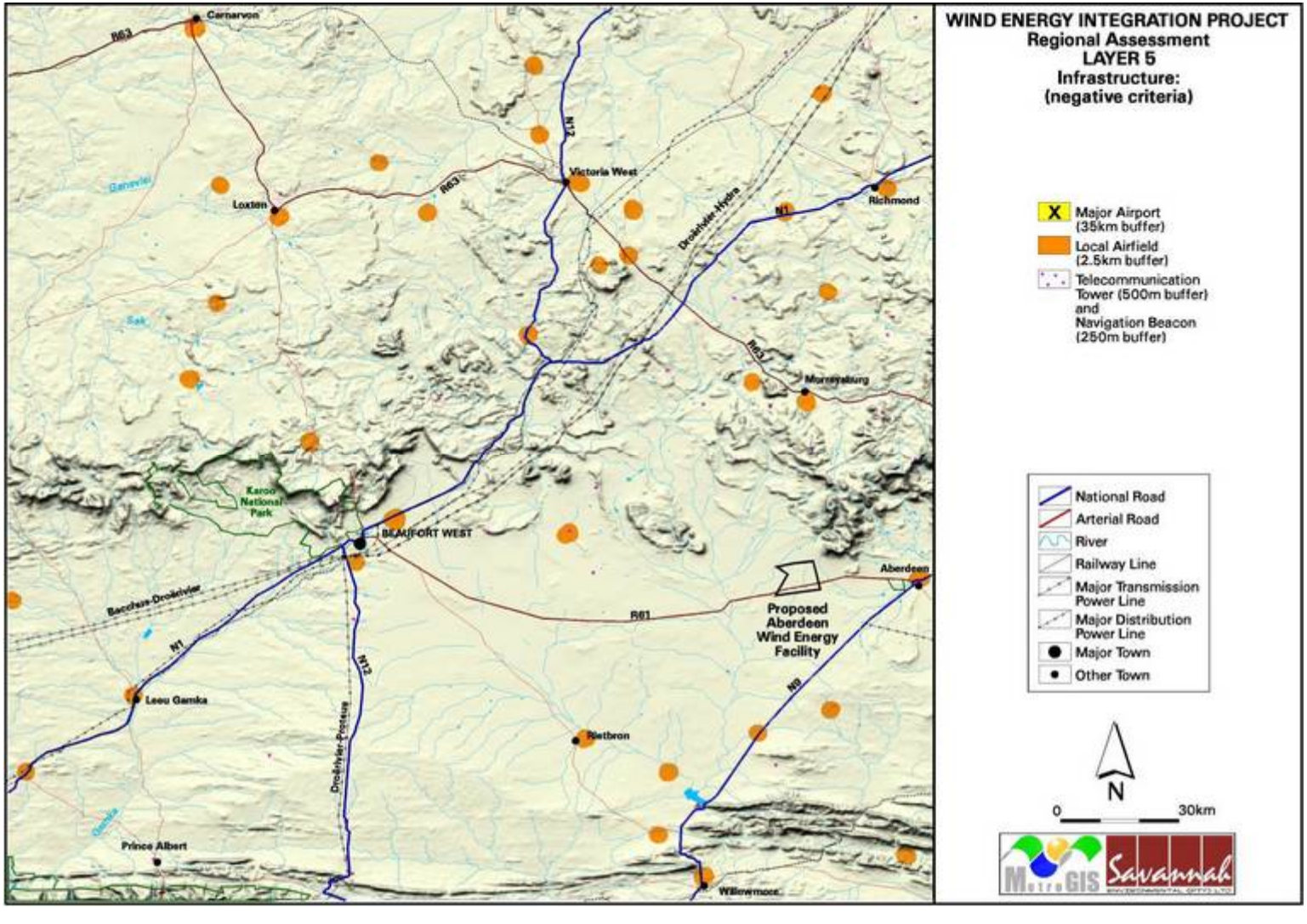
Layer 5 includes infrastructure criteria that would be negatively affected by the development of a Wind Energy Facility. A 35 km buffer around major airports and a 3 km buffer around local airfields are applicable for this study due to wind turbines affecting radar devices. However development **may 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.

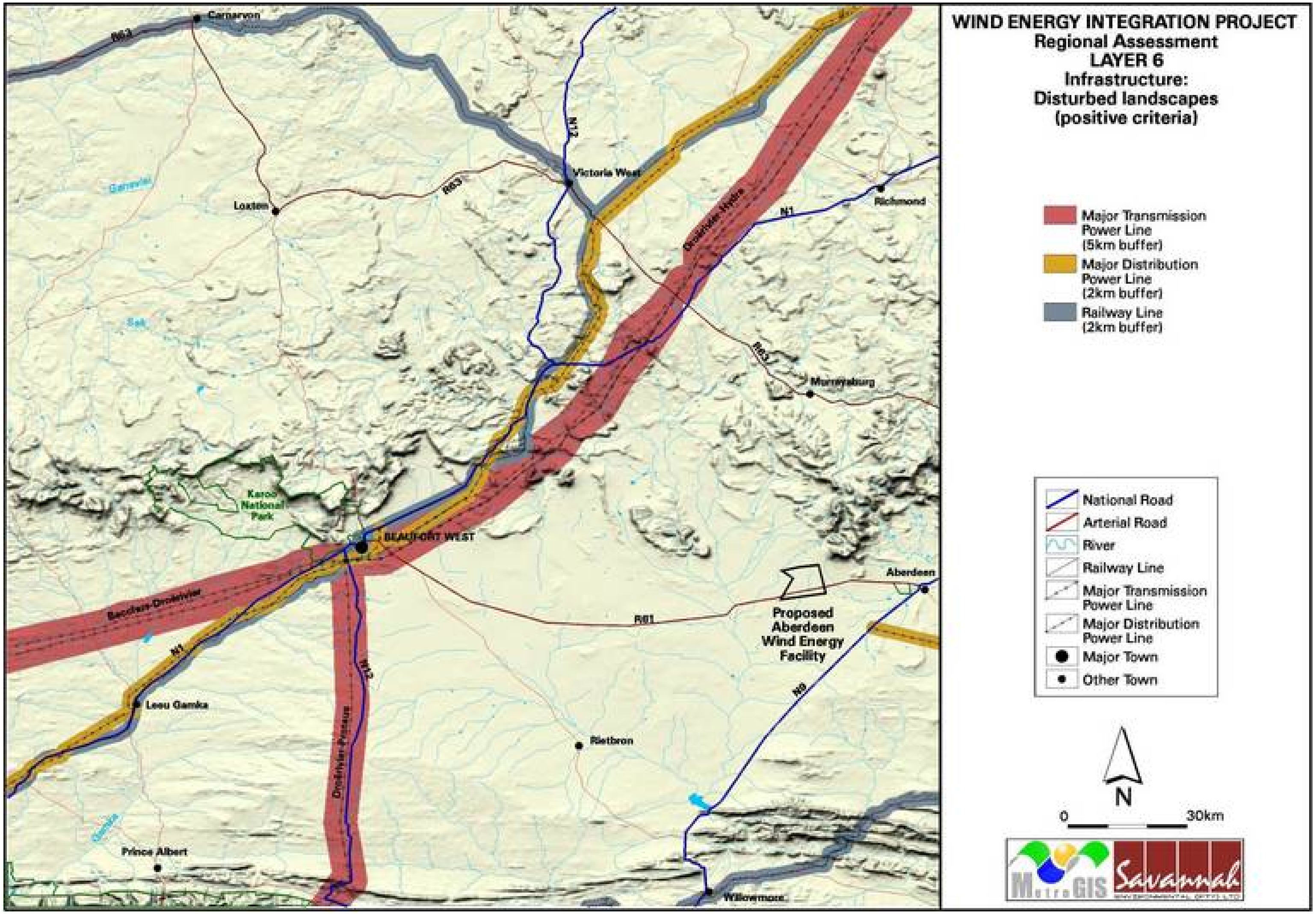
» *Other Infrastructure (Layer 5)*

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 Layer 5 map that **no constraints** in terms of airports and security sites were identified for the proposed development site.


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 3
Planning:
Urban and industrial areas
(positive and negative criteria)
Residential Area
(1km negative buffer)
Industrial/Mining
Area
(5km positive buffer)
National Road
Arterial Road
River
Railway Line
Major Transmission
Power Line
Major Distribution
Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
BEAUFORT WEST
Karoo
National
Park
Aberdeen
Proposed
Aberdeen
Wind Energy
Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
N9


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 5
Infrastructure:
(negative criteria)
Major Airport (35km buffer)
Local Airfield (2.5km buffer)
Telecommunication Tower (500m buffer) and Navigation Beacon (250m buffer)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
Karoo National Park
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
R32
N9


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 6
Infrastructure:
Disturbed landscapes
(positive criteria)
Major Transmission Power Line (5km buffer)
Major Distribution Power Line (2km buffer)
Railway Line (2km buffer)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Victoria West
Loxton
Richmond
Murraysburg
BEAUFORT WEST
Karoo National Park
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
N1
N12
N9
R63
R61

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**.

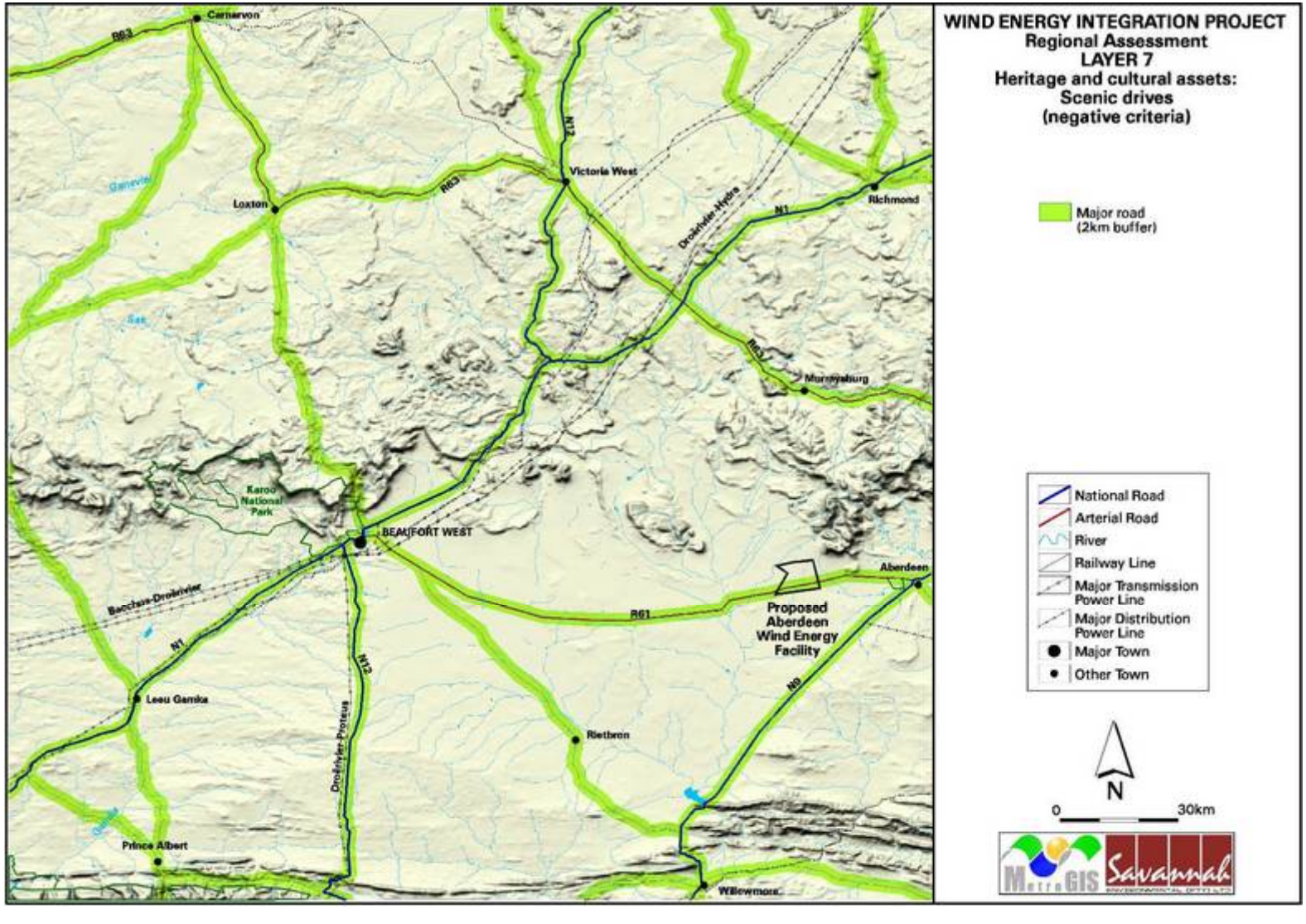
It can be seen from the Layer 6 map that the proposed site to the west of Aberdeen is located some distance from transmission and distribution infrastructure.

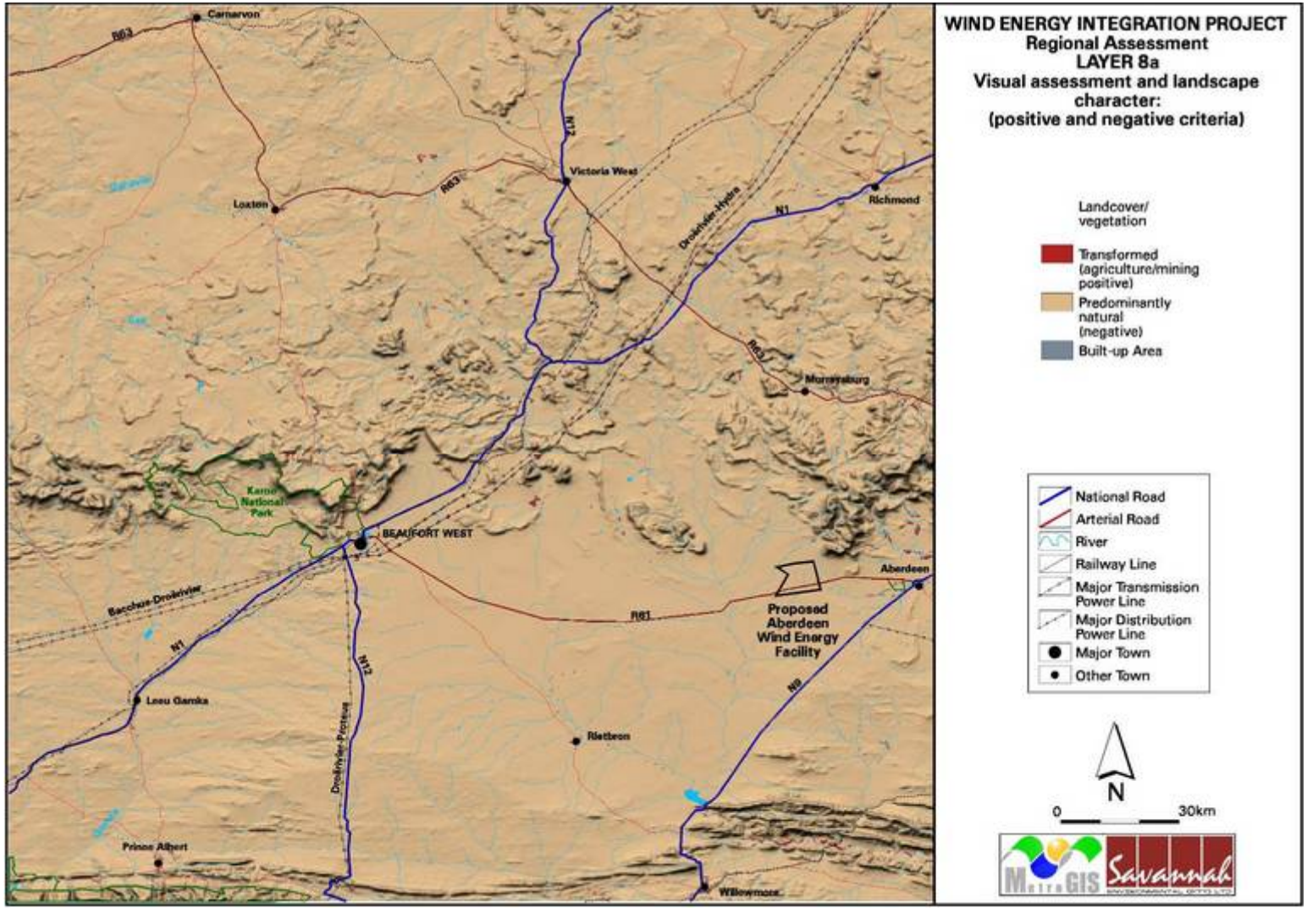
Landscape and Cultural Criteria

» *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 Layer 7 map that the major road R61 cuts across the proposed site to the west of Aberdeen.


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 7
Heritage and cultural assets:
Scenic drives
(negative criteria)
Major road
(2km buffer)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
Karoo National Park
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
R63
N12
N1
R61
N9
Meta GIS
Savannah


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 8a
Visual assessment and landscape character:
(positive and negative criteria)
Landcover/ vegetation
Transformed (agriculture/mining positive)
Predominantly natural (negative)
Built-up Area
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
Karoo National Park
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
R62
R9

Visual Assessment and Landscape Character

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

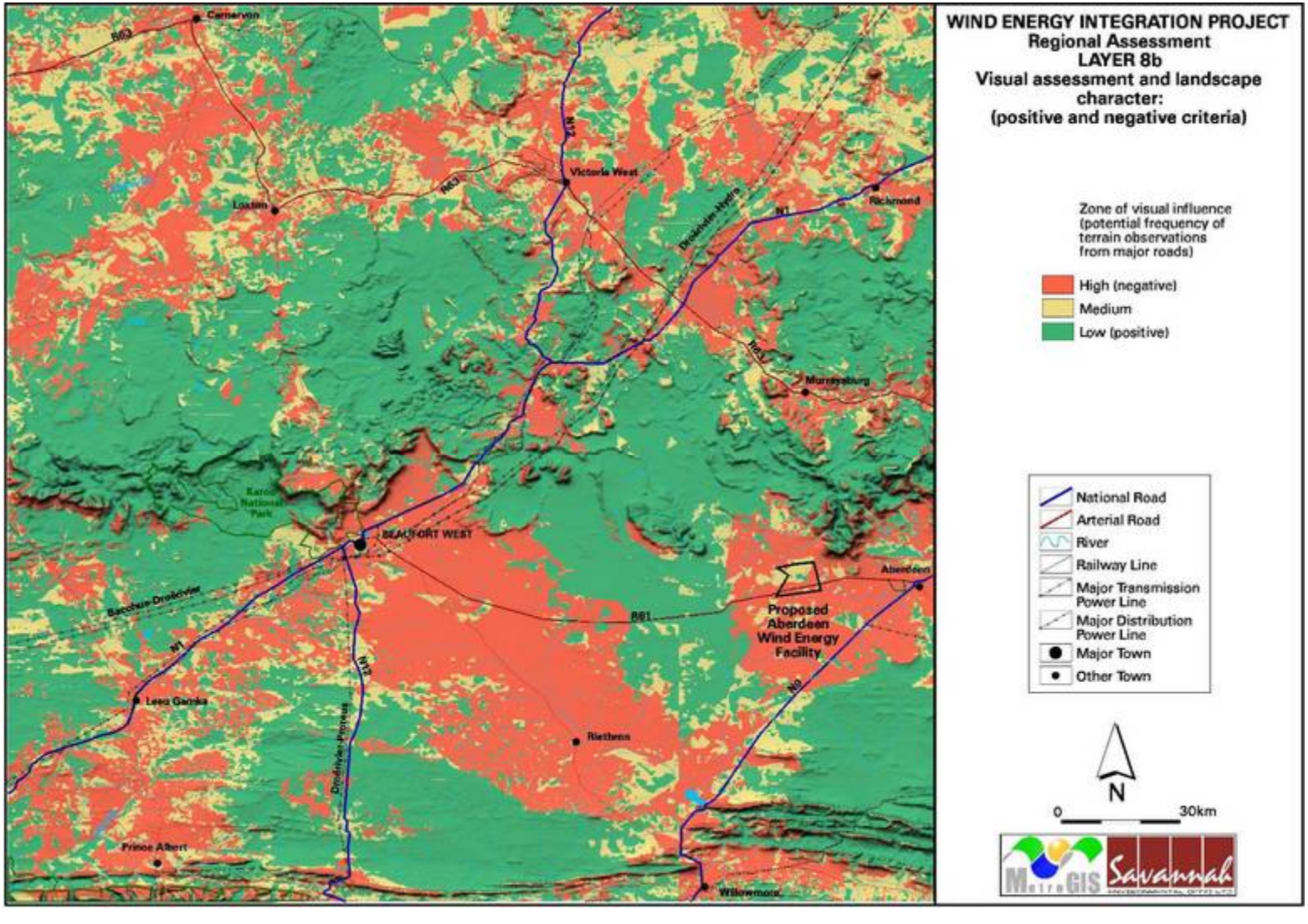
A landscape-based assessment was completed according to the methodology as set out in *Report 3: Methodology 2* of the DEA&DP guideline report, and is aimed at defining landscape character types and their relative visual sensitivity and capacity to absorb wind energy facility development.

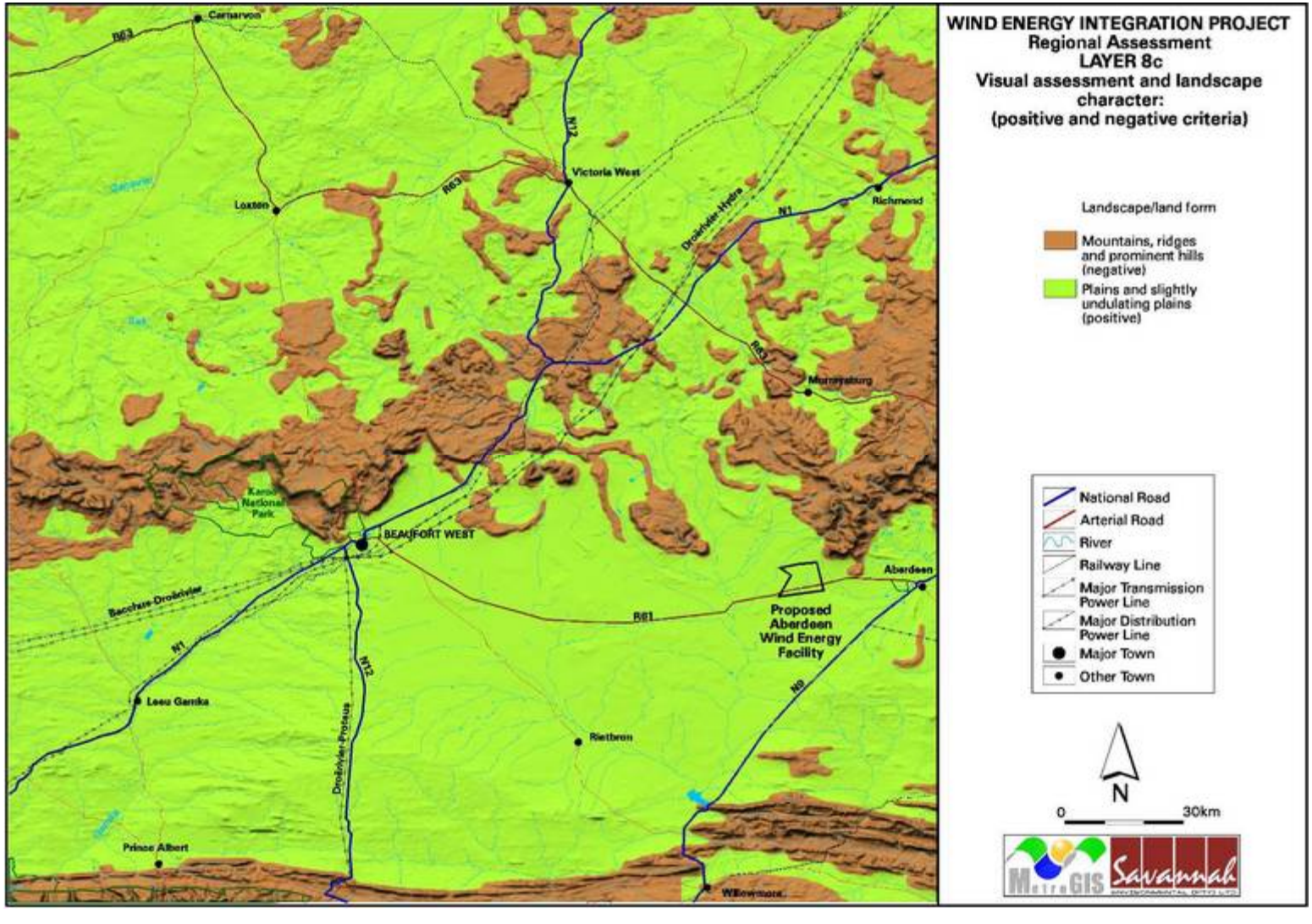
Layer 8a indicates areas that have been permanently transformed, predominantly by agricultural and mining practises. Other areas that are indicated as '*Predominantly Natural'* include areas considered to be natural vegetation and/or land cover types with varying levels of disturbance (e.g. from grazing 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.

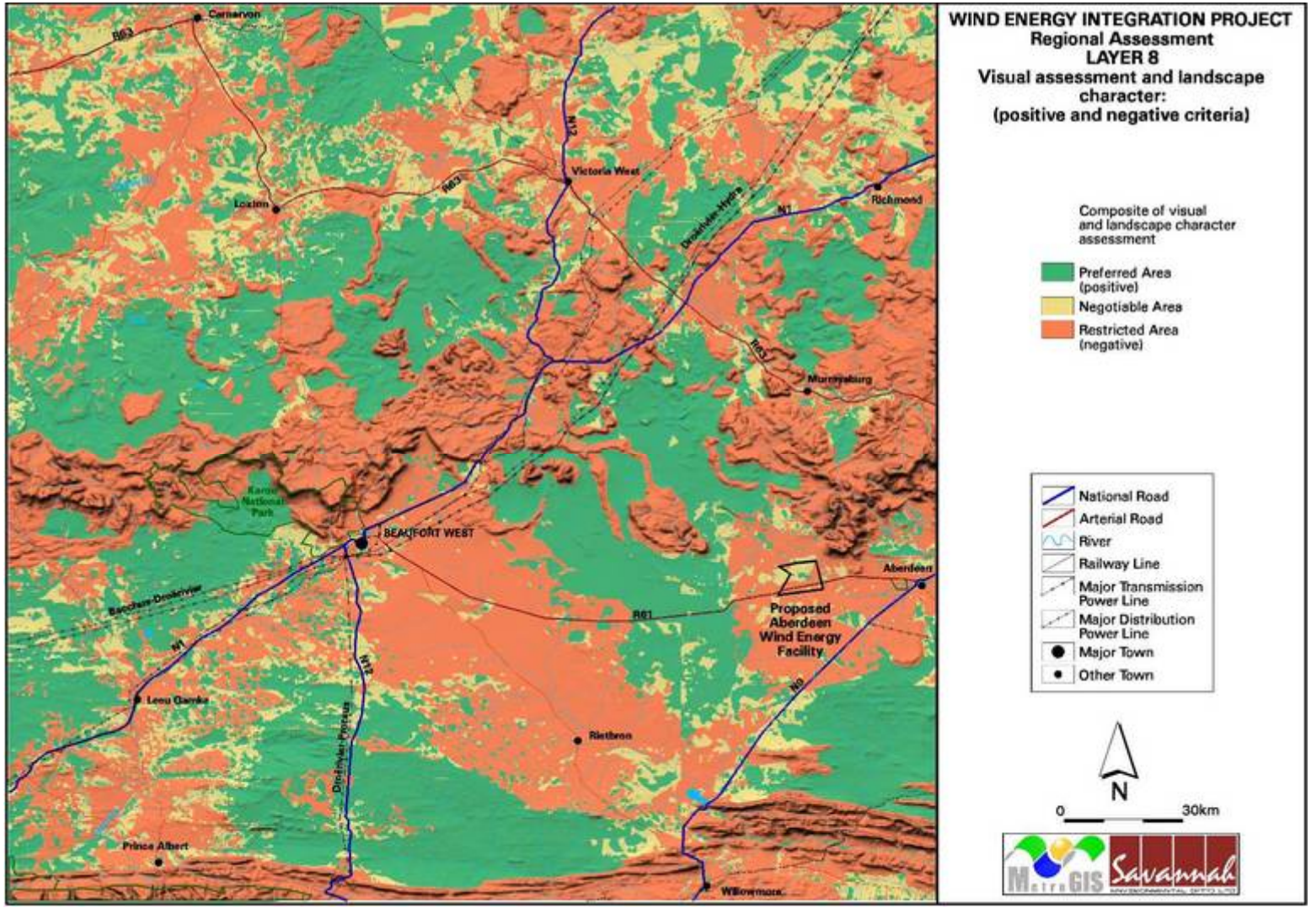
From the Layer 8a map it can be seen that the majority of the area surrounding the proposed study area is indicated as being predominantly natural at this scale.

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 Layer 8b map it can be seen that the proposed study area to the west of Aberdeen is indicated as being within a zone of high to 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 Layer 8c map it can be seen that the majority of the area to the west of Aberdeen is located within an area indicated as plains and slightly undulating plains.


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 8b
Visual assessment and landscape character:
(positive and negative criteria)
Zone of visual influence (potential frequency of terrain observations from major roads)
High (negative)
Medium
Low (positive)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
Karoo National Park
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Prince Albert
Rietbron
Willowmore
R63
N12
N1
R61
N9
N12


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 8c
Visual assessment and landscape character:
(positive and negative criteria)
Landscape/land form
Mountains, ridges and prominent hills (negative)
Plains and slightly undulating plains (positive)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Matjiesfontein
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
R81
N9


WIND ENERGY INTEGRATION PROJECT
Regional Assessment
LAYER 8
Visual assessment and landscape character:
(positive and negative criteria)
Composite of visual and landscape character assessment
Preferred Area (positive)
Negotiable Area
Restricted Area (negative)
National Road
Arterial Road
River
Railway Line
Major Transmission Power Line
Major Distribution Power Line
Major Town
Other Town
N
0
30km
Carnarvon
Loxton
Victoria West
Richmond
Murraysburg
BEAUFORT WEST
Aberdeen
Proposed Aberdeen Wind Energy Facility
Leeu Gamka
Rietbron
Prince Albert
Willowmore
R63
N12
N1
R61
R62
Karoo National Park

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 Layer 8 map it can be seen that the majority of the area to the west of Aberdeen is located within a restricted area largely due to its proximity to major roads in the 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 averse 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:

» This site includes areas of negotiable, restricted and highly restricted areas for development in terms of the results of the Regional Assessment. Restrictions are due to the presence of rivers, proximity to roads, presence of natural vegetation and the visual exposure.
» The southern portion of the site falls within an area indicated as being highly restricted. This is due to the proximity to the R61 and visual concerns.
» The remainder of the site falls within an area indicated as being restricted or negotiable (i.e. areas with one negative criteria or neutral areas). Small patches of preferred areas occur within the centre of the site.

Although large portions of the site fall within restricted or highly restricted areas, it was concluded that the total area proposed for development of a wind energy facility should be investigated at a site-specific level through an EIA as the issues associated with the restriction of a portion of the site could potentially be successfully mitigated, depending on the affected environment.

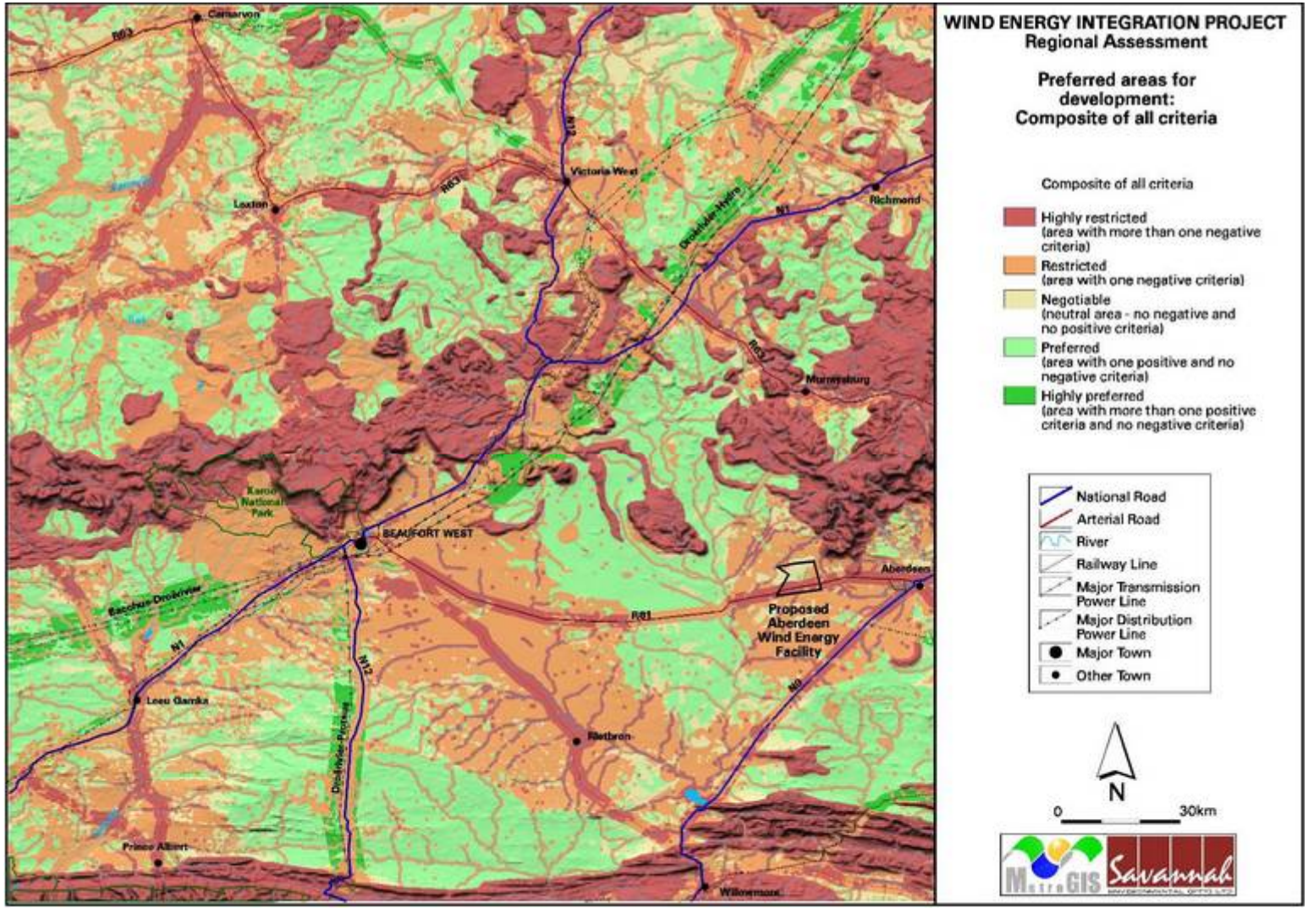


Figure 2.1: Composite map of all criteria of the Regional Assessment indicating the location of the proposed development site

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 resource 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 4.2.

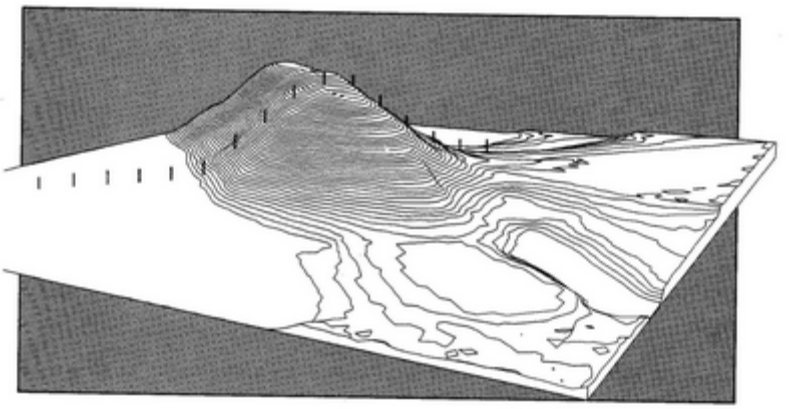


Figure 2.2: Perspective plot of the Askervein Hill

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.

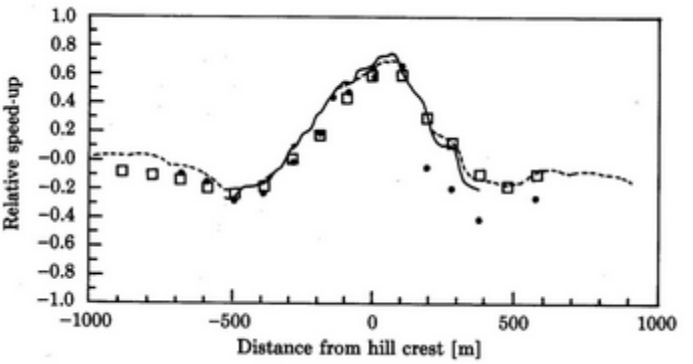


Figure 2.3: Relative speed-up ratios for flow over the Askervein hill at 10m above ground level. Measurements are indicated by dots and results from the orographic model by squares

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 potentially feasible area for development. The placement of a wind energy facility in this area must, however, consider the following technical factors:

» Predominant wind direction
» Obstruction obscuring the wind farm in the topography (slightly undulating plains 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 8 198 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 (~1% 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).

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 Aberbeen 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 and EIA phases, as well as considering the findings from the pre-construction monitoring programmes, the layout of the wind turbines and infrastructure has been developed by Eskom (refer to layout as shown in Figure 2.1, which is a revised layout in response to sensitivities identified through the bird and bat monitoring programmes as well as heritage and ecology) This layout is considered to be an 80% accurate layout, and allows for some adjustment to avoid any further site-specific environmental constraints identified, 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 informed the specialist impact assessments in this EIA phase, and where required, specialists have considered the revision to the layout. The planning process also included the positioning of other ancillary infrastructure, including, and internal substation site/s.

At the scoping phase it was concluded that, the site was selected based on the following technical factors:

» Predominant wind direction
» Obstruction obscuring the wind farm in the topography (slightly undulating plains 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 guided Eskom to site/locate their proposed facility within an area/zone of preference (which considers environmental and planning criteria), no alternative locations/sites will be required to be considered through the EIA process. The demarcated area is an indicative area (approximately 8 198 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 only ~10% 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).

2.3.4 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Aberdeen 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

2.4 The Need and Desirability for 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 Aberdeen Wind Energy Facility site is one of these sites.

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

Cacadu District Municipality Integrated Development Plan

The Cacadu District Municipality (CDM) Integrated Development Plan (IDP) (2012-2017) refers to the Medium Term Strategic Framework (MTSF) developed in July 2009 by the Minister of Planning. The aim of the MTSF is to guide planning and resource allocation across all the spheres of government through the identification of ten (10) National Strategic Medium Term Priorities. National, Provincial and Local spheres of government are expected to adapt their planning in line with the Strategic Priorities. The Strategic Priorities that are relevant to the proposed Aberdeen Wind Energy Facility include speeding up growth and transforming the economy to create decent work and sustainable livelihoods, strengthen the skills and human resource base and Sustainable Resource Management and Use.

The sustainable resource management and use is a specifically relevant priority as is makes reference to impact of climate change and South Africa's ratification of the United Nations Framework on Climate Change in August 1997 and the Kyoto Protocol in March 2002. The main objective of government in terms of this priority is to encourage sustainable resource management and use by focusing on various interventions including the pursuance of renewable energy alternatives and promotion of energy efficiency. The CDM IDP therefore specifically makes reference to the need to investigate renewable energy options, such as wind energy. The importance of wind energy generation in the district has been confirmed by the announcement by the Department of Energy in terms of successful wind farm developments, as a number of approved wind farm developments are to be developed in the district. The two largest energy generating wind farms, i.e. Cookhouse Wind Farm (135MW) and Jeffreys Bay (133.86MW) and Red Cap Kouga Wind Farm are currently under operation.

Camdeboo Local Municipality Integrated Development Plan 2012-2017

The LM's support for renewable energy projects is highlighted in its strategy for electrification in which it states that a core component of it future strategy is to, "Be more supportive of alternative & renewable energy initiatives." The IDP notes that while the CLM does support renewable energy developments, concerns have been raised regarding the potential impact of solar and wind energy facility developments on the area's sense of place. The CLM IDP (2012-2017) also makes reference to a number of renewable energy projects in the area. The IDP indicates that at least two more renewable energy developments are located in

the Aberdeen area i.e. the Mainstream Aberdeen WEF and the BioTherm Aberdeen PV/CPV SEF.

Financial Viability and Community Needs

In terms of the energy yield predicted from the facility, Eskom considers the Aberdeen project to be financially viable. The "need and desirability" of the local community as reflected in an IDP 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, SDF and/or EMF). The Aberdeen wind energy facility project is in line with both the Cacadu District and Camdeboo Local Municipality strategies as discussed above. In terms of the needs on the local community, the ID identified the need for development, social services, and education and employment opportunities in this area. The Aberdeen wind energy facility could potentially contribute positively to these community needs. The project will create employment and business opportunities, 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.

The Desirability for the Aberdeen 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 site was selected for the development of a wind energy facility based on its predicted wind climate (high wind speeds), and minimum technical constraints from a construction and technical point of view. Eskom Holdings SOC Limited considers this area, and specifically the demarcated site, to be highly preferred for wind energy facility development. Wind monitoring is currently being undertaken on the 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.

The current land-use on the site is agriculture, mainly used for extensive grazing due to the low rainfall and distinct soil constraints. The development of the wind

energy facility will allow livestock grazing on areas of the farm portions which will not be occupied by wind turbines and associated infrastructure. Therefore the current land-use will be retained, while also generating renewable energy from the wind. This represents a win-win situation of landowners, the site and the developer.

The potential environmental suitability of the site was determined through the regional assessment undertaken in 2009 (refer to Figure 2.1). It was concluded that although large portions of the site fall within restricted or highly restricted areas, it was concluded that the total area proposed for development of a wind energy facility should be investigated at a site-specific level through an EIA as the issues associated with the restriction of a portion of the site could potentially be successfully mitigated, depending on the affected environment.

WIND ENERGY AS A POWER GENERATION OPTION CHAPTER 3

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 Aberdeen Wind Energy Facility will be up to 200MW, and will feed into the national 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 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 and 3.2). 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 will be considered through the process of micro-siting the turbines on the site.

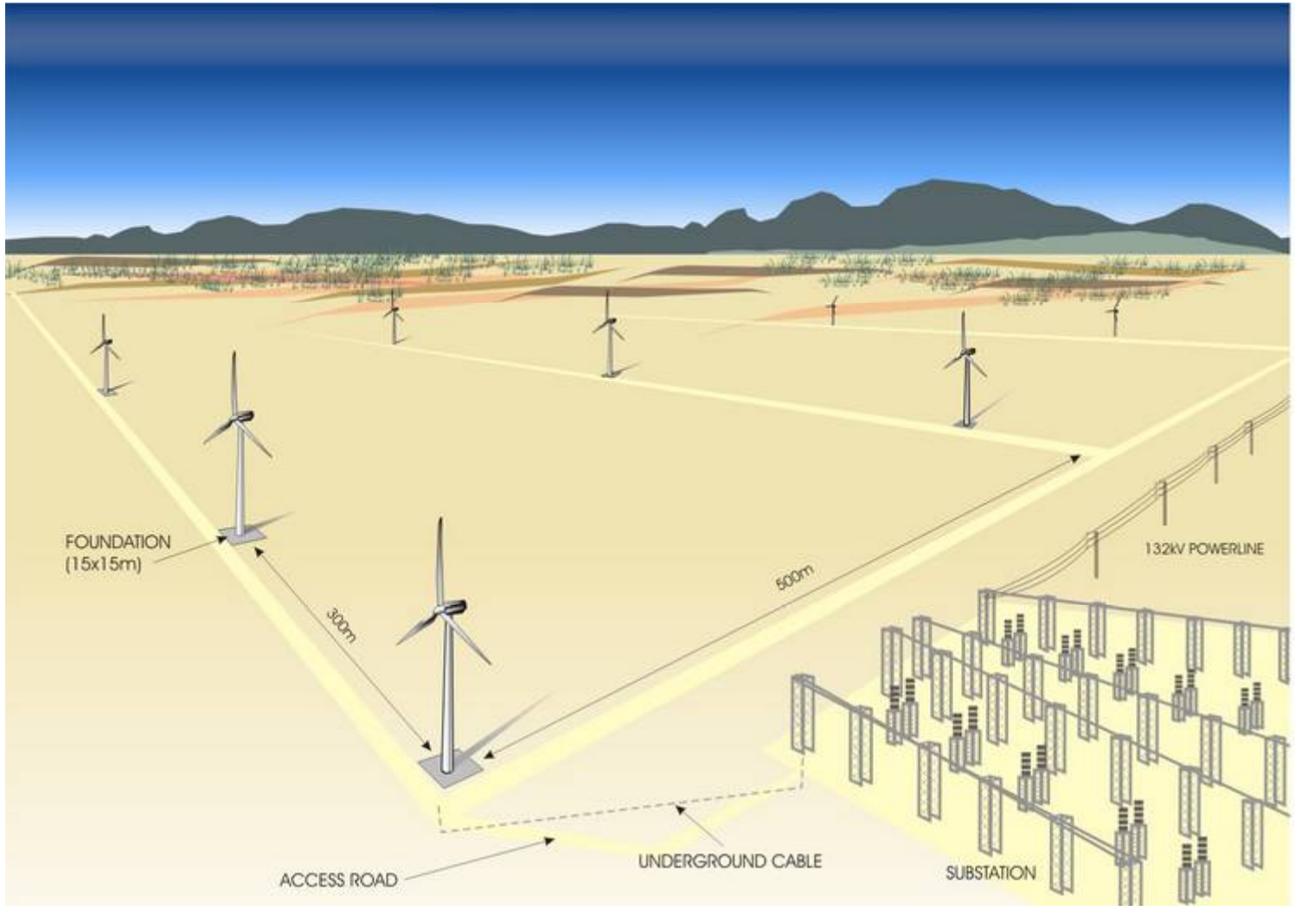


Figure 3.1: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

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 Aberdeen Wind Energy Facility in the Eastern Cape Province will have a maximum hub height of up to 140 m and rotor diameter of up to 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:

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

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.

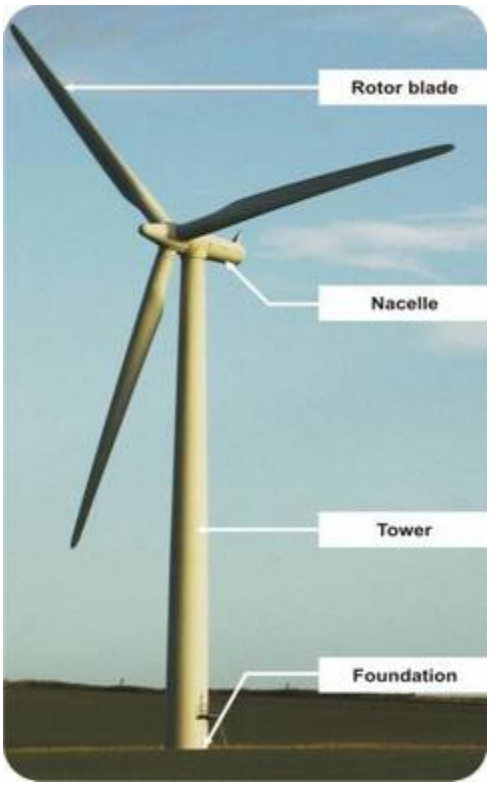


Figure 3.2: Illustration of the main components of a wind turbine

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.

REGULATORY AND LEGAL CONTEXT CHAPTER 4

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.

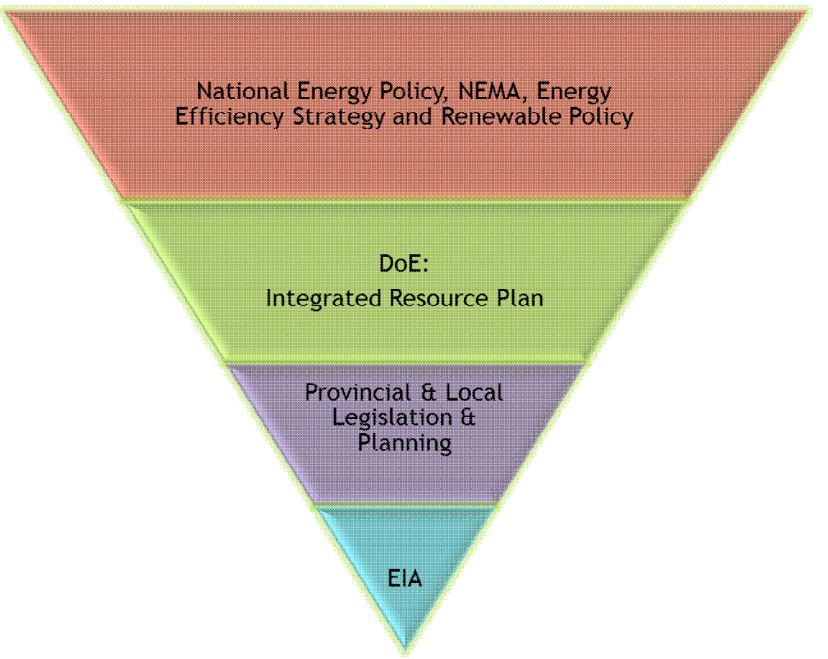


Figure 4.1: Hierarchy of electricity policy and planning documents

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 DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, i.e.:

» increasing access to affordable energy services;
» improving energy sector governance;
» stimulating economic development;
» managing energy-related environmental impacts; and
» securing supply through diversity.

In order to meet these objectives and the developmental and socio-economic objectives in South Africa, the country needs to optimally use the available energy resources. The South African Government is required to address what can be done to meet these electricity needs both in the short- and long-term.

The National Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process and the adoption of a National Integrated Resource Planning (NIRP) approach. Through these processes, the most likely future electricity demand based on long-term southern African economic scenarios can be forecast, and provide the framework for South Africa to investigate a whole range of supply and demand side options.

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 (DoE):* This Department is responsible for policy relating to all energy forms, including renewable energy, and is responsible for forming and approving the IRP (Integrated Resource Plan for Electricity).

- *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 solar 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.
- Square Kilometer Array (SKA)
- *The South African Heritage Resources Agency (SAHRA):* SAHRA is a statutory organisation established under the National Heritage Resources Act, No 25 of 1999, as the national administrative body responsible for the protection of South Africa's cultural heritage.
- *National Department of Agriculture, Forestry, and Fisheries (DAFF):* This Department is responsible for activities pertaining to subdivision and rezoning of agricultural land. The forestry section is responsible for the protection of tree species under the National Forests Act (Act No 84 of 1998).
- *South African National Roads Agency (SANRAL):* This Agency is responsible for the regulation and maintenance of all national routes.
- *National Department of Water and Sanitation:* This Department is responsible for water resource protection, water use licensing and permits.

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

- *Eastern Cape Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape DEDEAT).* This department is the commenting authority for this project.
- *Eastern Cape Department of Transport and Public Works –.* This department is responsible for provincial roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- *Eastern Cape Department of Agriculture and Rural Development* - This is the provincial authority responsible for matters affecting agricultural land.
- *Eastern Cape Provincial Heritage Resources Authority (ECPHRA)*: This department 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 Eastern Cape, both Municipalities i.e. *Camdeboo Local Municipality* and District Municipalities i.e. *Sarah Baartman (previously known as Cacadu) 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.

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 Draft 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 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)	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 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.	National Department of Environmental Affairs – lead authority. Provincial Environmental Department - commenting authority.	This EIA report is to be submitted to the DEA and Provincial Environmental Department in support of the application for authorisation.
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	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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	cumulative effect of a variety of impacts.		
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 » Eastern Cape DEDEAT	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)	National Noise Control Regulations (GN R154 dated 10 January 1992)	» National Department of Environmental Affairs » 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.
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.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
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. » 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	» National Department of Environmental Affairs » Eastern Cape DEDEAT	» 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
	failed to comply with the Act. » Dust control regulations promulgated in November 2013 may require the 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	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
	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 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 S 56(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	National Department of Environmental Affairs Eastern Cape DEDEAT	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
	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 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)	» Prohibition of the spreading of weeds (S5). » Classification of categories of weeds & invader plants (Regulation 15 of GN R1048) & restrictions in terms of where these species may occur. » Requirement & methods to implement control measures for alien and invasive plant species (Regulation 15E of GN R1048).	Department of Agriculture, Forestry and Fisheries	This Act will find application during the EIA 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. The permission of agricultural authorities will be required if the Project requires the draining of vleis,

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			marshes or water sponges on land outside urban areas.
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 should a veld fire occur on the property, that it does not spread to adjoining land. In terms of section 13 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.	Department of Water and Sanitation	While no permitting or licensing requirements arise from this 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'.	Department of Agriculture, Forestry and Fisheries	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Forests: (S7) Prohibits the destruction of indigenous trees in any natural forest without a licence.		
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 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.	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational 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	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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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 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.		are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.
National Road Traffic Act	The Technical Recommendations for Highways	Provincial Department of	An abnormal load/vehicle permit may

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
(Act No 93 of 1996)	(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. 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.	Transport (provincial roads) South African National Roads Agency Limited (national roads)	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 (height and width).

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
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.	Provincial Environmental Department - commenting authority. Camdeboo 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.
Provincial Legislation/ Policies / Plans			
Nature Conservation Ordinance (Act No. 19 of 1974)	» Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, and gathering, uprooting, damaging, or destroying). » Schedule 3 lists endangered flora and Schedule 4 lists protected flora. » Articles 26 to 47 regulate the use of wild animals.	Eastern Cape DEDEAT	» Permitting or licensing requirements may arise from this legislation for the proposed activities to be undertaken for the proposed project.
The Eastern Cape Sustainable energy Strategy - 2012	The strategy has the following goals: » Goal 1: Job creation and skills development » Goal 2: Alleviate energy poverty » Goal 3: Reduce CO2 emissions and environmental pollution » Goal 4: Improve industrial competitiveness » Goal 5: Promote renewable energy	Eastern Cape DEDEAT	This strategy aims to 1) facilitate the support and development of local energy supply capacity for the Eastern Cape Province, 2) resulting in local economic development, job creation and energy justice, while at the same time, 3) lowering the Provinces' contribution to emissions of Greenhouse Gasses.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	production in the Province » Goal 6: Promote the development of a renewable energy manufacturing industry and technology development		The Strategy further aims to stimulate industrial development by strengthening local production of renewable and other energy-related components.
Local Legislation / Policies / Plans			
Camdeboo Local Municipality Integrated Development Plan (IDP) (2012/ 2017)	» The LM's support for renewable energy projects is highlighted in its strategy for electrification in which it states that a core component of it future strategy is to, "Be more supportive of alternative & renewable energy initiatives."	Camdeboo Municipality	» New developments in the municipality to be in line with the IDP.
Cacadu DM (Sara Baartman) Land Use and Locational Policy for Renewable Energy Projects	» Land use and locational guidelines available to local municipalities to assist in making decisions with regards to RE » *Objectives*: o Formulate a detailed locational and land use strategy for the establishment of wind farms and large scale renewable energy projects; o Implement District wide land use and locational guidelines with respect to renewable energy technologies; o Assess the impact and possible spin-offs of renewable energy, especially	Cacadu District Municipality	Given the uncoordinated land use management approach for implementation of renewable energy projects on a National level, this policy should be seen as a point of departure for land use applications in the Cacadu district, with possible future refinement and rollout on a Provincial level.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	wind farms, on the municipal rates base; o Develop District level guidelines and policy for possible roll-out to individual LM's and province.		
Standards/ Guidelines			
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 may take single event noise into account, but	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
	single event noise by itself does not determine whether noise levels are acceptable for land use purposes.		
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. » Site specific risks/ impacts to bats associated with a proposed WEF. » Effective mitigation and monitoring methods that will be appropriate for the WEF.	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/ transects, spread evenly across all four seasons

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
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 facilities.	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
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 Aberdeen 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 to facilitate the connection between the facility and the electricity grid
GN 544, activity 11 The construction of: **(x)** buildings exceeding 50 square metres in size; or **(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 (x) buildings exceeding 100 square metres in size; (xii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse	The proposed facility will impact on drainage lines or other watercourses.
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,	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,	The proposed facility will impact on drainage lines or other watercourses.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
pebbles or rock or more than 5 cubic metres from **(i)** a water course	shell grit, pebbles or rock of more than 5 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 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 13metres.
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 200 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 Substation will be constructed to evacuate electricity into the national grid
GN 545, activity 15 Physical alteration of undeveloped, vacant or	GN984, activity 28 Residential, mixed, retail, commercial, industrial or	The facility is proposed to be established within an area of ~8 198 ha in extent.

Activity listed in GNR 544 – 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more	institutional developments where such land was used for agriculture or 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 1 The construction of billboards exceeding 18 square metres in size outside urban or mining areas or outside industrial complexes. **(a)** In Eastern Cape: **(vi)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	GN985, activity 1 The development of billboards exceeding 18 square metres in size outside urban areas, mining areas or industrial complexes. (b) In Eastern Cape: vi. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	Billboards exceeding 18 square metres in size outside urban will be constructed in areas falling within an area defined as a CBA.
GN 546, activity 2 The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres. **(a)** In Eastern Cape: **(iii)** outside urban areas **(dd)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	GN 985, activity 2 The construction of reservoirs for bulk water supply with a capacity of more than 250 cubic metres. **(b)** In Eastern Cape: **(iii)** outside urban areas **(dd)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Reservoirs for bulk water supply will be situated within an area defined as a CBA.
GN 546, activity 4 The construction of a road wider than 4 m with a reserve less than 13,5m.	GN 985, activity 4 The construction of a road wider than 4 m with a reserve less than 13,5m.	The project will require access roads to be constructed that are wider than 6m in areas falling within an area defined as a CBA.

Activity listed in GNR 544 – 546	**Activity listed in GNR 983 - 985**	**Relevance to the project**
(a) In Eastern Cape: **(ii)** outside urban areas **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	**(b)** In Eastern Cape: **(ii)** outside urban areas **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	
GN 546, activity 10 The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres **(a)** In Eastern Cape: **(ii)** outside urban areas **(ee)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	GN 985, activity 10 The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres (b) In Eastern Cape: (ii) outside urban areas (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Fuel to be used during construction will need to be stored on-site in areas falling within an area defined as a CBA.
GN546. Activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. **(b)** Within critical biodiversity areas identified in bioregional plans;	GN983, activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation GN 985, activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) In Eastern Cape: (ii) Critical biodiversity areas as identified in systematic biodiversity plans	Some of the wind energy facility infrastructure is proposed in natural vegetation which falls within an area defined as a CBA.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
GN 546, activity 13 The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, **(a)** Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority.	GN983, activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation GN 985, activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) In Eastern Cape: (ii) Critical biodiversity areas as identified in systematic biodiversity plans	The project will require the clearance of more than 1 hectare of vegetation where 75% or more of the vegetation cover constitutes indigenous vegetation which falls within an area defined as a CBA.
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 Eastern Cape: **i.** All areas outside urban areas	GN983, activity 27 The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation GN 985, activity 12 The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) In Eastern Cape: (ii) Critical biodiversity areas as identified in systematic biodiversity plans	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.
GN 546, activity 16 The construction of **(iii)** buildings with a footprint exceeding 10 square metres in size or **(iv)** infrastructure covering	GN 985, activity 14 The development of: (x) buildings exceeding 10 square metres in size; (xii) infrastructure or structures with a physical footprint of 10 square	There is drainage lines on the proposed site which will be impacted by the proposed infrastructure and buildings within an area defined as a CBA.

Activity listed in GNR 544 – 546	Activity listed in GNR 983 - 985	Relevance to the project
10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, **(a)** In Eastern Cape: **(ii)** outside urban areas **(ff)** Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	metres or more. within a watercourse; (c) In Eastern Cape: (ii) outside urban areas (ff) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	
GN 546, activity 19 The widening of a road by more than 4 meters or the lengthening of a road by more than 1 kilometres (a) In Eastern Cape: (ii) outside urban areas (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	GN 985, activity 18 The widening of a road by more than 4 meters or the lengthening of a road by more than 1 kilometres (b) In Eastern Cape: (ii) outside urban areas (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Access roads may be widened or lengthened within an area defined as a CBA.

5.2. Phase 1: Scoping Study

A draft Scoping Report was released for public review in February 2012 for a 30-day comment period (40 days for Organs of State). Following the review of the draft scoping, a final scoping report was submitted to DEA in April 2012. The DEA however requested additional information prior to providing acceptance for the process. A revised Final Scoping Report was submitted in August 2012. This together with the Plan of Study for the EIA was accepted by the DEA, as the competent authority, in November 2012. In terms of this acceptance, an EIA was required to be undertaken for the proposed project.

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 Aberdeen 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 Aberdeen 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 of 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 a Draft EIA Report in accordance with the requirements of the Regulation 31 of GN R543 of 2010.
» Prepare 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 a Draft 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 EC DEDEA representatives to visit and inspect the proposed site, and the study area
» Consultation with Organs of State that may have jurisdiction over the project:
  * Eastern Cape DEDEAT
  * Department of Energy
  * Department of Water and Sanitation
  * Department of Agriculture, Forestry and Fisheries (DAFF)
  * Eastern Cape Department of Agriculture and Rural Development
  * Department of Mineral Resources (DMR)
  * South African Heritage Resources Agency (SAHRA)
  * Civil Aviation Authority (CAA)
  * South African National Roads Agency
  * Department of Transport and Public Works
  * Eastern Cape Heritage Resources Authority (ECPHRA)
  * Camdeboo Local Municipality
  * Cacadu 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:

» Several focus group meetings (stakeholders invited to attend)
» Public meeting (advertised in the local and regional press: Graaff Reinet Advertiser and Burger Oos)
» 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	May 2011

	of adverts (Graaff Reinet Advertiser)	
	Document (BID) and written notice Distribution of Background Information	December 2011
	Advertisement of Public Meeting & Availability of Scoping report for public review - Second round of adverts (Graaff Reinet Advertiser and Burger Oos)	January 2012
	Focus group meetings	January 2012
	Public review period for DSR	17 February 2012 - 18 March 2012
	Public meeting	19 January 2012
	Notification to registered I&APs that the Final Scoping report was available & submitted to DEA	April 2012
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting - (Graaff Reinet Advertiser and Burger Oos)	March 2015
	Public meeting & stakeholder meetings » **Date:** 19 March 2015 » **Time:** 18:00-19:30 PM » **Venue:** Thembalesizwe Aberdeen Community Hall, Aberdeen	

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 E** 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	Ecology, flora and fauna	Appendix D

Lourens Leeuwner of Endangered Wildlife Trust	Avifauna pre-construction monitoring and impact assessment	Appendix E
Kate MacEwan of Inkululeko Wildlife Services	Bat pre-construction monitoring and impact assessment	Appendix F
Iain Paton of Outeniqua Geotechnical Services	Geology, soils and agricultural potential study)	Appendix G
Celeste Booth of Albany Museum	Heritage / Archaeology	Appendix H
John Almond of Natura Viva cc	Palaeontology	Appendix I
Morne de Jager of MENCO (M2 Environmental Connections cc)	Noise	Appendix J
Lourens du Plessis of MetroGIS	Visual	Appendix K
Tony Barbour of Tony Barbour Consulting and Research	Social Impact	Appendix L

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 M**.

5.4.5 Assumptions and Limitations

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 Droërivier 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-L** for more details).

5.4.6 Public Review of Draft EIA Report and Feedback Meeting

This Draft EIA report has been made available for public review from **27 February 2015 – 13 April 2015** at the following locations:

» www.savannahsa.com
» Aberdeen Library- Andries Pretorius Street, Aberdeen
» Horse Shoe Library- Parsonage Street, Graaff Reinet, 6280

Comments can be submitted to **Sustainable Futures ZA** by 13 April 2015 as written submission via fax, post or e-mail.

In order to provide feedback of the findings of the studies undertaken and receive comments to address in the draft EIA report, a public feedback meeting is to be held within the review period of the Draft EIA Report. All interested and affected parties are invited to attend the **public feedback meeting** (to be held on 19 March 2015 at the Thembalesizwe Aberdeen Community Hall, Aberdeen at 18h00.).

All registered I&APs were notified of the availability of the report and public meeting in writing. Adverts were also placed in the Burger Oos and Graaff Reinet Advertiser on 27 February 2015 and 5 March 2015, respectively (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 Aberdeen 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 - L.**

6.1 Regional Setting: Location of the Study Area

The site for the proposed wind energy facility is located approximately 24 km west of the town of Aberdeen in the Eastern Cape Province, within the Camdeboo Local Municipality. The broader area (~8 198ha in extent) comprises the following farm portions:

» RE of Portion 3 of Sambokdoorns 92
» RE of Portion 4 of Sambokdoorns 92
» RE of Sambokdoorns 92
» Portion 2 of Klipdrift 73
» Portion 2 of Farm 94, and
» RE of Portion 2 of Farm 94

The Camdeboo Local Municipality is located approximately 270km from Port Elizabeth (CBD) and forms part of an area known as the "Karoo Heartland", which defines a scenic route through the Karoo. The northern area of the study area is characterised by a mountainous terrain or high lying hinterland. The rural areas have low densities and are characterised by farming activities. The urban nodes within the municipality include:

» Graaff-Reinet, including Umasizakhe, Kroonvale, Adendorp and Kendrew;
» Aberdeen, including Lotusville and Thembalesizwe; and
» Nieu-Bethesda, including Pienaarsig.

The Camdeboo Local Municipality is renowned for its pristine natural environment, rich heritage, diverse people and cultures. Tourism is one of the key economic sectors and visitors are drawn to the area by its scenic landscapes and climate. The town of Graaff-Reinet, which is the 4th oldest town in South-Africa, is referred to as the "Gem of the Karoo" and functions as an important service centre for the Camdeboo Local Municipality.

6.2 Climatic Conditions

Rainfall is restricted primarily to the summer season, peaking in March. Mean temperatures are not extreme, with the mean annual temperature being approximately 17°C. Frost is a common phenomenon with up to 24 days of frost per year. Mean annual rainfall is just less than 250 mm per year. All areas with less than 400 mm rainfall are considered to be arid. The study area can therefore be considered to be arid.

6.3 Topographical & Geological Profile

The geology of the area to the west of Aberdeen is depicted in the 1:250 000 geology sheet 3222 Beaufort West (Council for Geoscience, Pretoria; Johnson & Keyser 1979) (Figure 6.1). The bedrocks underlying the study area belong to the lower portion of the Teekloof Formation (Pt) of the Lower Beaufort Group (Adelaide Subgroup, Karoo Supergroup) that is predominantly fluvial in origin (Johnson *et al.* 2006). This mudrock-dominated portion of the Teekloof succession is assigned to the Hoedemaker Member of Late Permian (Wuchiapingian) age (*c.* 260 Ma) (Smith & Keyser 1995, Rubidge 2005, Rubidge *et al.* 2013). Thin, closely-spaced, prominent-weathering sandstones of the overlying Oukloof Member can be seen within the slopes of the Kamdebooberg escarpment to the northeast. The geology of the Hoedemaker Member, which is up to 240 m thick, has been outlined by Smith (1980, 1993a, b) and later by Smith and Keyser (1995) as well as Cole and Smith (2008). The Hoedemaker succession is dominated by greenish-grey to purple-brown overbank mudrocks, with occasional single-storey sheet sandstones. Palaeosol (ancient soil) horizons characterized by calcrete nodules and rhizocretions (root casts) are common, as are also lacustrine (transient to long-lived playa lake) sediments deposited in depressions on the Late Permian floodplain. These last are associated with limestone crusts, gypsum crystals ("desert roses") as well as a range of fine-scale sedimentary features such as wave rippled sandstones, falling water marks, mudcracks, and trace fossils.

The Aberdeen Wind Farm study area is situated in a flat-lying region situated at c. 850-930 m amsl (refer to Figure 6.2), with a gentle slope towards the southwest. It lies on the eastern edge of the Aberdeen vlaktes and close to the foot of the Great Escarpment that is represented here by the Kamdebooberg (c. 1770-1860 m amsl). The area spans the R61 tar road between Aberdeen and Beaufort West and is traversed by several shallow NNE-SSW trending drainage lines constituting intermittently-flowing tributaries of the Gannaleegte drainage system that flows in turn into the Kariega River further to the southwest. Most of the area is currently managed for small-stock farming and is mantled with Karoo bossieveld vegetation. Levels of natural bedrock exposure are low to very low in such areas of low relief.

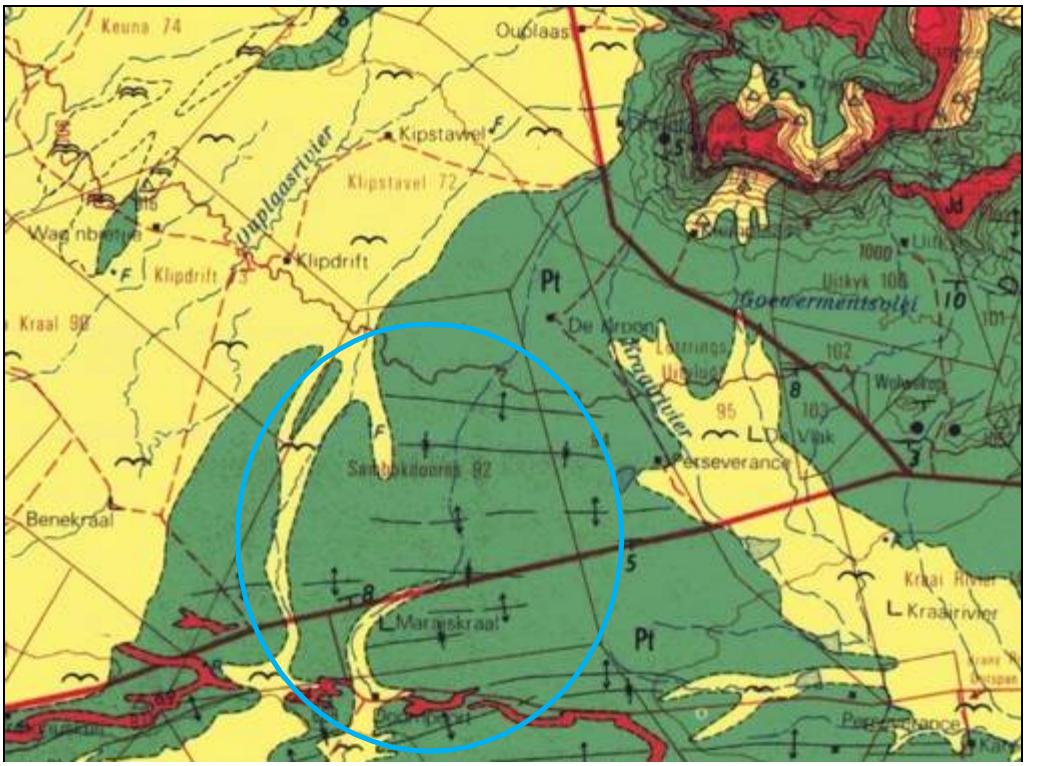


Figure 6.1: Extract from 1: 250 000 geology sheet 3222 Beaufort West showing the approximate boundaries of the Aberdeen Wind Farm project study area c. 30 km west of Aberdeen (blue circle)

6.4 Land-Use / Land Cover

Stock and game farming dominate the general land-use character of this region. The flat areas in the southern half of the study area are characterised by shrubland, while the higher lying and more mountainous areas contain zones of thicket and bushland as well as Grassland. Some thicket and bushland is also to be found along the drainage lines in the western part of the study area, and small scale agricultural fields are dotted throughout as shown in **Figure 6.3**.

6.5 Site access

The study area is located adjacent to the R61 road which links Aberdeen to Beaufort West. The N9 National road passes through Aberdeen. Access to the site is directly from the R61. The site is therefore well-connected to major routes in the region.

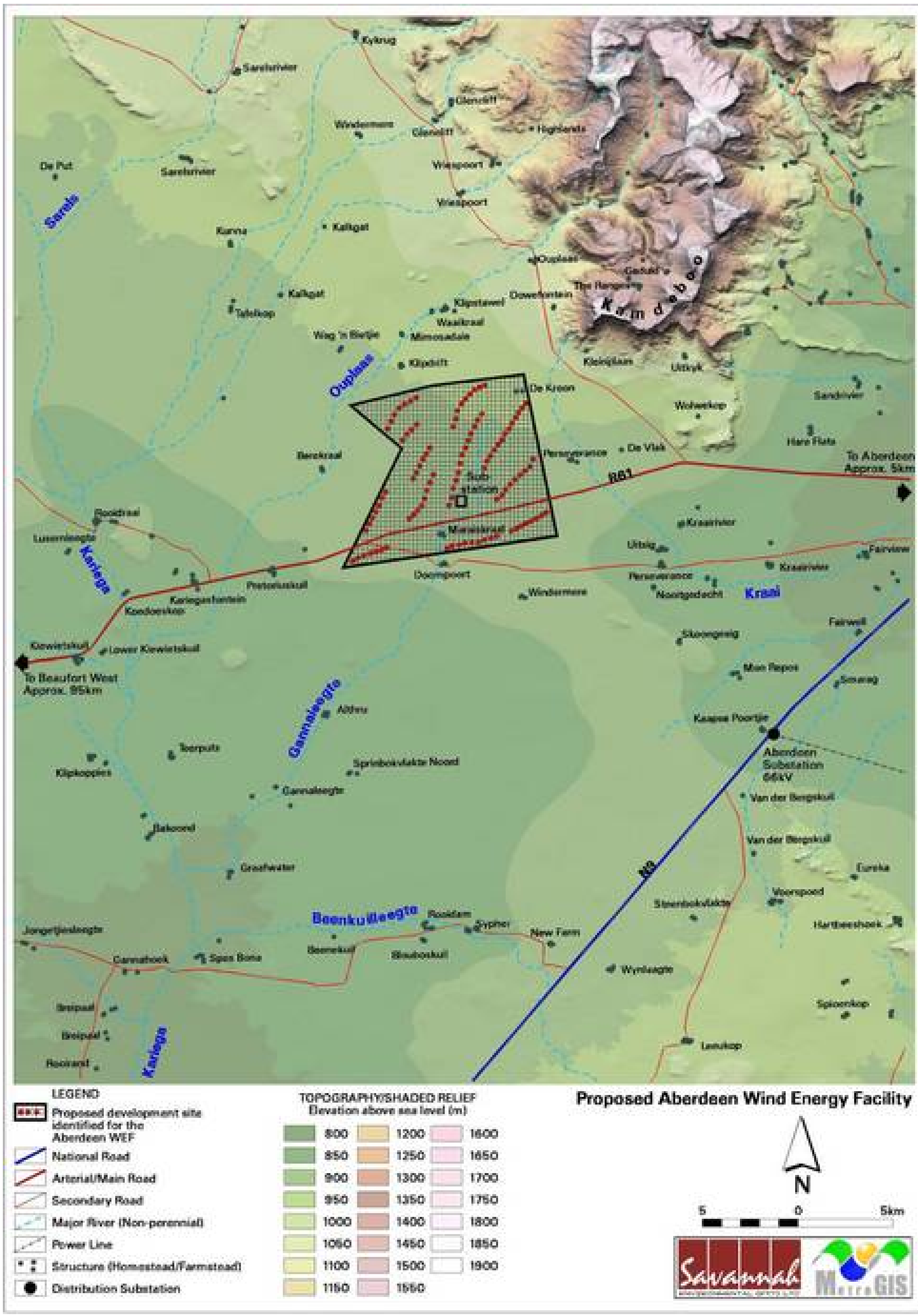


Figure 6.2: Shaded relief/ topographical map for the Aberdeen site and broader study area

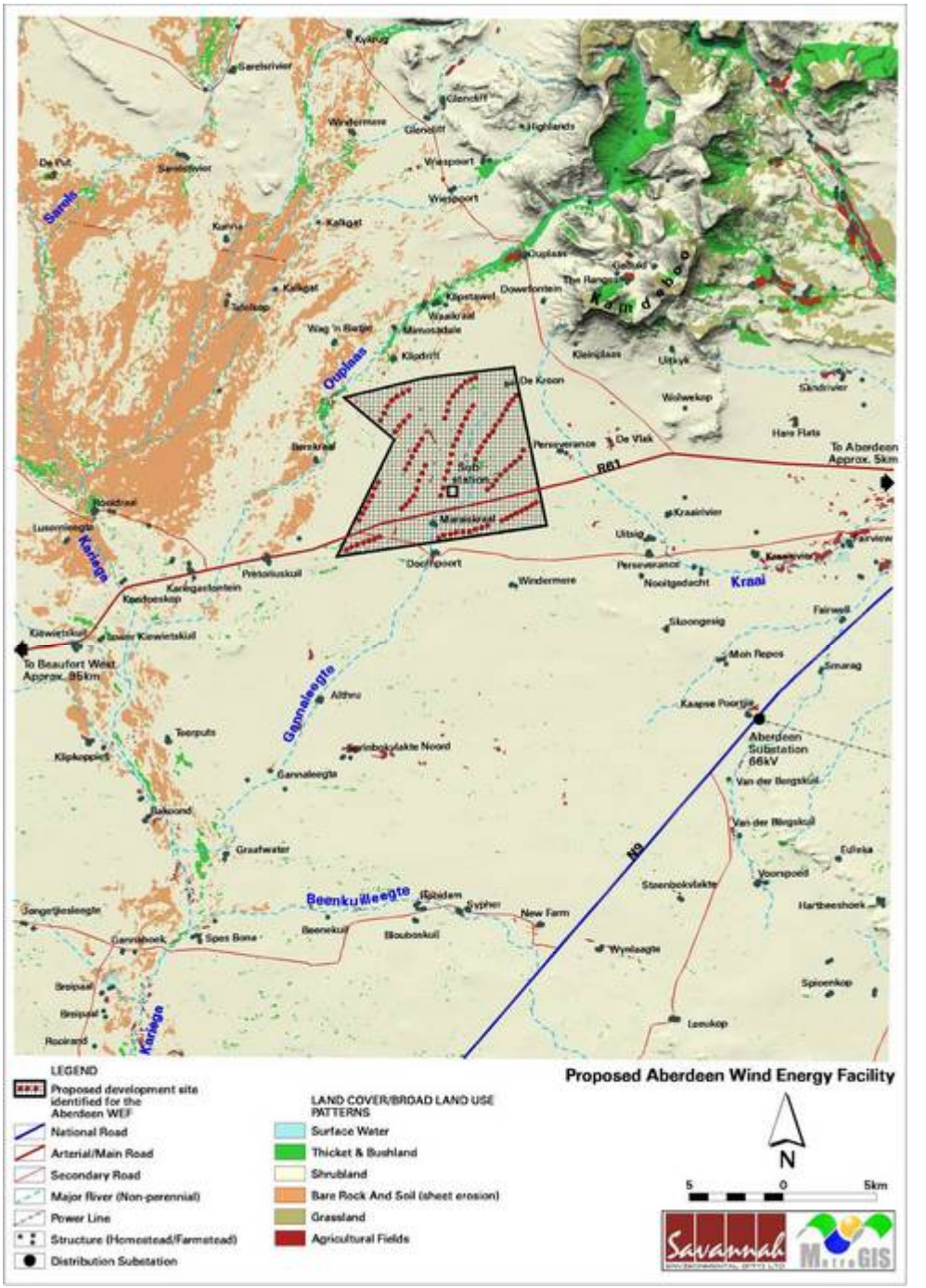


Figure 6.3: Land-Use / Land Cover Map for Aberdeen site and broader study area

6.6 Watercourses

The major drainage feature which occurs within the site is Klein Berg River which bisects the site, more or less parallel to the R44. Historically the Klein Berg River would have contained a lot of riparian vegetation as well as an extensive associated floodplain. Historically and currently, this area has been very heavily impacted by agriculture and little of the original vegetation still exists. The banks of the river are dominated by alien woody species, mainly *Eucalyptus camaldulensis*, *Acacia saligna* and *Sesbania punicea*. Along the banks and side channels, species such as *Bolboschoenus maritimus*, *Cotula turbinata*, *Cotula coronopifolia*, *Persicaria attenuata* subsp. *attenuata* and *Rumex crispus* were observed. Outside of the main channel itself, the floodplain consists of sandy flats and hummocks dominated by *Cynodon dactylon* and various shrubs and forbs such as *Wiborgia fusca* subsp. *fusca*, *Eriocephalus africanus* var. *africanus*, *Galenia africana*, *Leysera gnaphalodes*, *Lobelia erinus* and *Monopsis simplex*. Alien species are also common or dominant in this area and include *Bromus diandrus*, *Echium plantageum*, *Lolium rigidum*, *Polypogon monspeliensis*, *Erodium cicutarium*, *Hordeum murinum* and *Hypochaeris radicata*. Despite the obvious degradation of the area, the river and floodplain are considered sensitive on account of the ecological role and function provided by the riverine corridor.

Away from the Klein Berg River, there are a number of small dams on the property which are used for livestock watering and a newly built larger dam which is presumably for irrigation purposes. The dams are fringed by *Cynodon dactylon* with sedges and forbs such as *Bolboschoenus maritimus*, with occasional larger species such as *Typha capensis* and *Pseudoschoenus inanis*. The inflows of the dams have developed into small wetlands with species such as *Pennisetum macrourum* and *Micranthus alopecuroides* present. The minor drainage lines within the site have been heavily impacted and most have been canalized or are incised as a result of erosion. There is little vegetation within the eroded channels themselves, but some remnants of the original flanking vegetation persist and include species such as *Salvia africana-caerulea*, *Athanasia trifurcata*, *Dicerothamnus rhinocerotis*, *Berkheya rigida*, *Senecio pubigerus*, *Relhania fruticosa* and *Conyza scabrida* as well as the usual complement of alien annual grasses. These areas provide important habitat as well an ecological role in flow regulation.

6.7 Ecological Profile

6.7.1 Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006) (Figure 6.4), two vegetation types occur within the site, i.e. Eastern Lower Karoo and Southern Karoo Riviere.

Eastern Lower Karoo occupies 8321 km² of the plains and low hills of the southern Nama Karoo, from between Beaufort West and Aberdeen in the west to Pearston in the east. From north to south it is bounded by the mountains of the escarpment to the north and mountains and valleys of the Sundays River and Baviaans mountains. It occurs on plains interrupted by some dolerite dykes, butts and mesas, dominated by low to middle-height, microphyllous shrubland with drought resistant "white" grasses becoming abundant in places especially on sandy and silty bottomlands. Geology, consists of flat or gently sloping pediments composed of mudstones and resistant sandstones of the Beaufort Group, Ecca sediments and Dwyka tillites. Soils are red-yellow apedal, freely-drained soils with a high base status of the Ag land type, or shallow soils of the Glenrosa and Mispah soils of the Fc land type. Endemic taxa known from this vegetation type include *Aloinopsis rubrolineata*, *Chasmatophyllum nelii*, *Cylindrophyllum calamiforme*, *Euphorbia coerulans*, *Ruschia vanderbergiae*, *Haworthia decipiens* var. *cyanea* and *Haworthia greenii*. Eastern Lower Karoo is listed as Least Threatened and less than 2% has been transformed. It is however poorly conserved as less than 1% of a target of 16% falls within formally protected areas.

The Southern Karoo Riviere vegetation type occurs along the drainge lines and associated floodplains of the site. The Southern Karoo Riviere vegetation type is associated with the rivers of the central karoo such as the Buffels, Bloed, Dwyka, Gamka, Sout, Kariega and Sundays Rivers. It consists of riverine flats supporting a complex of *Acacia karoo* or *Tamarix usneoides* thickets and fringed by tall *Salsola*-dominated shrubsland on broad alluvia. In sandy drainage lines, *Stipagrostis namaquensis* may be dominant. Important species include trees such as *Acacia karoo*, *Searsia lancea*, *Diospyros lycioides*, *Tamarix usneoides*; tall shrubs such as *Cadaba aphylla*, *Euclea undulata*, *Grewia robusta*, *Gymnosporia buxifolia* and *Melianthus comosus*. Lower shrubs such as *Lycium cinereum*, *Asparagus striatus*, *Salsola aphylla*, *Drosanthemum lique* and *Salsola geminiflora*. Grasses and sedges include *Cynodon incompletus*, *Cenchrus ciliaris*, *Cyperus marginatus* and *Phragmites australis*. Southern Karoo Riviere is classified as Least Threatened with only about 1.5% conserved in the Karoo National Park and other reserves. About 12% has been transformed as a result of intensive agriculture and the construction of dams. Although it is classified as Least

Threatened, it is associated with rivers and drainage lines and those areas classified under this vegetation type should be considered sensitive.

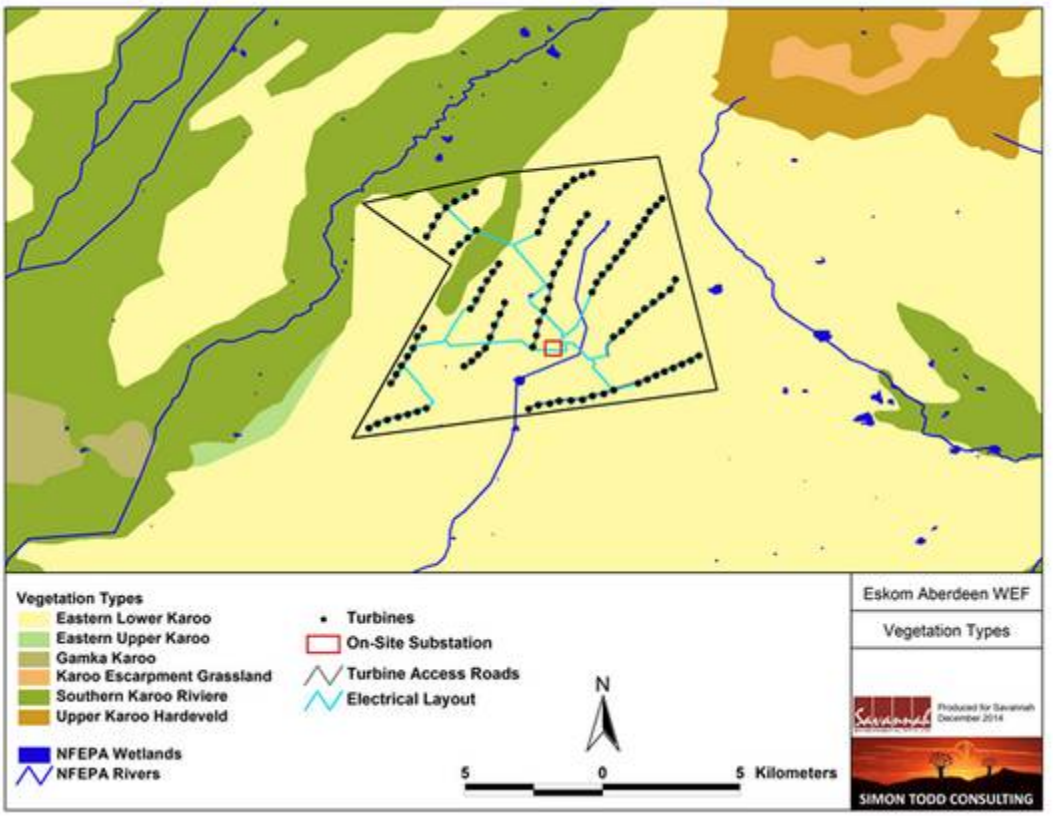


Figure 6.4: Broad-scale overview of the vegetation in and around the Aberdeen Wind Energy Facility. The vegetation map is an extract of the national vegetation map as produced by Mucina & Rutherford (2006), and also includes rivers and wetlands delineated by the National Freshwater Ecosystem Priority Areas assessment (Nel et al. 2011).

6.7.2 Fine-Scale Vegetation Patterns

In this section the different habitats and vegetation types observed on the site are described in terms of their characteristic and significant species and their potential sensitivity in terms of development potential.

Open plains of Eastern Lower Karoo

The majority of the site consists of typical karoo plains dominated by low woody shrubs. The vegetation of the plains is reasonably homogenous, but there is some variation apparent, related to the nature of the substrate and to some extent, land use as well. There are some low ridges present which have a rocky substrate and dominated by a higher proportion of taller shrubs and grasses.

There are also some degraded areas on silty plains, where trampling and overgrazing have resulted in soil capping which results in the development of bare, silty capped areas where infiltration is limited by fine particles which form a seal on the soil surface and also reduce natural recovery even under more favourable management. Areas of deeper soils, are generally discernible through their higher cover and greater proportion of succulent shrubs within the vegetation.

The open plains are typically dominated by widespread karoo shrubs such as *Pentzia incana*, *Rosenia humilis*, *Asparagus capensis*, *Ruschia cradockensis*, *Felicia muricata*, *Lycium cinereum*, *Phymaspermum parvifolium*, *Plinthus karooicus*, *Asparagus suaveolens*, *Chrysocoma ciliata*, *Asparagus striatus*, *Eriocephalus eriocoides*, *Asparagus glaucus*, *Thesium hystrix*, *Blepharis capensis*, *Hermannia spinescens*, *Hermannia filifolia* var. *filifolia* and *Hermannia desertorum*, while common succulent shrubs include *Euphorbia ferox*, *Sarcocaulon camdeboense*, *Senecio acutifolius*, *Drosanthemum lique* and *Mestoklema tuberosum*; dominant grasses include *Eragrostis obtusa*, *Tragus koelerioides*, *Eragrostis lehmanniana* and *Aristida adscensionis*. Geophytes observed within this habitat during the site visit include *Drimia anomala*, *Albuca setosa* and *Moraea polystachya*.

The more rocky areas are dominated by species such as *Rhigozum obovatum*, *Asparagus suaveolens*, *Aristida diffusa*, *Pteronia staehelinoides*, *Tragus koelerioides*, *Oropetium capense*, *Indigofera sessilifolia* and *Pteronia glauca*. Although the plains are largely open, there may some occasional scattered trees on the plains, usually *Searsia longispina*, *Searsia burchellii*, *Acacia karoo* or *Lycium oxycarpum*. The abundance of species of conservation concern within this habitat was low and no listed or endemic plant species were observed at the site within this habitat. Notable protected species observed include *Aloe claviflora* and *Aloe striata*, which occurred at a low density and with suitable avoidance, it is not likely that they would be significantly impacted.

Drainage Lines & Washes

Although the majority of the site consists of open plains considered to be of relatively low sensitivity, it is dissected by a number of drainage lines, which are considered high sensitivity and which represent the most significant feature of the site. Especially in the north-west of the site, these are well developed and associated with alluvial floodplains dominated by woody vegetation. The woody layer is dominated by *Acacia karoo* with variable amounts of other species such as *Searsia lancea*, *Diospyros lycioides*, *Lycium oxycarpum* and *Searsia longispina*. Other shrubs and forbs associated with these areas include *Lycium pumilum*, *Salsola aphylla*, *Melianthus comosus*, *Atriplex vestita*, *Psilocaulon coriarium* and *Malephora lutea with grasses such as Cynodon incompletus*, *Aristida adscensionis*, *Sporobolus fimbriatus* and *Scirpoides dioecus*. Although the abundance of listed

and protected species in this habitat type on the site was low, it is ecologically important and is considered highly sensitive.

Alien species abundance

The majority of the site was relatively free of alien species, but varieties of alien species were observed within disturbed habitats around watering points or previously disturbed areas around homesteads. Species observed include *Opuntia ficus-indica*, *Argemone mexicana*, *Malva parviflora* and *Salsola kali*, *Prosopis glandulosa*, *Schinus molle*, *Agave americana* and *Atriplex nummularia*. Some of these species are likely to respond quickly to disturbance at the site and would be likely to invade along access roads and at turbine sites.

6.7.3 Listed Plant Species

According to the SANBI SIBIS database, 470 plant species have been recorded from the quarter degree squares 3223 BC, BD, DA and DB, of which 115 were recorded at the site. This is not intended to provide an indicative total of the total number of species likely to be encountered within the site, which would require multiple site visits at different times of the year, but rather provides an indication of the species richness of the site in context of the broader landscape and also provides an indication of the number species likely to be encountered within the development footprint. A total of 10 listed species are known from the area (Table 6.1), but these are generally associated with the mountainous regions of the area and are not associated with the open plains and as such it is not surprising that none of these species were observed at the site. The only listed species which may occur at the site with a reasonable likelihood is *Boophone disticha*, but this species is not rare and was not observed at the site.

Table 6.1: Listed species known from the broad area around the site. (None of these species were observed at the site).

Family	Species	Status
AMARYLLIDACEAE	*Boophone disticha*	Declining
ASTERACEAE	*Cineraria lobata subsp. lobata*	Declining
ASTERACEAE	*Euryops dentatus*	VU
ASTERACEAE	*Gnaphalium declinatum*	NT
ASTERACEAE	*Senecio cicatricosus*	Rare
ERICACEAE	*Erica passerinoides*	VU
HYPOXIDACEAE	*Hypoxis argentea var. argentea*	LC
GERANIACEAE	*Pelargonium sidoides*	Declining
GUNNERACEAE	*Gunnera perpensa*	Declining
IRIDACEAE	*Dierama grandiflorum*	Rare

6.7.4 Critical Biodiversity Areas

The site lies within the planning domain of the Eastern Cape Biodiversity Conservation Plan (Berliner & Desmet 2007). This biodiversity assessment identifies Critical Biodiversity Areas (CBAs) which represent biodiversity priority areas which should be maintained in a natural to near natural state. The CBA maps indicate the most efficient selection and classification of land portions requiring safeguarding in order to maintain ecosystem functioning and meet national biodiversity objectives.

The site falls almost entirely within an extensive Tier 2 CBA which is intended to provide a corridor to maintain the connectivity of the landscape and enable fauna and flora to respond to global change. As such it is important to note that the site does not fall within a site that has been identified as being a hotspot of biodiversity for any fauna or flora. Therefore, the major issue with regards to the development as it pertains to the CBA status of the site is the extent to which the development is likely to threaten or disrupt the connectivity of the landscape and hence compromise the ecological purpose and functioning of the CBA.

6.7.5 Faunal Communities

Mammals

The proposed Aberdeen Wind Energy Facility site lies within the range of 44 terrestrial mammals, including two listed species. The only listed species known from the area is the Honey Badger (Endangered) and Leopard (Near Threatened). It is unlikely that the Leopard occurs within the site given the open nature of the habitat and agricultural land use. Although it is possible that the Honey Badger occurs at the site, the development is not likely to have a significant impact on the local population of this species as they are wide-ranging and are not likely to maintain a high density of individuals within the study area, which does not contain an abundance of favourable habitat for this species. Species observed at the site include Springbok, Steenbok, Greater Kudu, Black-backed Jackal, Bat-eared Fox, Vervet Monkey, Meerkat, Aardwolf, Cape Porcupine, Cape Hare, Aardvark and South African Ground Squirrel. These are typical species for the area and those species associated with rocky hills such as Klipspringer are not likely to be present or utilising the site. In terms of specific habitats and areas at the site which are likely to be of above average significance for mammals, the drainage lines are clearly the most important areas due to the higher cover these areas offer and their higher levels of productivity and forage availability.

Reptiles

According to the literature and records from Southern African Reptile Conservation Assessment (SARCA), as many as 39 reptiles could occur at the Aberdeen wind energy facility site, indicating that the site is likely to have

moderate to low reptile diversity. No listed species are known from the area and the variety of habitats present is relatively low as no rocky hills or areas with significant rock cover are present. Species observed at the site include Burchells' Sand Lizard, Cape Cobra, Angulate tortoise and Leopard Tortoise. As with mammals, areas of higher cover and productivity are likely to be most important for reptiles, although some of the lizards prefer areas with lower cover.

Amphibians

Eleven frog species are known from the broad area around the site, including the Giant Bullfrog which is listed as Near Threatened. The rivers at the site are ephemeral and are likely to present temporary breeding sites only, while earth dams and other artificial water sources around homesteads are likely to represent the most important habitat for most of the water-dependent species known from the area such as the Platanna and Cape River Frog. Toads, cacos and sand frogs are less dependent on permanent water and are likely to range more freely about the site, but would also utilise temporary and permanent water sources for breeding purposes as required. No pans were observed within the site that would represent suitable breeding habitat for the Giant Bullfrog. It is therefore considered unlikely that this species is present within the site.

Butterflies

The butterfly community at the site is dominated by widespread species such as the Common meadow white, Dull copper, Common zebra blue, Painted lady, Topaz babul blue, Velvet-spotted babul blue, African grass blue and Smoky orange tip, all of which have a wide distribution in Africa and often beyond as well. Notable species known from the broad area include the Camdeboo Skolly and Camdeboo brown, which both local endemics are known only from a couple of quarter degree squares. The Camdeboo Skolly is however restricted to high elevation grassland whiles the Camdeboo Brown is associated with moist woodland and scrub at high altitude and as a result, neither would occur at the site. Barber's ranger, is somewhat more widespread, but again is known from high elevation grassland along stream banks and marshy areas and would not occur at the site.

6.7.6 Avifauna

In order to characterise the bird communities on the site (baseline) a pre-construction bird monitoring programme was undertaken at the Aberdeen 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

The vast majority of the wind farm site itself is Eastern Lower Karoo, with a small element of Southern Karoo Riviere, both of which form part of the greater Karoo Biome. Bird species that favour short, shrubland type vegetation such as korhaans, larks, pipits, prinia and bustards have all been recorded in the study area.

Bird presence in the study area

a) Species occurring in the area in significant abundances

Species that have been recorded in abundance on the site within altered habitats (e.g. pastures and cultivated lands) include: Blacksmith Lapwing, Cape Wagtail, Cape Sparrow, Egyptian Goose, South African Shelduck, and Spur-winged Goose. The majority of species were however recorded in natural vegetation such as "shrublands" and karoo scrub where species that have been recorded in abundances include: Ant-eating Chat, Bokmakierie, Cape Clapper Lark, Cape Bunting, Cape Weaver, Grey-backed Cisticola, Karoo Prinia, Large-billed Lark, Karoo Scrub-robin, White-throated Canary and Yellow Canary. The small terrestrial species that were recorded during the walk transects over the survey period are not threatened or restricted in range. The bird monitoring report (**Appendix E**) provides a full list all the species recorded on the site.

b) Groups of species which could possibly be impacted on by wind farms

The taxonomic groups that have been found to be vulnerable in two or more of these regions are as follows: Pelicaniformes (pelicans, gannets, cormorants); Ciconiiformes (storks, herons, ibises, spoonbills); Anseriformes (swans, ducks, geese); Falconiformes (birds of prey); Charadriiformes (gulls, terns, waders); Strigiformes (owls); Caprimulgiformes (nightjars); Gruiformes (cranes, bustards, rails); Galliformes (pheasants, grouse, francolins); and Passeriformes (songbirds).

c) Red Listed Bird Species

A total of 144 different species were recorded on the proposed sites across the four surveys with the majority of the species observed in the summer survey (November). Twelve recorded species appear on the regional Red List with two classified as Endangered (Ludwig's Bustard and Martial Eagle) and four as Vulnerable (Verreaux's Eagle, Lanner Falcon, Southern Black Korhaan and Secretarybird). The Blue Crane, Pallid Harrier, Kori Bustard, Double-banded Courser and Karoo Korhaan are currently listed as Near Threatened.

Target/ Priority Bird Species

Sixteen (16) priority bird species were identified on the site including:

» Black Harrier,
» Black-shouldered Kite,
» Blue Crane, Greater Kestrel,
» Lanner Falcon,
» Karoo Korhaan,
» Kori Bustard,
» Ludwig's Bustard,
» Martial Eagle,
» Verreaux's Eagle,
» Secretarybird,
» Southern Black Korhaan,
» Southern Pale Chanting Goshawk,
» Spotted Eagle Owl,
» Jackal Buzzard,
» Steppe Buzzard and
» African Harrier Hawk

Subsequently additional species such as Rock Kestrel have also been added to the site specific priority species list. A single black Harrier was observed during the initial scoping site visit but was not recorded during the following surveys.

6.7.7 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 F**) was undertaken at the Aberdeen Wind Energy Facility site and at a control site.

a. Potential bat species

Purely based on historical records and modelled distributions (Monadjem et al., 2010), 14 bats have the potential to occur at Aberdeen Wind Energy Facility, but vary in their Likelihood of Occurrence. – 3 highly likely, 3 moderately likely and 8 with a low likelihood but possible (refer to Table 6.2).

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

FAMILY	SPECIES	COMMON NAME	Likelihood of occurrence	NATIONAL CONSERVATION STATUS
MOLLOSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	High	LC
VESPERTILIONIDAE	*Neoromicia capensis*	Cape serotine bat	High	LC
VESPERTILIONIDAE	*Eptesicus hottentotus*	Long-tailed serotine bat	High	LC
NYCTERIDAE	*Nycteris thebaica*	Egyptian slit-faced bat	High	LC
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	Moderate	NT
RHINOLOPHIDAE	*Rhinolophus capensis*	Cape horseshoe bat	Moderate	NT
RHINOLOPHIDAE	*Rhinolophus clivosus*	Geoffroy's horseshoe bat	Moderate	NT
VESPERTILIONIDAE	*Myotis tricolor*	Temmincks myotis	Moderate	NT
PTEROPODIDAE	*Rousettus aegyptiacus*	Egyptian Rousette	Low	LC
VESPERTILIONIDAE	*Cistugo lesueuri*	Lesueur's hairy bat	Low	NT

Key to Conservation Status Abbreviations: LC = Least Concern; NE = Not Evaluated; NT = Near Threatened; PWA = Protected Wild Animal according to the Western Cape Nature Conservation Ordinance No. 19 of 1974

b. Confirmed bat species

Of the 14 potentially occurring bat species, five have been confirmed at Aberdeen through call analyses and live capture and release, and one more is suspected 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.

Table 6.3: Confirmed Bat species for Aberdeen Wind Energy Facility

FAMILY	SPECIES	COMMON NAME	CONSERVATION STATUS (National)	CONSERVATION STATUS (Global)	CONFRIMATION METHOD
MINIOPTERIDAE	*Miniopterus natalensis*	Natal long-fingered bat	NT	LC	Confirmed – calls and capture
MOLOSSIDAE	*Tadarida aegyptiaca*	Egyptian free-tailed bat	LC	LC	Confirmed – calls and capture
RHINOLOPHIDAE	*Rhinolophus clivosis*	Geoffroy's horseshoe bat	NT	LC	Confirmed – calls only
RHINOLOPHIDAE	*Rhinolophus capensis*	Cape horseshoe bat	NT	LC	Confirmed – calls only
VESPERTILIONIDAE	*Neoromicia capensis*	Cape serotine bat	LC	LC	Confirmed – calls and capture
VESPERTILIONIDAE	*Eptisicus hottentotus*	Long-tailed serotine bat	LC	LC	Suspected based on calls recorded

Key to Conservation Status Abbreviations: LC = Least Concern; NT = Near Threatened; V = Vulnerable; PWA = Protected Wild Animal according to the Western Cape Nature Conservation Ordinance No. 19

6.8. Land Types, Soils and Agricultural Potential

6.8.1 Land Types

There are two land types in the study area, the Ia and Ag land types (Figure 6.5). The site falls into the **Ag8**, **Ag9** and **Ia43** land types (Land Type Survey Staff, 1972 - 2006) (Refer to Figure 6.4 for the land type map of the area).

Land Type Ag8

Soils: Mainly shallow soils and rock outcrops with occasional occurrences of deep eutrophic and lime containing red soils. Variable depth soils with signs of incipient pedogenesis occur in drainage depressions.

Land capability and land use: Exclusively extensive grazing due to climatic and soil constraints.

Agricultural potential: Very low potential due to the low rainfall (less than 200 mm per year) and shallow soils.

Land Type Ag9

Soils: Mainly shallow soils and rock outcrops with occasional occurrences of deep eutrophic and lime containing red soils. Variable depth soils with signs of incipient pedogenesis occur in drainage depressions.

Land capability and land use: Exclusively extensive grazing due to climatic and soil constraints.

Agricultural potential: Very low potential due to the low rainfall (less than 200 mm per year) and shallow soils.

Land Type Ia43

Soils: Variable depth eutrophic and lime containing soils with signs of incipient soil formation. Structured / duplex soils occur occasionally.

Land capability and land use: Exclusively extensive grazing due to climatic and soil constraints.

Agricultural potential: Very low potential due to the low rainfall (less than 200 mm per year) and shallow soils.

6.8.2 Soils

The transported alluvium soil cover mainly consists of silt and fine sand with minor gravel. In areas where the rock is very shallow or where rock outcrops occur, the soil will generally be coarser with more gravel-sized particles. The soil

types can be broadly classified according to the Universal Soil Classification as ML (inorganic silts and very fine sands), GM (poorly graded silt-clay-gravel mixes with low to moderate plasticity) or SM (silty sands or poorly graded silt-sand mixtures).

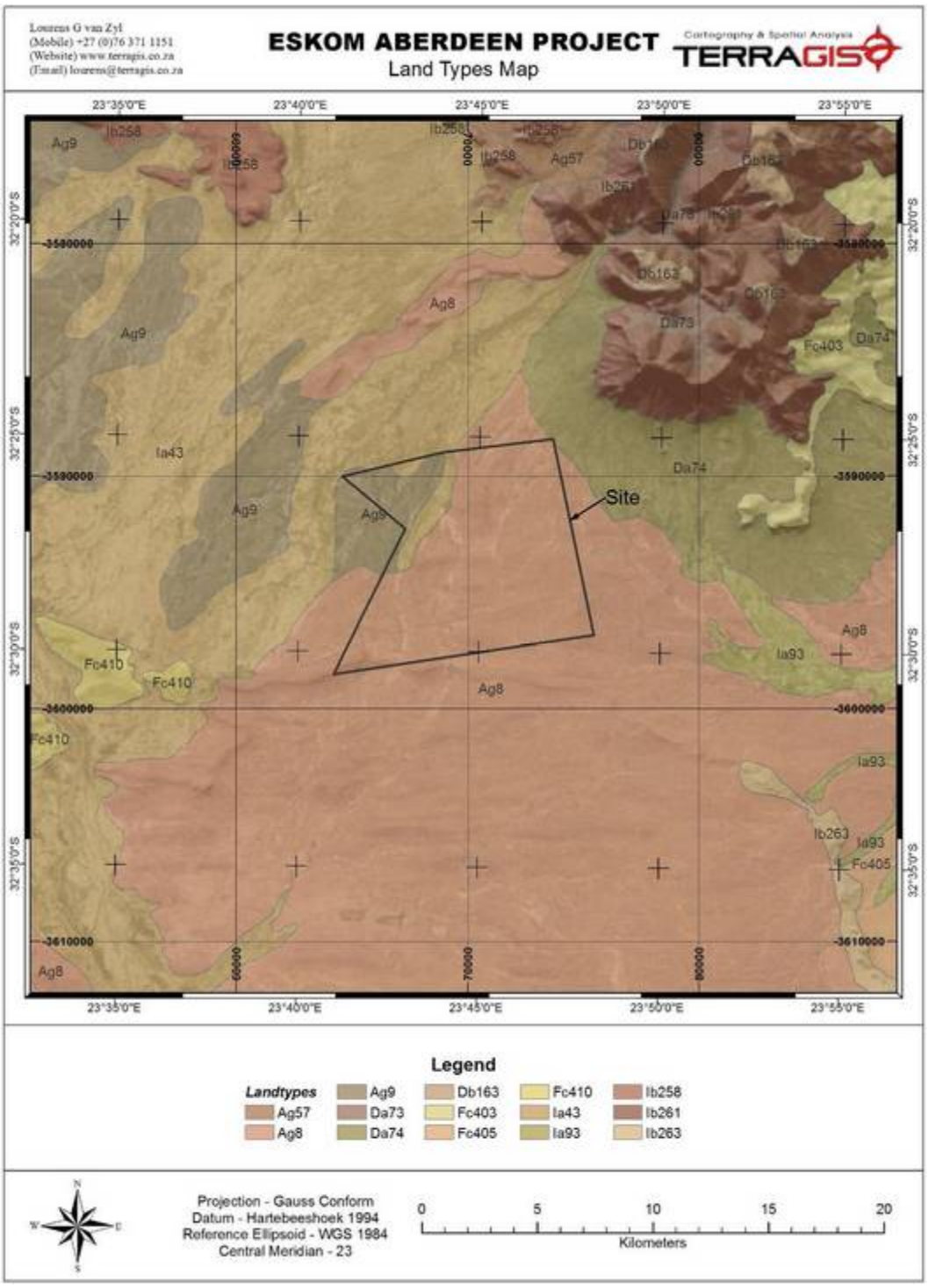


Figure 6.5: Land types on the Aberdeen site

6.8.3 Agricultural Potential

Agricultural land use capability and potential is primarily determined by the suitability of the soil profile to support crop production. The soil needs to be adequately thick to support root development and the drainage characteristics needs to be good to prevent chemical crusting on the surface. The presence of shallow soils and the dry climate places a significant limitation on agricultural potential. The land use capability is restricted to grazing by animals such as small stock (Merino sheep and Angora goats) and even large stock (beef cattle) when abundant grass pasture is available in the floodplain/alluvial areas. Game such as springbuck is dominant in the area. The carrying capacity of the property is estimated at ±6 hectares per small stock unit (SSU). The carrying capacity is low due to low and erratic rainfall (less than 300 mm/annum). In summary, the potential of the property is low and limited to extensive grazing due to the low rainfall and shallow marginal soils. The little potential for irrigation farming is restricted by the shallow soils and lack of irrigation water. However, on a large property such as this (±7800 hectares), a herd of approximately 1200 small stock units can be kept.

6.9 Social and Demographic Profile

The CLM consists of 6 Wards and covers an area of 7 230 km² 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

Based on the 2011 Census Statistics the Camdeboo Local Municipality (CLM) had a population of 50 993 in 2011 made up of approximately 12 400 households, giving an average of 3.8 people per house. Of the 2011 total, ~ 64.8 % were Coloureds, 24.8 % Black African and 9.6 % Whites. The dominant language in the area is Afrikaans. In terms of settlements, the largest concentration of people live in Graff-Reinet (35 672), followed by Umasizake (8 237), Aberdeen (7 162), Thembalesizwe (2 029), Nieu-Bethesda (1 540). Approximately 4 579 live in the rural, farming areas of the LM (Census 2011).

6.9.2 Education

Based on the 2011 Census data ~ 50% of population older than 20 years are semi- or completely illiterate, whilst the majority of the remaining 50% do not have secondary, matric or a higher qualification. In this regard ~ 1% of persons

older than 20 years have a tertiary education. Due to the low education levels a large number of persons are employed as general labourers, and have to perform menial tasks with limited responsibility (CLM IDP 2007-2012). Youth development and education have therefore been identified a key priorities by the CLM.

6.9.3 Household income

Census 2011 data indicated that of the ~ 12 400 households in the Camdeboo, 19.3% earned below R800 per month and 43.4 % earned between R801 and R3 200 per month. At the time of the Census, the Poverty Line Income was defined as R800 per month per household. The Department of Social Welfare classifies a household as indigent and living below the poverty line if it has an income of up to R9 600 per year, which is R800 per month. The low income levels in the area are closely linked to the low education levels. As a result of the low income levels a large portion of the population derives its income from Social Support (Welfare). Based on the latest statistics (2010), 42% of the total population (50 000) receive some form of social support from the Government. In terms of totals, a total of ~ R194 million is paid out per annum in social grants. Of this total, Child Support Grants make up 50% of Grants & Pensions paid out in the CLM. This total is expected to increase as the age threshold is moved up (CLM IDP 2007-2012).

6.9.4 Employment

According to the 2011 National Census, 16.4% of the employable sector was unemployed and 41.8% were not economically active. Of the Employable Sector (age group 15-65 years), 38% was employed; of those 71% worked in the Formal Sector, 12% in the Informal Sector and 18% in the Farming (Agricultural) Sector. Recent figures for the area indicate that in 2008 the level of unemployment had risen to 25% compared to the 2001 level of 20%. This is the same as the National Unemployment rate for 1st Quarter of 2011 (25%).

6.9.5 Basic services

The 2011 Census data indicated that an average of 94.3% of households in the CLM had access to piped water within 200m from their dwelling. In terms of sanitation, ~ 89.4% of households had access to a minimum of a VIP pit latrine, while an approximate average of 83.2% of households had access to weekly refuse collection. With regard to electricity, ~ 94.1% of all households had access to electricity.

6.9.6 Road infrastructure

The IDP notes that tourism is one of the main economic drivers in the Camdeboo and it is therefore crucial that roads, signage and markings be of acceptable standard and are maintained properly. The IDP indicates that many rural gravel roads throughout the District are in a very poor state of repair.

6.10 Noise Sensitive Receptors

Five Noise-sensitive developments were identified to occur in the area. Potential Noise-sensitive developments identified are highlighted in Figure 6.6 and considered further in the Noise Impact Assessment (**Appendix J**).

6.10 Scenic routes / Visual Quality of the Area

There are no towns or urban centres within the study area, but a number of farms and homesteads occur throughout the study area. These tend to lie in the vicinity of the rivers. The population density within the region is low, at an average of 5.8 people per km². Major roads include the N9 National Route (which links the N1 with the East Coast) and the R61 arterial route (which runs between Beaufort West and Aberdeen). There are also a few lower order secondary roads off these main roads. The greater region is generally seen as having a high scenic value and lies en-route to a number of known tourist destinations, including the so-called Sunshine Coast. The study area has a rural character with very few structures. Electrical infrastructure is limited to a single power line linking with the Aberdeen Substation to the south east of the site.

6.12 Heritage Profile

6.12.1 Archaeology

No systematic archaeological research has been conducted within this region of the Eastern Cape, and therefore little is known about the archaeology of the immediate area proposed for the Aberdeen Wind Energy Facility. The Albany Museum holds records of sites recorded mainly to the east of Aberdeen and closer to Graaff Reinet, approximately 75 km to the east of Aberdeen. These are mainly rock art sites and open site scatters of stone artefacts in association with some other organic and material archaeological remains. However, engravings, burials, and historical buildings and structures have also been recorded. The closest heritage site in proximity to the proposed area for development that has been recorded is a rock shelter containing rock paintings, situated approximately 40 km to the east, past Aberdeen.

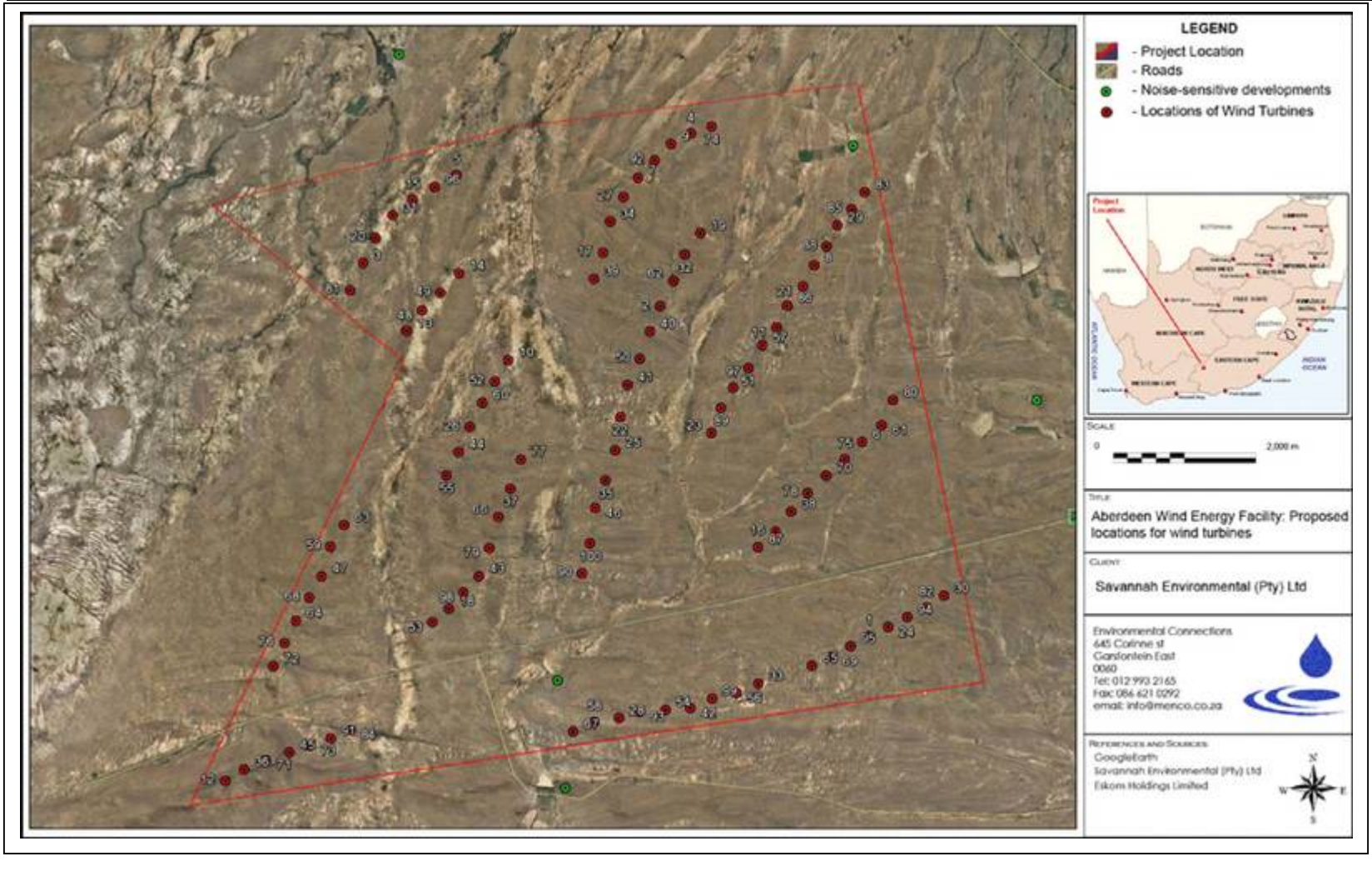


Figure 6.6: Aerial image indicating identified noise-sensitive developments in proximity of the site (indicated as green dots)

A farm situated approximately 70 km to the north-west of the proposed area has been noted to contain about six Later Stone Age sites including rock shelters with rock paintings. A number of rock engravings have been recorded and published in and around Beaufort West, within approximately 114 km to the west along the R61 (Parkington *et al.* 2008). And recently, various Middle Stone Age, Later Stone Age, rock shelters, and rock engravings have been recorded about 75 km to the north on a site about 34 km south of Victoria West (Binneman *et al*. 2011a).

Eight large areas / sites comprising several cores and surface scatters of stone artefacts were identified on the site. These areas comprised several micro-sites that were difficult to determine individually, and were therefore the demarcated as larger areas. Mainly isolated surface scatters of Middle Stone Age stone artefacts were observed distributed across the proposed development area. It is unlikely that the stone artefact surface scatters that occur on the exposed surface areas are positioned *in situ*; however, stone artefacts may occur between 50 – 80 cm below the surface. One stone walling farmstead complex was documented outside of the area proposed for the wind turbines. One collapsed circular stone walling feature with possible associated historical artefacts was documented near to the proposed positions of wind turbines, underground cabling, and access route.

6.12.2 Palaeontology

No vertebrate or other fossil remains were recorded actually *in situ* from the Lower Beaufort Group bedrocks within the study area during the present field assessment. This is probably due to some extent to the very limited exposure levels of the Karoo bedrocks (especially the mudrock facies), to local tectonic cleavage development, as well as to the weathering and calcrete veining near-surface.

However, numerous fragments of Permian silicified fossil wood were recorded within the Late Caenozoic (Quaternary to Recent) surface gravels here. These cherty blocks have clearly weathered-out of the Lower Beaufort Group bedrocks and been secondarily concentrated, together with other resistant-weathering rock types, within alluvial gravels and downwasted surface gravels. The fossil wood specimens were recorded from a majority of surface gravel exposures examined and are clearly of widespread occurrence. However, they are usually quite scarce in any one area, with higher concentrations only being notes at a few sites (*e.g.* Locs. 025, 034, 035). The woods display a range of hues, including creamy, buff, brown and reddish-brown. The blocks vary in size from fine gravels to cobble-sized (*c.* 15 cm maximum dimensions) and are generally angular to subangular; well-rounded examples were not seen. Many show excellent preservation of the original woody tissue (e.g. seasonal growth rings, radial rings of tracheids) while others are fairly structureless, or show islands of well-preserved wood embedded

within an amorphous cherty matrix. The latter might represent biodegraded woody tissue that was already largely decomposed (*e.g.* by fungi) at the time of silicification, and it is possible that traces of fungal or arthropod structures might be preserved in such specimens. It is considered probably that most or all of the fossil wood material observed is of local provenance, rather than transported from a higher stratigraphic level in the nearby Escarpment zone; i.e. it is derived from the Hoedemaker Member rather than younger units of the Teekloof Formation. Supporting evidence for a local origin of most of the petrified wood material observed within the study area includes:

» Angular nature of many blocks, and their occasionally fairly substantial size.
» Local concentrations of wood fragments. Some of these are possibly associated with channel sandstone exposures (e.g. Loc. 035); the bases of river channel infills are the most likely source of petrified logs.
» Higher concentrations of fossil wood in the south-western *vlaktes* rather than closer to the Escarpment area in the northeast of the study area.

A specimen of fossil *akkedis* (lizard) has been reported by the farmer Mnr Loots from a patch of surface gravels close to the northern edge of Farm Sambokdoorns RE/3/92 (Mnr Loots, pers. comm., Nov. 2014) (Locs. 446-447). These surface gravels include occasional reworked palaeocalcrete nodules, some pale green and silicified, one of which may have contained the fossil mentioned, possibly a small therapsid or reptile. However, no further fossil vertebrate material was recorded during the field assessment.

This chapter provides details regarding the scope of the proposed Aberdeen 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 100 wind turbines. The facility would be operated as a single facility with each turbine being up to 3MW in capacity.
- 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.
- Internal access roads (up to 8 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 at the Droërivier Substation, approximately 140 km from the site[7]

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

[7] The proposed power line is being assessed within a separate EIA process and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

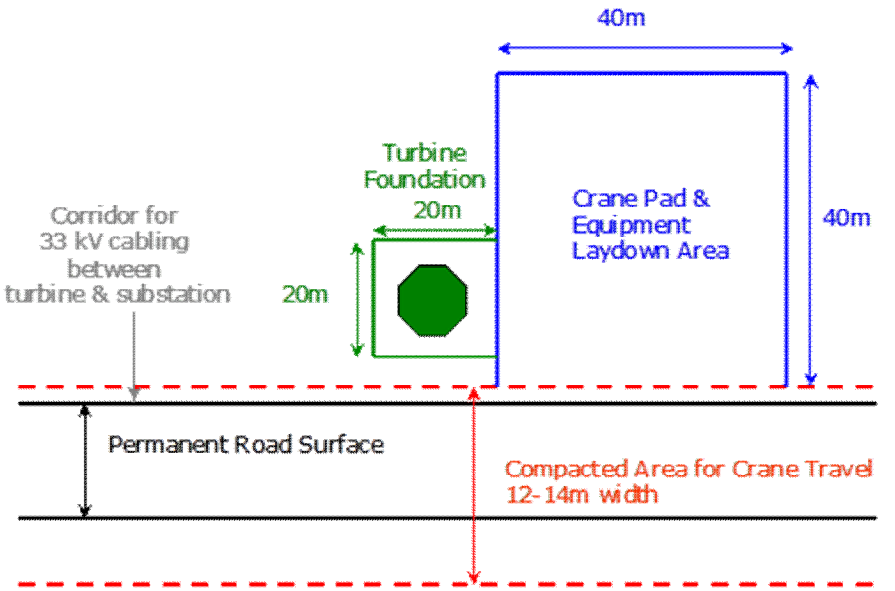


Figure 7.1: Diagrammatic representation of a typical layout of components.

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 below.

Table 7.1 details the main activities associated with construction of the wind energy facility.

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	» 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 13m wide in some places due to turning circles that are required. » Establish internal access roads: up to 6 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 Aberdeen site is currently accessible from the R61. » Existing access roads will be utilised and upgraded. » 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 required. Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. » 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 13 m in width is required to be established on the site.
Undertake site preparation	» Site establishment of offices / workshop with ablutions 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.

Main Activity/Project Component	Components of Activity	Details
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 location (final dimensions to be defined by geotechnical survey of the site) – refer to Figure 7.1	» Foundation holes will be mechanically excavated. » Shoring and safety barriers will be erected. » 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	» 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

Main Activity/Project Component	Components of Activity	Details
	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)	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, heavy components » A crane for the assembly of the rotor	» The large lifting crane will lift the tower sections into place (Figure 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

Main Activity/Project Component	Components of Activity	Details
		the rotor.
Construct substations and associated ancillary infrastructure.	» Substations and associated components; » Security fencing around high-voltage (HV) yard; and » An operations and maintenance building, including a workshop building, is proposed.	» 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). » A 400 kV on-site substation will be constructed with a HV yard footprint of up to 100 m x 100 m (Figure 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 * 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 substations	» Wind turbines » 33 kV underground (where practical) electrical cabling connecting each turbine to the substations.	» 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

Main Activity/Project Component	Components of Activity	Details
		roads as far as reasonably possible.
Connect substations to power grid	» A new 132kV overhead power line feeding into the power grid at the new Droërivier Substation.	» 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.
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	» The site will be rehabilitated and can be returned to the agricultural or other land-use

	area must be used.	

Figure 7.1: Concrete foundation (Eskom Sere Wind Facility)

Figure 7.2: Tower sections being lifted (Eskom Sere Wind Facility)

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

Figure 7.4: Substation (Eskom Sere Wind Facility)

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

Environmental impacts associated with the proposed Aberdeen 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 Eskom, 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 M**).

In order to assess the impacts associated with the proposed Aberdeen 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 Aberdeen site (approximately ~8 198ha) 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 Portion 3 of Sambokdoorns 92
» RE of Portion 4 of Sambokdoorns 92
» RE of Sambokdoorns 92
» Portion 2 of Klipdrift 73
» Portion 2 of Farm 94, and
» RE of Portion 2 of Farm 94

The project will include the following infrastructure:

» A cluster of up to **100 wind turbines** to be constructed over an area of ~ **8 198 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 (100 m x 100 m (including HV yard))
» An overhead power line (400kV) feeding into Eskom's electricity grid at the Droërivier Substation, approximately 140 km from the site[8]
» Internal **access roads** between each wind turbines (permanent roads of approximately 6 m wide and 7m during construction)
» **Borrow pits** within the site for the construction of access roads

[8] The proposed power line is being assessed within a separate Basic Assessment process (DEA ref #:14/12/16/3/3/2/357) and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

» **Office/Workshop** area for operations, maintenance and storage (approximately 100m x 100m).
» **Information centre**
» Ablution facilities and temporary **water storage** for construction and small storage for operation drinking water will be required at the site.

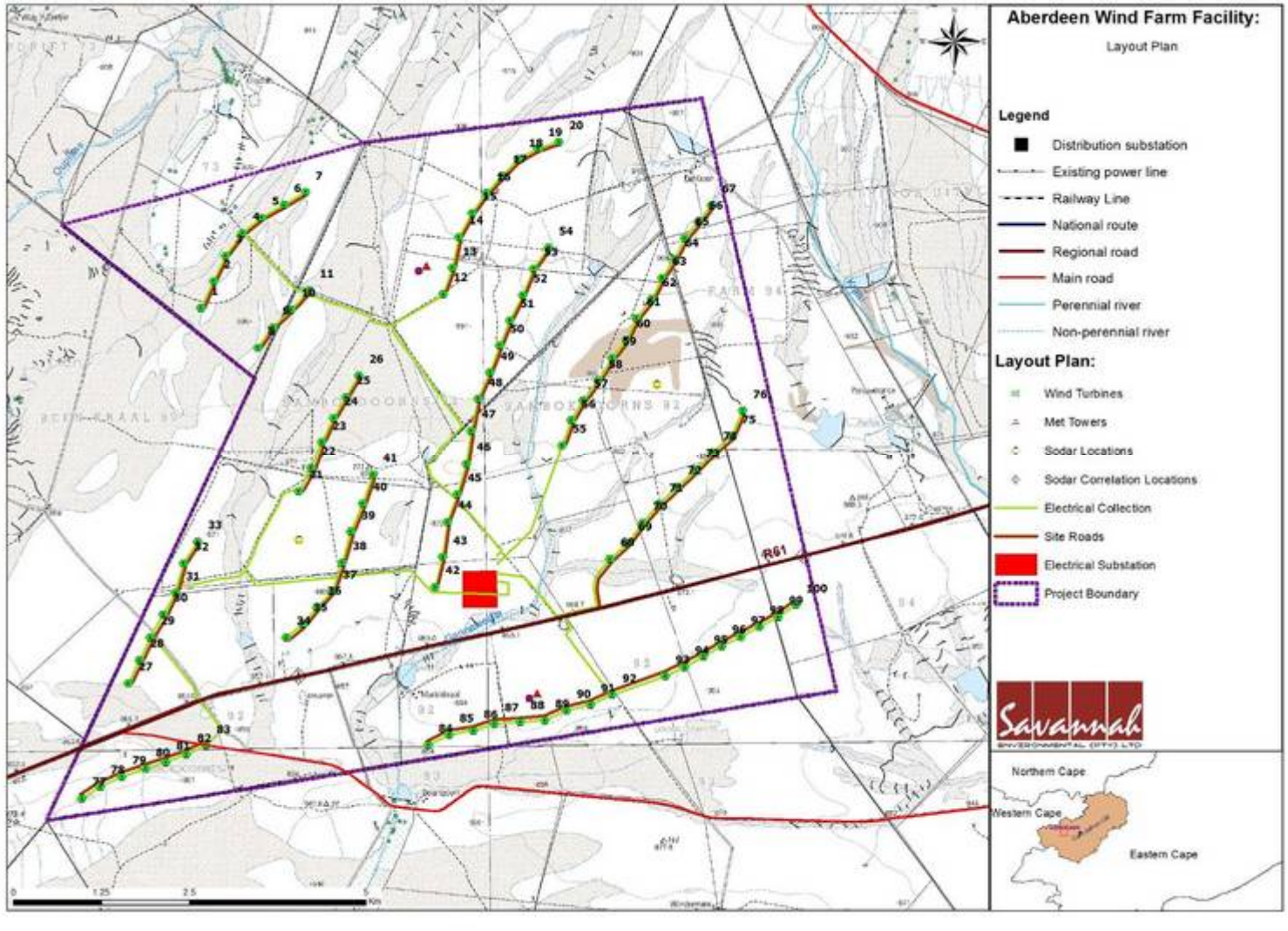


Figure 8.1: Layout map showing the preliminary design and layout of the Aberdeen Wind Energy Facility

» **Information centre**
» Ablution facilities and temporary **water storage** for construction and small storage for operation drinking water will be required at the site.

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 **100 wind turbines** as well as associated infrastructure. The assessment of issues presented within this chapter (and within the specialist studies attached **Appendices D – L**) considers the worst-case scenario in terms of potential impacts.

8.1 Assessment of Potential Impacts on Ecology

Potential ecological impacts resulting from the development of a wind energy facility at the Aberdeen site would stem from a variety of different activities associated with the construction and operational phases of the project including the following:

» Construction Phase
  * Vegetation clearing and 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 may result in the following impacts on ecology:

» Impacts on vegetation and protected plant species
» Soil erosion and associated degradation of ecosystems
» Direct Faunal Impacts
» Alien Plant Invasion
» Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes

The ecological sensitivity map for the Aberdeen Wind Energy Facility site is provided in **Figure 8.2**. The major sensitive feature of the site is the larger drainage lines which are fairly well developed, especially in the western parts of the site with significant amounts of woody biomass along the drainage line as well as on the adjacent floodplains, which contrasts with the surrounding landscape. Development within the drainage lines and floodplain habitat should be minimised and while it may be necessary for roads to traverse some of these areas, no turbines should be located within these higher sensitivity areas.

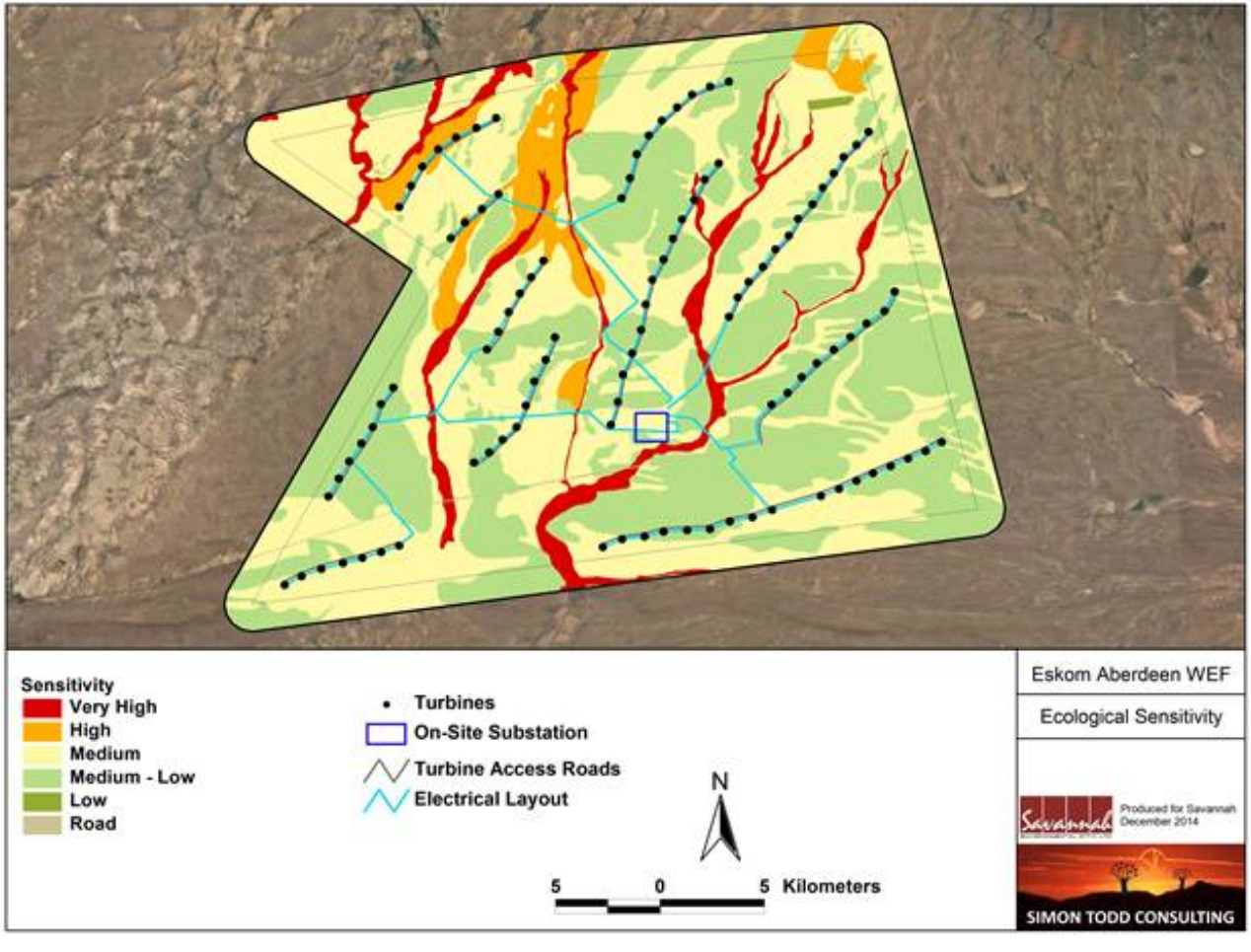


Figure 8.2: Ecological sensitivity map of the Aberdeen Wind Energy Facility study area.

The majority of the site consists of open karroid plains with few species of conservation concern or features of significance and are consequently considered to be relatively low sensitivity where the risks associated with development are manageable with standard mitigation and avoidance measures. Perhaps the greatest concern resulting from the development would be the potential impact on the Critical Biodiversity Areas (CBAs), which occupy the majority of the site. However, due to a variety of reasons including the intact nature of the surrounding landscape and location of the most important part of the CBA outside of the affected area, the overall impact of the development on the CBA is considered to be relatively minor and is not likely to compromise the overall functioning of the CBA.

8.1.1. Impact Tables summarising impacts on ecology

Planning & Construction Phase Impacts

Nature: Impacts on vegetation and protected plant species will occur due to vegetation clearing and disturbance associated with the construction of the facility.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium-High (6)	Medium (5)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Medium-Low (30)**
Status	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Impacts on protected plant species can to some extent be mitigated through avoidance, but some impact on vegetation and habitat is inevitable and cannot be avoided.	

Mitigation

» Preconstruction walk-through of the facility in order to locate species of conservation concern that can be translocated.
» Vegetation clearing to commence only after walk through has been conducted and necessary permits obtained.
» Development within the drainage lines and floodplain habitat should be minimised and while it may be necessary for roads to traverse some of these areas, no turbines should be located within these higher sensitivity areas.
» Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
» ECO to supervise vegetation clearing activities within sensitive areas.
» Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared.
» All construction vehicles should adhere to clearly defined and demarcated roads. No

off-road driving to be allowed.

» Temporary lay-down areas should be located within the development footprint or within areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.

Cumulative Impacts

The potential for cumulative impacts is relatively low as there are currently few other renewable energy developments in the area and the landscape is currently largely intact. In addition, there are no narrow endemics observed that would be significantly impacted by the development.

Residual Impacts

Some residual habitat loss will result from the development, equivalent to the operational footprint of the facility.

***Nature**:* 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	Short-term (2)	Short-term (2)
Magnitude	Medium-High (7)	Medium (5)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (55)**	**Medium (44)**
Status	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Large amounts of noise and disturbance at the site during construction is largely unavoidable.	

Mitigation

» All personnel should undergo environmental induction with regards to fauna and in particular awareness about not harming or collecting species such as snakes, tortoises and owls which are often persecuted out of superstition.

» Any fauna threatened by the construction activities should be removed to safety by the ECO or appropriately qualified environmental officer.

» Regular dust suppression during construction, especially along access roads which are used frequently.

» No construction activity should be allowed at the site between sunset and sunrise.

» All construction vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises.

» 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.

» If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.

Cumulative Impacts

During the construction phase, the activity would contribute to cumulative fauna

disturbance and disruption in the area, but the impact would be of local extent and not of high significance with mitigation.
Residual Impacts
There will be some residual impact as the facility will persist past the construction phase.

Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated by the turbine service areas and access roads.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (36)**	**Low (12)**
Status	Negative	Negative
Reversibility	Moderate	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	

Mitigation

» Dust suppression and erosion management should be an integrated component of the construction approach.
» Disturbance near to drainage lines should be avoided and sensitive drainage areas near to the construction activities should demarcated as no-go areas.
» Regular monitoring for erosion problems along the access roads and other cleared areas during construction.
» Erosion problems should be rectified on a regular basis.
» Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other waste heaps present during the wet season.
» A low cover of vegetation should be left wherever possible within the construction footprint to bind the soil, prevent erosion and promote post-disturbance recovery of an indigenous ground cover.

Cumulative Impacts

Cumulative erosion impacts are likely to be very low after mitigation

Residual Impacts

If erosion at the site is controlled during construction, then there will be very little residual impact.

Nature: Alien plants are likely to invade the site as a result of the large amounts of disturbance created during construction		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Probable (4)	Improbable (3)
Significance	**Medium (40)**	**Low (21)**
Status	Negative	Negative
Reversibility	Moderate	High

Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation

» Due to the disturbance at the site as well as the increased runoff generated at the site, alien plant species are likely to be a long-term problem at the site and a long-term control plan will need to be implemented.
» Rehabilitation of cleared areas with indigenous species after construction to reduce alien invasion potential.
» Regular monitoring for alien plants within the development footprint.
» Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible and should only be used for woody species which resprout following manual control.

Cumulative Impacts

Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impact from alien species would not be significant.

Residual Impacts

If alien species at the site are controlled, then there will be very little residual impact

Operational Phase Impacts

Nature: The operation and presence of the facility may lead to disturbance or persecution of fauna.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium-Low (4)	Low (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To some extent, but not that part related to the presence and operation of the facility.	

Mitigation

» No unauthorized persons should be allowed onto the site.
» Undesirable and problem fauna such snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.
» No fires should only be allowed at the site.
» No fuelwood collection should be allowed on-site.
» No dogs should be allowed on site.
» If parts of the site must be lit at night for security purposes, 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. » All vehicles on the site should adhere to a low speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.
Cumulative Impacts The development would contribute towards habitat loss for fauna in the area. As the landscape in the vicinity of the facility site is currently overwhelmingly intact this would be a relatively low contribution to cumulative impact.
Residual Impacts The facility will be operational for at least 20 years and impact sources such as noise will persist for the operational lifetime of the facility and cannot be mitigated although many fauna would become habituated to these disturbance sources.

Nature: Increased erosion risk as a result of soil disturbance and loss of vegetation cover as well as increased runoff generated by the turbine service areas and access roads.		
	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (14)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Yes	No
Can impacts be mitigated?	Yes	
Mitigation » All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk. » 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. » A cover of indigenous species should be established in disturbed areas in order to bind the soil and prevent erosion.		
Cumulative Impacts Cumulative impacts are likely to very low after mitigation		
Residual Impacts If erosion at the site is controlled, then there will be no residual impact		

Decommissioning & Closure

Nature: Disturbance or persecution of fauna during the decommissioning phase may occur.		
	Without Mitigation	**With Mitigation**

Extent	Local (2)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Medium (4)	Low (2)
Probability	Probable (3)	Improbable (3)
Significance	**Low (24)**	**Low (15)**
Status	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation

» Site access to be controlled and no unauthorized persons should be allowed onto the site.
» The collection, hunting or harvesting of any plants or animals at the site should be strictly forbidden.
» No fires to be allowed on site.
» No fuelwood collection should be allowed on-site.
» No dogs should be allowed on site.
» Any accidental chemical, fuel and oil spills that occur at the site during decommissioning should be cleaned up in the appropriate manner as related to the nature of the spill.
» No open excavations, holes or pits should be left at the site as fauna can fall in and become trapped.
» All disturbed areas should be rehabilitated with a cover of indigenous grass.

Cumulative Impacts

Cumulative impacts at the decommissioning phase are likely to be low.

Residual Impacts

With avoidance measures there should be no residual impact on fauna.

Nature: Alien plants are likely to invade the site as a result of disturbance created during decommissioning

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Medium-term (3)
Magnitude	Medium (5)	Low (3)
Probability	Highly Probable (4)	Improbable (3)
Significance	**Medium (44)**	**Low (24)**
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Yes	

Mitigation

» Due to the disturbance at the site during decommissioning, alien plant species are likely to invade the site and a long-term control plan will need to be implemented for several years after decommissioning.
» Regular monitoring (bi-annual) for alien plants within the development footprint for 2-3 years after decommissioning.

» Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible. » Cleared and disturbed areas should be revegetated with a cover of indigenous grass or shrubs.
Cumulative Impacts Alien invasion would contribute to cumulative habitat degradation in the area, but if alien species are controlled then, then cumulative impacts from alien species would not be significant.
Residual Impacts If alien species at the site are controlled, then there will be very little residual impact

8.1.2. Implications for Project Implementation

» Overall, the development would likely result in moderate impacts during construction and low impacts during operation.
» There are no long-term impacts associated with the development that cannot be mitigated to a low level, and no impacts which are likely to represent a fatal flaw or red flag for the development.
» Although the site is located within a CBA and this is certainly a significant concern for the development, the ultimate impact of the development on the CBA is not likely to compromise the overall ecological functioning of the CBA or impact on any features of high potential concern that warrant longer-term protection in order to retain biodiversity pattern.
» Development within the drainage lines and floodplain habitat should be minimised and while it may be necessary for roads to traverse some of these areas, no turbines should be located within these higher sensitivity areas.

8.2 Assessment of Potential Impacts on Avifauna

The findings of the pre-construction bird monitoring programme have been incorporated into this section, supplementary to the avifaunal impact assessment (EWT, September 2014).

Based on the pre-construction bird monitoring programme, sixteen (16) priority bird species were identified on the site including:

» Black Harrier,
» Black-shouldered Kite,
» Blue Crane, Greater Kestrel,
» Lanner Falcon,
» Karoo Korhaan,
» Kori Bustard,
» Ludwig's Bustard,
» Martial Eagle,
» Verreaux's Eagle,

» Secretarybird,
» Southern Black Korhaan,
» Southern Pale Chanting Goshawk,
» Spotted Eagle Owl,
» Jackal Buzzard,
» Steppe Buzzard and
» African Harrier Hawk

The Avifaunal Impact Assessment study (EWT 2014) presented avian sensitivity maps, which were generated using site visit information, aerial imagery, and vegetation, and avifaunal habitat mapping. This information was used to determine the avian risk maps developed for the pre-construction bird monitoring report. The recommended exclusion zones for the Aberdeen site in relation to the turbine layout is shown in Figure 8.3.

The sensitivity categories were assigned using the following factors:

» High sensitivity: The high sensitivity zones are indicated in red and dark red on Figure 8.3. They include a 1.5km buffer around an identified Blue Crane roost site as well as a 500m buffer around wetlands and/or farm dams. Following the results of the 12 month monitoring program, three other Flight Exclusion Zones were determined. No construction of infrastructure in these zones should be permitted, and it is recommended that these be designated as "no-go" areas. The confidence with which these "High sensitive" areas were identified was medium.
» Medium Sensitivity: The medium sensitivity zones are indicated by Orange on Figure 8.3, and include a 1km buffer around rivers, as well as a buffer zone from 500m -1km around wetland and/or farm dams. Small drainage lines, identified at a desk top level, are buffered by 50m and also regarded as being of medium sensitivity. It is recommended that turbines and other infrastructure should not be built within these areas. However construction of infrastructure may be possible, with caution and in accordance with a site specific Environmental Management Programme (EMPr).
» Low Sensitivity (unknown sensitivity): These are all the remaining areas, and are not colour coded on Figure 8.3. No obvious avifaunal features or high risk flight movement were identified in these areas during the study, and it is likely that the majority of these areas could be designated as Low sensitivity. Therefore, these low and unknown sensitivity areas are preferred for construction.

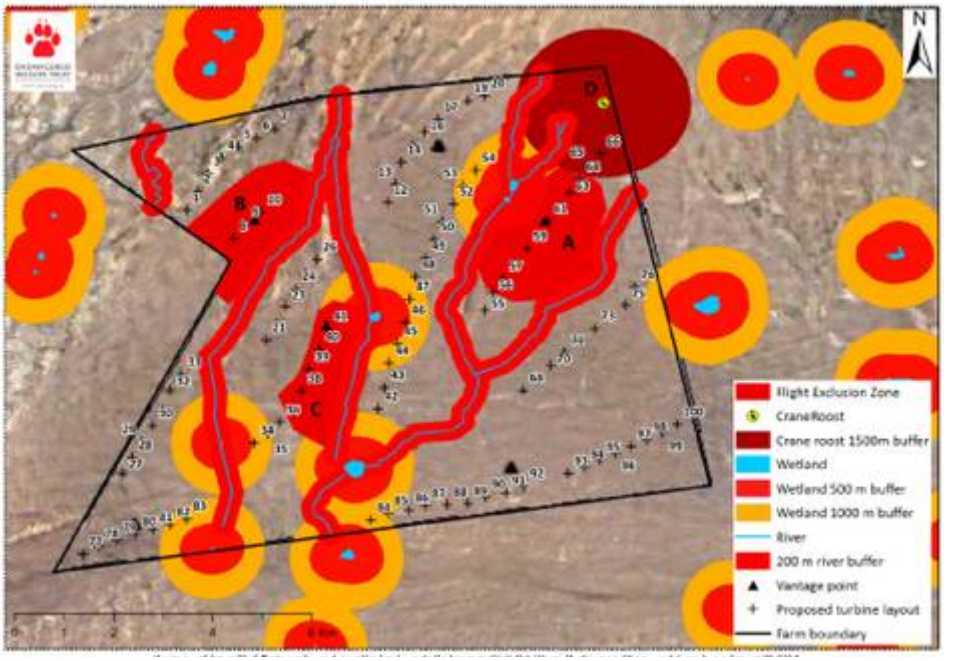


Figure 8.3: Recommended exclusion zones for Aberdeen Wind Farm site and the original turbine layout

Four main areas were identified as high risk in terms of collision:

» Turbines 57 to 63 – many high risk flights occurred across this line of turbines, most likely between the two water courses (or vegetation associated with the watercourses) on either side. Species involved were mainly Ludwig's Bustard, Southern Black Korhaan and Blue Crane.
» Turbines 8 to 11 – a large number of Ludwig's Bustard activity was recorded in this area. Other species active in this area were Southern Black Korhaan and Karoo Korhaan.
» Turbines 37 to 41 – nesting sites of Secretarybird and Blue Crane as well as associated high risk flights occur in this zone.
» Turbines 64 to 66 - Within 1.5 km of a known blue crane roost. During the avifaunal surveys, there were many incidental sightings of Blue Cranes in this area (148 in total across 4 seasons).

The effects of a wind energy facility on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and species of birds present. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss causes a reduction in birds using an area which might then reduce the risk of collision). The principal areas of concern are:

Construction: Disturbance of birds

	Habitat destruction
Operational:	Collision with turbines
	Collision with associated overhead power lines (within the facility)
	Electrocution on associated overhead power lines(within the facility)
	Disturbance during operation and maintenance
	Disruption in local bird movement patterns

8.2.1. Impact Tables summarising impacts on birds

These impacts are assessed in the tables which follow.

Nature of the Impact: Disturbance of birds during construction of Aberdeen Wind Farm

During the construction phase habitat destruction and alteration inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, through the modification of habitat. During the construction and maintenance of the wnd energy facility, a certain amount of disturbance will also result. For shy, sensitive species this can impact on their usual daily activities, particularly whilst breeding.

	Without Mitigation	**With Mitigation**
Extent	Local – site & immediate surrounds only (2)	Local – site & immediate surrounds only (2)
Duration	short term (2)	short term (2)
Magnitude	moderate (6)	moderate (6)
Probability	highly probable (4)	probable (3)
Significance	**Medium (40)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Partially. It is difficult to mitigate completely for this impact as some disturbance is inevitable as a result of the use of equipment and heavy vehicles.	

Mitigation:

» Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. Sensitive zones (rivers, wetlands) identified in Figure 8.3 should be avoided where possible.
» Environmental measures detailed in the site specific EMPr must be enforced and overseen by the Environmental Control Officer (ECO) for the project.
» During the construction phase a site walkthrough is recommended so that the ECO can identify any breeding sensitive bird species in close proximity to specified turbines and associated infrastructure positions.
» If any of the "Focal Species" identified in the avifauna study are observed to be roosting

and/or breeding in the vicinity, a suitably qualified ornithologist is to be contacted for further instruction.
Cumulative impacts: Medium – if other wind sites nearby are being constructed at the same time
Residual impacts: Low

Nature of the Impact: Habitat destruction during construction of Aberdeen Wind Farm		
	Without Mitigation	**With Mitigation**
Extent	Site (2)	Site (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low-Moderate (4)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (60)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Partially	
Mitigation » Strict control over contractors, to ensure only the minimum required areas is cleared. » No off-road driving to be permitted. » Minimize footprint areas, road lengths, road widths, wherever possible during the final layout design. » Where possible existing roads must be used and batching plants, labour camps, equipment storage, etc. should be situated in areas that are already disturbed.		
Cumulative impacts Low		
Residual impacts Low		

Nature of the Impact: Collision of birds with turbines during the operation of the Aberdeen Wind Farm

Four main areas were identified as high risk in terms of collision, i.e. the areas in the vicinity of turbines 57 to 63, 8 to 11, 37 to 41 and 64 to 66.

	Without Mitigation	**With Mitigation**
Extent	Site- Impact will occur locally, but have national implications for certain species (2)	Site- Impact will occur locally, but have national implications for certain specie (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Very high (10)
Probability	Probable (3)	Probable (3)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Negative	Negative

Reversibility	Irreversible	Irreversible
Irreplaceable loss of Resources?	Yes	Yes
Can impacts be mitigated?	Partially	

Mitigation:

» The most important mitigation option is the correct positioning of turbines outside of the identified high sensitivity zones, and where possible, outside of the medium sensitivity zones.
» A post-construction monitoring program will be vital to determine any additional mitigation measures which may be required.
» Additional available or potential mitigation options include: curtailment, i.e. shutting down certain turbines at certain times; and manipulation of blade height to accommodate predominant bird flight height.

Cumulative impacts

The cumulative impact of bird collisions in the area may be significant. Many of the target species for this study are species that are potentially already significantly impacted upon by collisions/electrocutions with overhead cables in the area. If additional power lines in the broader area are built, they may further impact on these target species' populations.

Residual impacts

This impact is undetermined as there is not nearly enough collision data to estimate the residual impact, however it expected that there will some of loss of certain bird species.

Nature of the Impact: Collision of birds with associated overhead power lines at Aberdeen Wind Farm (within wind energy facility site only)

Collisions of birds with a power line are a threat to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. These species have not evolved to cope with high adult mortality, with the result that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term.

	Without Mitigation	**With Mitigation**
Extent	Site- Impact will occur locally, but have national implications for certain species (2)	Site- Impact will occur locally, but have national implications for certain species (2)
Duration	Long term (4)	Long term (4)
Magnitude	Very high (10)	Very high (10)
Probability	Probable (3)	some probability (2)
Significance	**Medium (48)**	**Medium (32)**
Status (positive or	Negative	Negative

negative)		
Reversibility	Irreversible	Irreversible
Irreplaceable loss of Resources?	Yes	Yes
Can impacts be mitigated?	Partially	

Mitigation:

Power lines and cables connecting turbines should be placed underground where possible. Mark relevant sections of overhead lines (i.e. within the Medium-High Sensitivity zones) with appropriate marking devices.

Cumulative impacts

The cumulative impact of bird collisions in the area is likely to be significant. Many of the target species for this study are species that are in all likelihood already significantly impacted upon by collisions/electrocutions with overhead cables in the area. If additional power lines in the broader area are built, they may further impact on these target species' populations.

Residual impacts

Low

Nature of the Impact: Disturbance of birds during operational activities and routine maintenance at the Aberdeen Wind Farm

	Without Mitigation	**With Mitigation**
Extent	site only (1)	site only (1)
Duration	short term (1)	short term (1)
Magnitude	moderate- low (5)	low (4)
Probability	probable (3)	probable (2)
Significance	**Low (21)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	High
Irreplaceable loss of Resources?	No	No
Can impacts be mitigated?	Partially	

Mitigation:

» Strict control should be maintained over all maintenance activities, in particular heavy machinery and vehicle movements, and staff.
» Operating procedures and maintenance schedules must be properly followed. Vehicles should be fitted with standard noise damping exhaust systems and maintenance should be avoided during breeding season at turbines where birds are found to be nesting. Operating procedures must indicate that maintenance personnel should not interfere with fauna, including birds on site.
» During maintenance and operation, if any of the "Focal Species" identified in this report are observed to be roosting and/or breeding in the vicinity, or if any carcasses of these species are found, a suitably qualified ornithologist is to be contacted for further instruction.
» A post-construction or operational monitoring program is recommended.

Cumulative impacts

Low

Residual impacts

Low

Nature of the Impact: Disruption in local bird movement patterns

Large scale wind energy facilities will form an obstacle for birds to avoid and this avoidance behaviour may lead to increased energy costs to the bird as they expend more energy flying from one point to another. This in turn may result in decreased breeding productivity and ultimately population level impacts.

	Without Mitigation	**With Mitigation**
Extent	local-regional (3)	local-regional (3)
Duration	long term (4)	long term (4)
Magnitude	low-moderate (5)	low-moderate (5)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of Resources?	Possible	Possible
Can impacts be mitigated?	Unknown	

Mitigation:
This impact is not yet well understood, and not possible to mitigate for.

Cumulative impacts
High. Of particular concern is the cumulative impact of multiple wind energy facilities in one area.

Residual impacts
Undetermined

8.2.2. Implications for Project Implementation

The proposed facility has the potential to significantly impact on avifauna in the area, although the confidence in this assessment is low due to the limited operational experience of commercial scale wind farms in South Africa. There are no foreseeable fatal flaws associated with the site, however the project should proceed in line with the recommendations and mitigations provided. The final site layout planning should consider the sensitivities indicated in Figure 8.3.

Post-construction or operational monitoring programs are highly recommended as per the Best Practise Guidelines. It is suggested that the monitoring program continue for two years after construction with the first year consisting of frequent monitoring (at least monthly) that covers at least 75-100% of the turbines (adhering to the Guidelines unless a motivated otherwise). The second year can focus on specific turbines or areas of collision as recorded within the first year of monitoring. It is recommended that the turbines located along the edge of the high risk areas be focused upon.

8.3 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 pre-construction bat monitoring programme was undertaken at the Aberdeen 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 to date confirmed that of the 11 potentially occurring bats, five have been confirmed. Of the 11 potentially occurring species, six species are considered as "near threatened" and five considered as species of "least concern". Two confirmed and seven potential bat roosts were located at and around the Aberdeen 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:

- The High Sensitivity Areas were made up as follows (no-go areas):
  - Southern Karoo Reverie/ Azonal vegetation type.
  - All FEPA wetlands & rivers with a 500m buffer.
  - All desktop delineated riparian areas.
  - Confirmed bat roosts with 1km
- The Medium-High Sensitivity Areas were made up as follows(It is recommended that no parts of the turbines are constructed or encroach into these areas):
  - All potential bat roosts with a 500m buffer.
  - Secondary tributaries and drainage lines plus a 200m buffer.
- The Medium Sensitivity Areas were made up of Dolerite geology plus a 200m buffer - an initial operational mitigation strategy is recommended for these areas in autumn, spring and summer, under specific weather conditions.

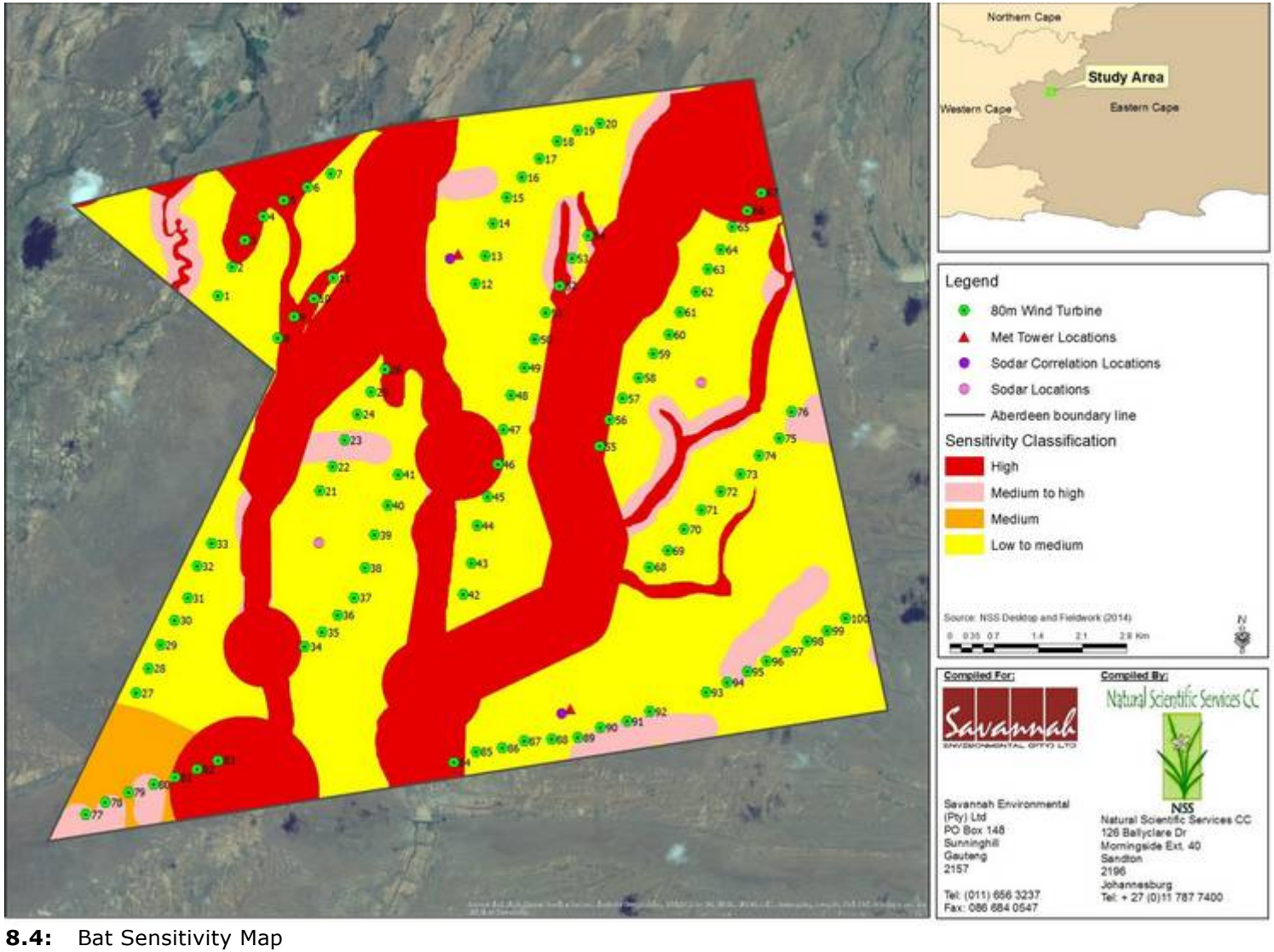


Figure 8.4: Bat Sensitivity Map

8.3.2 Impact Tables summarising impacts on bats

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

The only roosts identified on the site were tree/ shrub roosts and 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	local (1)	local (1)
Duration	short term (1)	short term (1)
Magnitude	Moderate (4)	Low (2)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (20)**
Status (positive or negative)	Negative	Neutral
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Possible loss of breeding success and local population crash	Unlikely
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Avoid areas of high sensitivity as per Figure 8.4.
» Turbine placement is to 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 be kept to a minimum.
» Blasting activities 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:

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 Aberdeen wind energy facility alone is considered of Low significance; however, when combined with the other 4 facilities within a 100km radius of the site, the cumulative impact is considered to be of Medium 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 at the office and substation site. 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	Regional (3)	Local (2)
Duration	very short (1)	very short (1)
Magnitude	moderate (7)	Low (4)
Probability	definite (5)	highly probable (4)
Significance	**Medium (55)**	**Low (28)**
Status (positive or negative)	Negative	Neutral
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Unlikely
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Turbine placement is to 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 be kept to a minimum.
» Minimise impacts to wetlands and water resources by following all applicable provisions of the National Water Act and keep all turbines outside of No-Go areas.

Cumulative impacts:

The greater the area to be disturbed by development, the greater the loss or disturbance to foraging land. Whilst this is true, construction phase impacts are short term impacts. In addition, the majority of turbines in the more mountainous regions associated with the other facilities in the area are anticipated to be at the top of ridges or escarpments, not in the valleys where the majority of foraging takes place.

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

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	long term (4)	long term (4)
Magnitude	Low(5)	Minor(2)
Probability	highly probable (4)	probable (3)
Significance	**Medium (48)**	**Low (24)**
Status (positive or negative)	Negative	Neutral
Reversibility	Possible	Reversible
Irreplaceable loss of resources?	Yes	Possible
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Turbine placement is to 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 be kept to a minimum.
» Minimize impacts to wetlands and water resources by following all applicable provisions of the National Water Act and keep all turbines outside of No-Go areas.
» Gaps of at least 3 turbine blade lengths should be left open between turbines, from blade tip to blade tip.
» Keep road, turbine, quarry and substation 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 land. The main areas of foraging in these dry Karoo regions are associated with wetlands and riparian fringes. As long as these remain undeveloped and appropriate buffers are maintained, the cumulative impact should not be too significant. Should more information become available with regard to key foraging or migration corridors, adaptive operational management plans must take this into consideration. A similar strategy of keeping turbines out of river and agricultural valleys should be adopted at all facilities within a 100km radius to reduce the cumulative impacts on foraging bats.

Residual impacts:

Bats may permanently need to find alternative foraging areas or change their migration routes. Bats not avoiding these areas, may suffer fatalities. Refer to Section 3.4 for the residual impacts of fatalities.

Nature: Bat fatalities due to collision or barotrauma while foraging

Bats cover large distances to forage nightly (2 to more than 30km), 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	Permanent (5)	Permanent (5)
Magnitude	High (8)	Minor (2)
Probability	highly probable (4)	probable (3)
Significance	**High (60)**	**Medium (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Possible	Unlikely
Can impacts be mitigated?	Partially	Partially

Mitigation:

» Turbine placement is to 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.
» It is recommended that a taller turbine with a shorter blade length be used, so that rotor sweep does not reach below 40m from ground level.

- Turbine engineers should 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 impacts after the turbines are constructed.
- Turbines within areas of Low to Medium Sensitivity
  1. With the exception of when temperatures are below 11.5°C, barometric pressure is lower than 895kPa and higher than 915kPa, an initial cut-in speed of 4.6m/s (approximately 50% of bat activity occurs below this wind speed) is recommended from sunset to sunrise in the following months - March, April, October and November. Furthermore,
  2. Operational monitoring according to Aronson *et al.* (2014), or any more recent revisions to this document, is to 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:
  3. As soon as a fatality is discovered, all the relevant data to do with that fatality must be recorded.
  4. The turbine where the fatality was discovered is to be searched every day for a period of one month following the fatality.
  5. Should no further carcasses be discovered in the next month, the carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to Step 4. For the months of March, April, October and November, proceed to Step 8.
  6. Should further bat fatalities be discovered at that turbine, then turbine feathering to be implemented from sunset to sunrise. Fatality searches to continue daily at that turbine for a month.
  7. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
  8. Should further carcasses be found at that turbine, an increased cut-in speed of 4.6m/s (below which approximately 50% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month. If the fatality was discovered in March, April, October and November, only these months require the additional mitigation, however, if the fatality was found outside of the months, then the additional mitigation measures are required for that turbine for all seasons.
  9. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
  10. Should further carcasses be found at that turbine, an increased cut-in speed of 7.4m/s (below which approximately 80% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month.
  11. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
  12. Should further carcasses be found at that turbine, an increased cut-in speed of 9.25m/s (below which approximately 90% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month.
  13. Should no further carcasses be discovered in the next month, the mitigation

strategy must remain, but carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.

14. Should further fatalities be discovered, that turbine should not operate from sunset to sunrise. If the fatality was discovered in March, April, October and November, only these months require the additional mitigation, however, if the fatality was found outside of the months, then the additional mitigation measures are required for that turbine for all seasons.

» Areas of Medium Sensitivity

1. With the exception of when temperatures are below 11.5°C, barometric pressure is lower than 895kPa and higher than 915kPa:

» An initial cut-in speed of 4.6m/s (approximately 50% of bat activity occurs below this wind speed) is recommended from sunset to sunrise in the following months - March, April, September, October and November. Furthermore,

» Operational monitoring according to Aronson et al. (2014) or any more recent revisions to this document is to 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:

1. As soon as a fatality is discovered, all the relevant data to do with that fatality must be recorded.
2. The turbine where the fatality was discovered is to be searched every day for a period of one month following the fatality.
3. Should no further carcasses be discovered in the next month, the carcass searches can revert to weekly. As soon as another fatality is discovered at that turbine, commence to Step 4. For the months of March, April, September and October and November, proceed to Step 8.
4. Should further bat fatalities be discovered at that turbine, then turbine feathering to be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month. If the fatality was discovered in March, April, October and November, only these months require the additional mitigation, however, if the fatality was found outside of the months, then the additional mitigation measures are required for that turbine for all seasons.
5. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can resume to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
6. Should further carcasses be found at that turbine, an increased cut-in speed of 4.6m/s (below which approximately 50% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month.
7. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can resume to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
8. Should further carcasses be found at that turbine, an increased cut-in speed of 7.4m/s (below which approximately 80% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month.
9. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can resume to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
10. Should further carcasses be found at that turbine, an increased cut-in speed of

9.25m/s (below which approximately 90% of bat activity occurs) must be implemented from sunset to sunrise. Fatality searches to continue at that turbine every day for a month.

11. Should no further carcasses be discovered in the next month, the mitigation strategy must remain, but carcass searches can resume to weekly. As soon as another fatality is discovered at that turbine, commence to the next step.
12. Should further fatalities be discovered, that turbine should not operate from sunset to sunrise.

» Pre-construction and operational monitoring bat data to feed into the SANBI bird and bat toolkit. Monthly carcass searching reports to be submitted to SABAAP.
» As new information becomes available with regard to successful mitigation strategies tested, this information should feed into the adaptive management plan.

Cumulative impacts:
The greater the number of turbines, the higher the potential for fatalities during foraging. However, higher risk areas are areas associated with nightly foraging activity, such as river valleys, water bodies, irrigated agricultural 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	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (7)	Low (4)
Probability	highly probable (4)	probable (3)
Significance	**High (64)**	**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 river valleys, ridges, tree rows etc. With migrating bats, cumulative impacts could reach several populations across the country and neighbouring 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 insectivorous bats, as likely to occur at Aberdeen have ever been reported to be killed by power lines.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (18)**	**Low (9)**
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:
The greater the number of wind energy facilities 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.

8.3.3. Implications for Project Implementation

With the exception of the areas delineated with higher sensitivities, the Aberdeen 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, NSS recommends 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.

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

The proposed activity could carry potentially *negative direct* impacts in terms of soil and/or rock degradation (erosion, excavation/removal, loosening, compaction, contamination/pollution, etc.) and reduced agricultural potential. The activity may also lead to *negative indirect* impacts such as dust pollution and increased siltation of watercourses away from the site or activity areas. The severity or significance of the various impacts is a factor of the nature and extent of the activity. The activity can also have positive impacts on the geological environment (either directly or indirectly), such as a reduced demand for non-renewable energy sources (such as coal, uranium) and an improvement in the status quo in terms of erosion and soil degradation due to improved storm water handling systems and roads engineering on the site (more specifically on degraded sites). Negative impacts are dominantly related to the construction phase with insignificant additional impacts in the post construction and decommissioning phases.

The study indicates that the majority of the proposed site has a very thin soil cover with numerous interstitial rock outcrops and low agricultural potential with only localised evidence of significant erosion and therefore is considered to have a low erosion sensitivity. However, thicker, finer-grained soil is anticipated along natural drainage lines and significant sheet erosion is noted in these areas and therefore these areas are deemed to be highly sensitive. Construction activity in areas of low sensitivity can still result in some erosion of soil in areas that are cleared of vegetation and normal mitigating measures should be applied to controlling soil erosion. The agricultural potential of the site is considered low and the proposed activity will not have any significant effect on this status as grazing can continue in areas where construction is not taking place.

Activities / infrastructure that may have an impact on soils include:

» Wind turbines (i.e. construction and positioning of the concrete foundations of the wind turbines, positioning and construction of underground cabling between the wind turbines, construction and positioning of an on-site substation, construction and positioning of a workshop, office, maintenance and storage area)
» Construction and positioning of internal access roads
» Construction and positioning of the overhead power line/s
» Use of potential sources of contaminants on the site (i.e. oil, petrol, diesel and other substances used by the vehicles and equipment)

8.4.1 Impact tables summarising impacts on Soils & Agricultural Potential

An assessment of the potential direct impacts associated with the proposed development is tabulated below.

Nature: Soil degradation (soil removal, mixing, compaction, etc.) due to the construction of foundations for structures (turbines, buildings, substations,).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Short term (2)	Very Short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (20)**
Status	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes.	
Mitigation: Rehabilitate topsoil & vegetation around turbine and other infrastructure immediately after construction.		
Cumulative impacts: The site is located on undeveloped agricultural land and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts: Minor degradation of soil under structures.		

Nature: Soil degradation (soil removal, mixing, compaction, etc.) due to the construction of new access roads.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Moderate (45)**	**Moderate (35)**
Status	Negative	Negative
Reversibility	Irreversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes.	
Mitigation: » Minimise the length and width of new access roads (preferably just gravel tracks). » Use existing tracks where practical. » Maintain access roads in good condition, preventing detours due to bad road conditions		
Cumulative impacts: The site is located on undeveloped agricultural land and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts:		

Minor degradation of soil under roads.

Nature: Soil degradation due to pollution of soil by contaminants used on site during construction (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (18)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Reversible
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » Control use and disposal of potential contaminants or hazardous materials. » Remove contaminants and contaminated topsoil and replace topsoil in affected areas.		
Cumulative impacts: The site is located on undeveloped agricultural land and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts: Minor temporary degradation of soil		

Nature: Soil degradation due to increased soil erosion by wind and/or water on construction areas.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status	Negative	Negative
Reversibility	Practically irreversible	Practically irreversible
Irreplaceable loss of resources?	Practically irreplaceable	Practically irreplaceable
Can impacts be mitigated?	Yes.	
Mitigation: » Minimise size of the construction footprint/camp. » Implement effective erosion control measures around site. » Carry out earthworks in phases across site to reduce the area of exposed ground at any one time. » Protect and maintain denuded areas and material stockpiles to minimise erosion and instability		
Cumulative impacts: The site is located on undeveloped agricultural land and there are no other significant		

existing developments in the vicinity. No other significant potential developments are known.
Residual impacts: Minor localised erosion.

Nature: Impact on existing land-use.		
	Without mitigation	***With mitigation***
Extent	Local (1)	-
Duration	Long term (4)	-
Magnitude	Minor (2)	-
Probability	Probable (3)	-
Significance	**Low (28)**	-
Status	Negative	-
Reversibility	Reversible	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Impractical and not considered necessary	
Mitigation: None required		
Cumulative impacts: » The site is located on agricultural land with low capability and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts: » Insignificant temporary loss of grazing land while facility is in use.		

Nature: Reduction in agricultural potential.		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (4)	Probable (4)
Significance	**Low (28)**	**Low (28)**
Status	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Impractical and not considered necessary	
Mitigation: None required		
Cumulative impacts: » The agricultural potential is low and there are no other significant existing developments in the vicinity.		
Residual impacts: » Minor loss of grazing land while facility is in use.		

An assessment of the potential indirect impacts associated with the proposed development is tabulated below

Nature: Degradation of watercourses due to increased siltation downstream from site.		
	Without mitigation	***With mitigation***
Extent	Regional (3)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Unlikely (2)
Significance	**Moderate (33)**	**Low (14)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Protect denuded areas with mulch and install anti-erosion measures such as silt fences, geosynthetic erosion protection, and/or flow attenuation along watercourses below construction sites. » Strictly control activity near water courses/natural drainage lines as sediment transport is higher in these areas.		
Cumulative impacts: » The site is located on undeveloped agricultural land and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts: » Minor localised erosion and siltation across site		

Nature: Increased dust pollution from construction sites affecting surroundings.		
	Without mitigation	***With mitigation***
Extent	Regional (2)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, minor	Yes, insignificant
Can impacts be mitigated?	Yes	
Mitigation: » Apply dust control measures such as straw & mulch and dampen dusty denuded areas.		
Cumulative impacts: » The site is located on undeveloped agricultural land and there are no other significant existing developments in the vicinity. No other significant potential developments are known.		
Residual impacts: » Minor localised dust pollution		

Nature: Reduction in demand for non-renewable energy sources.		
	Without mitigation	***With mitigation***
Extent	National (3)	n/a
Duration	Long term (4)	n/a
Magnitude	Moderate (6)	n/a
Probability	Very probable (4)	n/a
Significance	**Moderate (52)**	n/a
Status	Positive	
Reversibility	N/A	
Irreplaceable loss of resources?	N/A	
Can impacts be mitigated?	Not re1uired	
Mitigation: *None required*		
Cumulative impacts: » The cumulative positive impact on a national scale is potentially significant.		
Residual impacts: *None*		

8.4.2 Implications for Project Implementation

It is recommended that the development of the wind energy facility be approved conditional to appropriate planning to minimse degradation of soil resources. If suitable mitigating measures are applied, the proposed activity will have an overall low negative impact on the soil and the agricultural potential.

8.5 Assessment of Potential Visual Impacts

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours 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 on **Figure 8.5**. The visibility analysis was undertaken from 100 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.

The viewshed analysis not only indicates areas from which the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed).

The dark orange areas indicate a high frequency (i.e. 91-100 turbines or parts thereof may be visible) while the yellow areas represent a low frequency (i.e. 1-10 turbines or parts thereof may be visible).

The following is evident from the viewshed analysis:

» The proposed facility will have a large core area of potential visual exposure on the development site itself, and within a 5km offset. The entire area within 5km will potentially be visually exposed to the wind energy facility. This is due to the predominantly flat terrain surrounding the site and its environs.
» This core area includes the R61, two secondary roads and a number of farms and homesteads. The south western tip of the Kamdeboo Mountains also lies within this zone, and the south western slopes will be visually exposed.
» Potential visual exposure remains high in the medium distance (i.e. between 5 and 10km) with visually screened areas occurring only in the north east within the mountains. In general, the southern and western slopes of the mountains are exposed to potential visual impact.
» In the longer distance (i.e. between 10km and 20km), potential visual exposure decreases to some extent, especially in the north eastern mountains. Some south and west facing slopes will however still be visually exposed.
» Visual receptors that may experience visual impact include users of the N9, the R61, secondary roads as well as a number of farms and homesteads which are situated within 10-20km radius.

It is envisaged that the turbine structures may be highly visible to observers travelling along the National and arterial roads and residing on the farms and in homesteads throughout the study area. The facility would constitute a high visual prominence within this environment, especially within a 10km radius, potentially resulting in a visual impact.

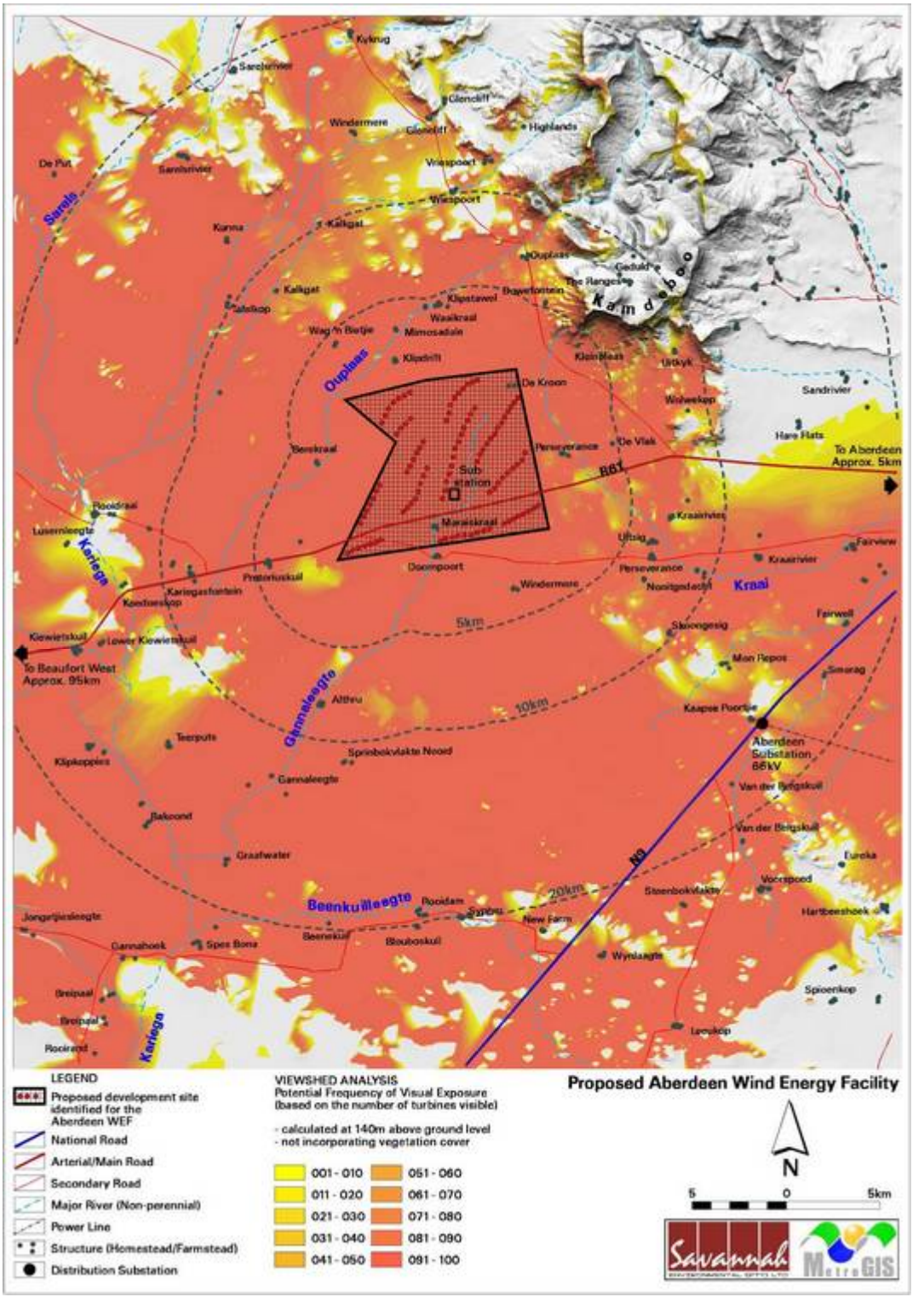


Figure 8.5: Viewer exposure for the Aberdeen Wind Energy Facility

Visual Impact

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed Aberdeen Wind Energy Facility are displayed on **Figure 8.6**. Here the weighted impact and the likely areas of impact are indicated as a visual impact index. Values are 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 magnitude) 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 following is of relevance:

» Within a 5km radius of the proposed wind energy facility there are a number of areas that may experience **very high** visual impact. These include a number of homesteads, an 18km section of the R61 arterial road that traverses the proposed development site and two sections of secondary road alternately traversing north-east and south of the proposed development site. Homesteads located within this zone include: *Wag 'n Bietjie, Klipdrift, Mimosadale, Waaikraal, Klipstawel, Kleinplaas, De Vlak, Perseverance, Windermere, Doornpoort, Pretoriuskuil* and *Berekraal*. Another two homesteads (*De kroon* and *Maraiskraal*) are located on the development site and is expected to be integrated into the development.

» **High** potential visual impacts may occur within a 5km radius of the proposed development. This predominantly includes land where potential sensitive visual receptors are absent.

» The area between 5km to 10km is generally expected to have a **moderate** visual impact where observers are predominantly absent. Observers travelling along the R61 arterial road or the secondary roads within this zone may experience a **high** visual impact, although only for brief periods. Residents and visitors to homesteads within this zone may similarly experience a **high** visual impact. These include: *Kalkgat, Ouplaas, Uitkyk, Kraairivier, Uitsig, Perseverance (2), Nooitgedacht, Skoongesig, Althru* and *Kariegasfontein*.

» Within the 10km to 20km zone a number of homesteads and road users may experience a **moderate** visual impact. This includes a section of the N9 national road traversing south-east of the proposed development. The rest of this zone, predominantly vacant farmland or natural open space, is expected to have a **low** or **very low** visual impact.

» Visibility and potential visual impacts beyond a 20km radius of the proposed wind energy facility are expected to be **negligible** due to the relatively long distance between the development and the potential observer.

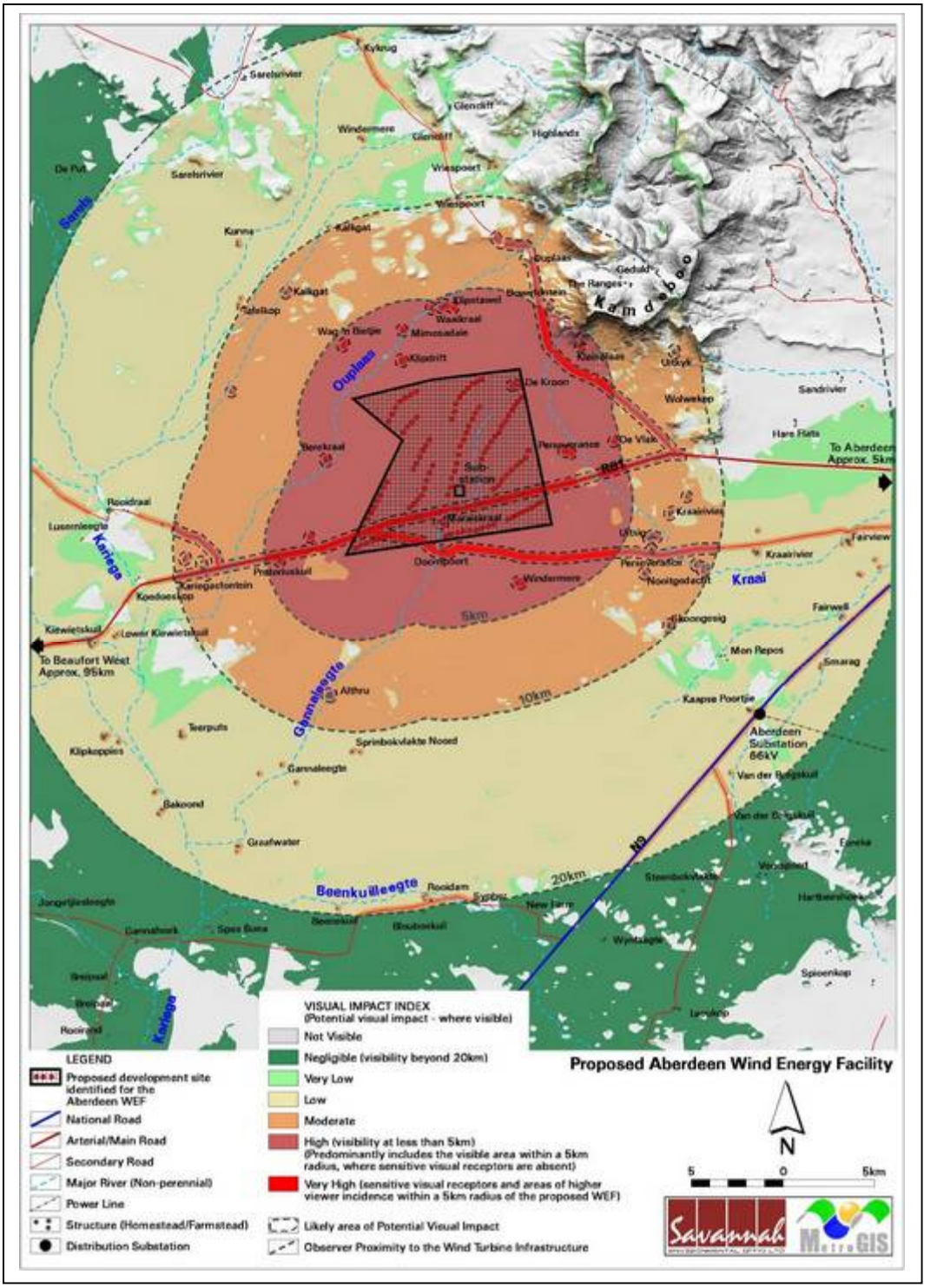


Figure 8.6: Visual impact index of the proposed Aberdeen wind energy facility

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

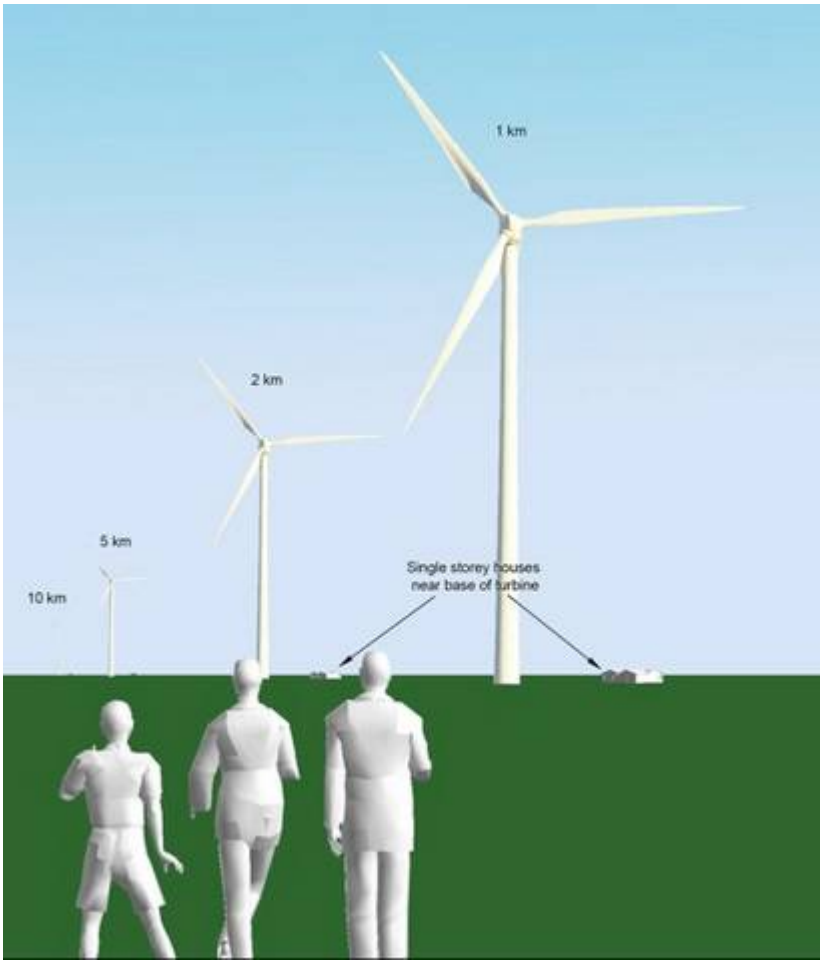


Figure 8.7: Visual experience of a wind turbine structure at a distance of 1km, 2km, 5km and 10km.

Photo Simulations

Photo simulations were undertaken (**Figure 8.8 and 8.9**) in order to illustrate the potential visual impact of the proposed Aberdeen Wind Energy Facility within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

Figure 8.8.: Viewpoint 1 is located along the secondary road traversing north-east of the proposed development site. The point is located roughly where this road crosses the Kraai River bed, at a distance of approximately 3.2km from the nearest wind turbine. The viewing direction is south-westerly and is representative of a short distance view that travellers along this road and residents located at homesteads within this zone, may experience. Virtually all the wind turbines are fully or partially visible in the landscape. This view is typical of a high frequency visual exposure in close proximity to the proposed

Figure 8.9.: Viewpoint 2 is located along the R61 arterial road traversing between Aberdeen and Beaufort West. The point is located approximately 3.2km away from the nearest turbine. The viewing direction is west and is representative of a short distance view that travellers along this road may experience. The turbines are partially obscured by the undulating nature of the terrain, but still protrude above the skyline due to the tall wind turbine structures. This road traverses the proposed development site, and as the observer continues in a westerly direction, the whole facility will become exposed with turbines located both north and south of this road. This view is typical of the high frequency exposure attributed to the generally flat topography surrounding the site.

The photo simulations provide a simulation of the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout as indicated on the maps.

The simulated views show the placement of the wind turbines during the longer-term operational phase of the facility's lifespan. It is assumed that the necessary post-construction phase rehabilitation and mitigation measures, as proposed by the various specialists in the environmental impact assessment report, have been undertaken.

The panoramic overview allows for a more realistic viewer scale that would be representative of the distance over which the turbines are viewed. Where relevant, each panoramic overview indicates the section that was enlarged to show a more detailed view of the wind energy facility. The simulated wind turbines, as shown on the photographs, were adapted to the atmospheric conditions present when the original photographs were taken. This implies that factors such as haze and solar glare were also simulated in order to realistically represent the observer's potential view of the facility.

8.5.1. Impact Tables summarising visual impacts

Construction impacts

Nature of Impact: Dust from construction work could also result in potential visual impact 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	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Improbable (2)
Significance	**Moderate (33)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable (3)	Recoverable (3)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Retain and maintain natural vegetation in all areas outside of the development footprint. Construction: » Ensure that vegetation is not unnecessarily 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 using approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).
» Restrict construction activities to daylight hours whenever possible in order to reduce lighting impacts.
» Rehabilitate all disturbed areas immediately after the completion of construction works.

Cumulative impacts:
None.

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.

	Without mitigation	**With mitigation**
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (28)**	**Low (14)**
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 will contribute to the cumulative visual impact of built structures within the region.
Residual impacts: The visual impact will be removed after decommissioning, provided the substation is removed. 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

Potential visual impact on users of the R61 and secondary roads in close proximity of the proposed wind energy facility (i.e. within a 5-10km radius) is expected to be of **high** significance. No mitigation is possible[9].

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Very high (10)	N/A
Probability	High(4)	N/A
Significance	**High (72)**	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 up to 100 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as power lines and substations) within the region. No authorised wind farm facilities are present in the area, as could be determined at the time of compiling this report.

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 residents of farmsteads in close proximity to the proposed *wind energy facility*

[9] 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 WEF, 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 potential visual impact on residents of farmsteads within a 5-10km radius of the proposed wind energy facility is expected to be of **high** significance. No mitigation is possible.

	No mitigation	***Mitigation considered***
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Very high (10)	N/A
Probability	High (4)	N/A
Significance	**High (72)**	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 100 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as power lines and substations) within the region. No authorised wind farm facilities are present in the area, as could be determined at the time of compiling this report.

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 sensitive visual receptors within the region.

The visual impact on the users of roads and the residents of settlements and homesteads within the region (i.e. beyond a 10km radius) 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	Probable (3)	N/a
Significance	**Moderate (39)**	**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 100 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as power lines and substations) within the region. No authorised wind farm facilities are present in the area, as could be determined at the time of compiling this report.

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 internal *access roads* on observers in close proximity to the proposed wind energy facility

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Very 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:

» Make use of existing roads wherever possible and plan the roads and infrastructure with due cognisance of the topography to limit cut and fill requirements.
» Plan roads to avoid / minimise clearing of vegetation.
» 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 the access roads.

Operation:

» Maintain roads to avoid erosion and suppress dust.
» Use a paving material that blends in with the surrounding soil colours.

Decommissioning:

» Remove of infrastructure and roads 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 access roads will contribute to the cumulative visual impact of road infrastructure within the region.

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 *substation* on observers in close proximity to the proposed wind energy facility

The substation could present a visual impact as it would be a built structure within a natural context. In addition, vegetation will need to be removed for this structure to be built.

	No mitigation	***Mitigation considered***
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (28)**	**Low (14)**

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 will contribute to the cumulative visual impact of built structures within the region.

Residual impacts:

The visual impact will be removed after decommissioning, provided the substation is removed. Failing this, the visual impact will remain.

***Nature of Impact*:** Potential visual impact of shadow flicker on visual receptors in close proximity to the proposed wind energy facility

Shadow flicker occurs when the sky is clear, and when the rotor blades of the wind turbine 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 300-400m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring.

There are no major roads or places of residence within this 300-400m buffer. The significance of shadow flicker is therefore anticipated to be **low**.

	Without mitigation	**With mitigation**
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:

Decommissioning:

Removal of infrastructure not required for post decommissioning use and rehabilitation of

the footprint areas.

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 on the visual character of the landscape 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 and 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.

A visual 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 predominantly natural land cover types, the wide open vistas and the picturesque Kamdeboo Mountains that form the backdrop to many views of this region. The construction of up to a 100 wind turbine generators is likely to result in a partial loss of or alteration to, the characteristics of the baseline environment with the introduction of elements that are prominent and uncharacteristic when set within the attributes of the receiving landscape. The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be of **moderate** significance. There is no mitigation for this impact.

	Without mitigation	**With mitigation**
Extent	Regional (3)	n/a
Duration	Long term (4)	n/a
Magnitude	High(8)	n/a
Probability	Probable (3)	n/a
Significance	**Moderate (45)**	**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 100 wind turbines will increase the cumulative visual impact of industrial and/or power related infrastructure (such as power lines and substations) within the region. No authorised wind energy facilities are present in the area, as could be determined at the time of compiling this report.

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.

8.5.2. Implications for Project Implementation

The construction and operation of the proposed Aberdeen Wind Energy Facility and its associated infrastructure will have a visual impact on the surrounding environment. However, the facility has an advantage over other more conventional power generating plants (e.g. coal-fired power stations). The facility utilises a renewable source of energy (considered as an international priority) to generate power and is therefore generally perceived in a more favourable light. It does not emit any harmful by-products or pollutants and is therefore not negatively associated with possible health risks to observers.

However, these positive aspects should not distract from the fact that the proposed development would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, residents of rural homesteads and (to a lesser degree) tourists passing through the region en-route to holiday destinations. A number of mitigation measures have been proposed (**Appendix K** – VIA report), which, if implemented and maintained, will reduce the significance of the certain visual impacts associated with the proposed facility.

8.6 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. Potential receptors were identified and are indicated on **Figure 8.10**.

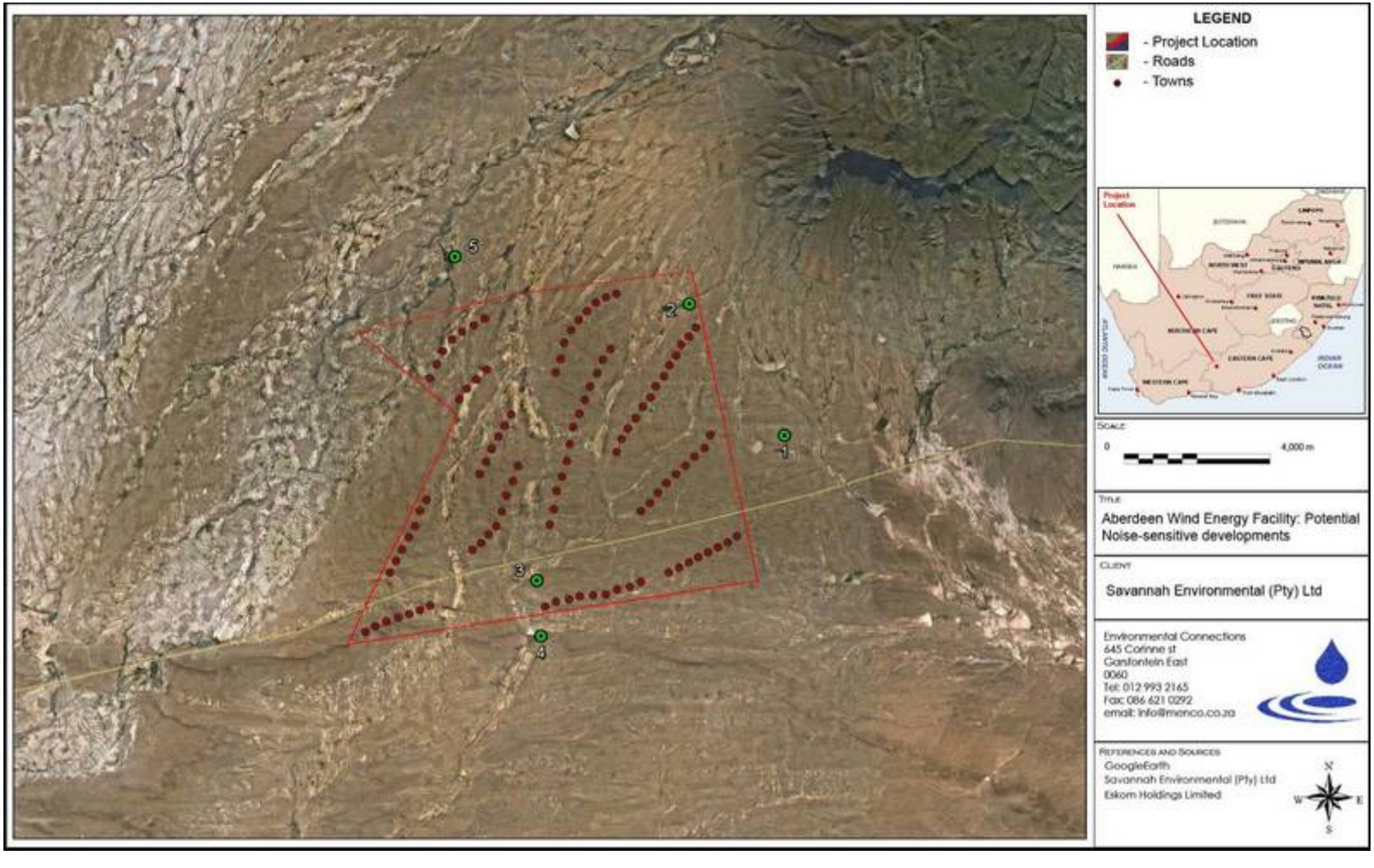


Figure 8.10: Aerial image indicating potential noise sensitive receptors and property boundaries for the Aberdeen Wind Energy Facility

8.6.1. 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 the NSDs is remote.*

» **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 (without mitigation) during Construction

***Nature*:** Numerous simultaneous construction activities that could cause noise impacts on receptors.	
Acceptable Rating Level	Numerous simultaneous construction activities that could impact on receptors.
Extent ($\Delta L_{Aeq,D}$>7dBA)	Rural district (excluding construction traffic): 45 dBA outside during day Use of $L_{Req,D}$ of 45 dBA for rural areas Ambient sound level = 35 - 45 dBA, used 45 dBA for modelling
Duration	Local– Change in ambient sound levels would not extend further than 1,000 meters from activities (2).
Magnitude	Temporary– Noisy activities in the vicinity of the receptors would last a portion of the construction period (1)
Probability	Ambient noise levels < Rating Level Low (2)
Significance	While it is likely that NSDs 3 and 4 would hear construction noises it is unlikely to change ambient sound levels sufficiently to impact on the receptors. Improbable (1)
Status	**Low (26)**
Reversibility	Negative
Irreplaceable loss of resources?	High
Comments	Not relevant
Can impacts be mitigated?	*Modelling considered a worse-case scenario with significant activities taking place for 16 hours each day*
Mitigation: *Mitigation not required*	
Effectiveness of mitigation: *Not required*	
Cumulative impacts: This impact is cumulative with existing ambient sound as well as other noisy activities conducted in the same area	
Residual Impacts: None. The impact will be removed once construction is completed.	

8.6.2. 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**.

Results of Noise Modelling – Operational Phase

The Noise study focuses on the impacts on the surrounding sound environment during times when a quiet environment is highly desirable. Noise limits are therefore appropriate for the most noise-sensitive activity, such as sleeping, or areas used for relaxation or other activities (places of worship, school, etc.). Appropriate Zone Sound Levels are therefore important, yet it has been shown that the SANS recommended (fixed) Night Rating Level (LReq,N = 35dBA) might be inappropriate due to the increased ambient sounds relating to wind action. A more appropriate method to determine the potential noise impact would be to make use of the projected noise levels due to the operation of the wind energy facility as well as the likely ambient sound levels due to wind induced noises.

Projected Noise Levels in the area due to the operation of the wind energy facility are indicated in **Figure 8.11** which illustrates the projected noise levels due to the operation of the proposed wind energy facility. As indicated in this figure, it is likely that a noise risk could occur at NSD03 with a low risk of a noise impact at other receptors in the area. While the noise level is still less than the 45 dBA identified as the limit by ETSU-R97 and the International Finance Corporation Environmental, Health and Safety Guidelines. The projected noise level exceeds the 40 dBA ideal ambient noise level for NSD02, NSD03 and NSD04 as defined by the latest WHO Night-time Noise guidelines.

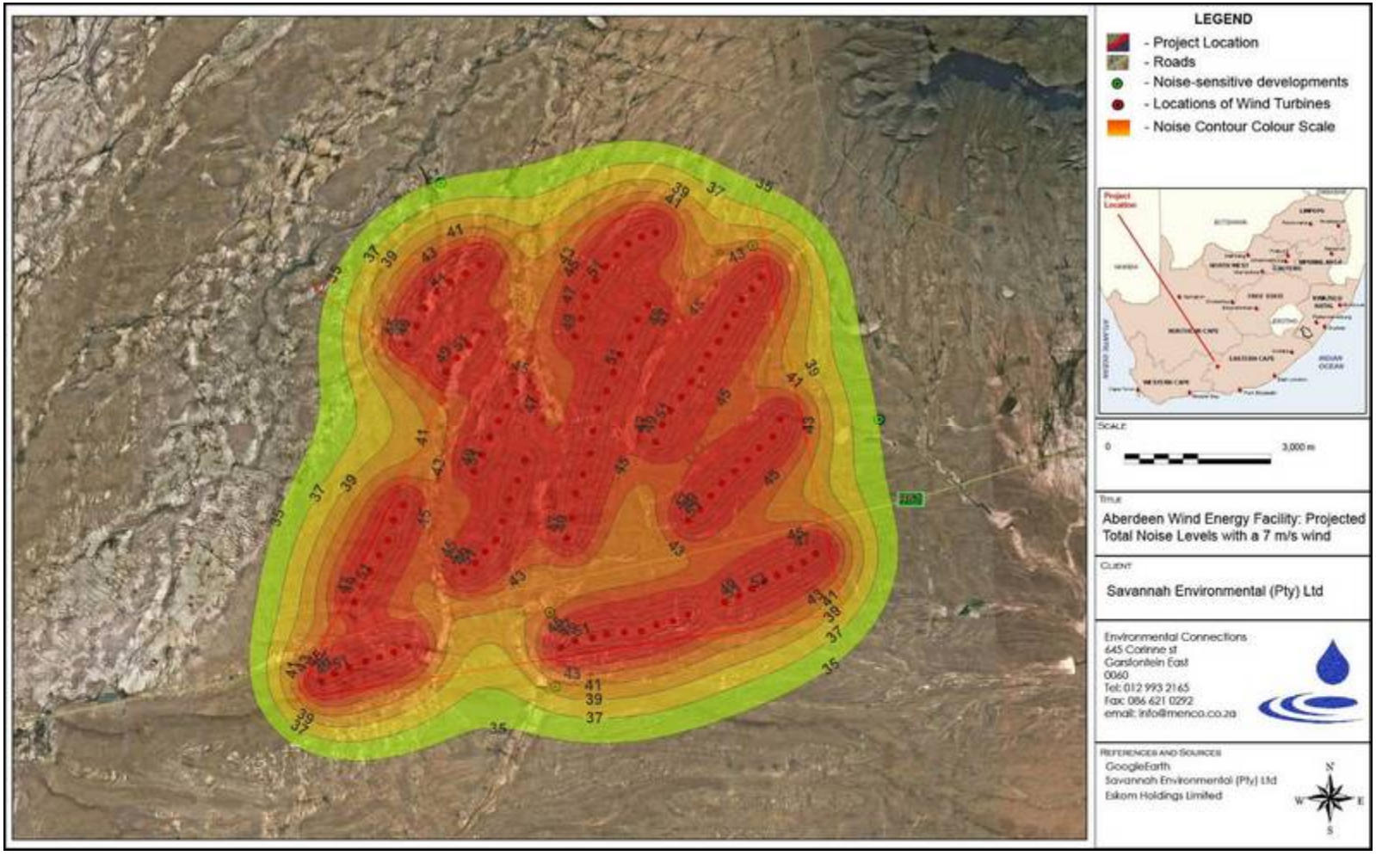


Figure 8.11: Projected Noise Levels (ISO model) from wind turbines; Contours of constant sound levels for a 7 m/s wind

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
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	Low to low-medium for most NSD Medium High (6) – NSD03
Probability	Likely (3) for NSD03
Significance	**36 (Medium)**
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	*Not relevant.*
Comments	-
Can impacts be mitigated?	Yes
Mitigation: The developer must discuss the projected noise level with NSD03 (refer to **Figure 8.10**), and if the projected noise level is unacceptable to this receptor mitigation as presented below is recommended: » The NSD can be relocated to a different location; » Most wind turbine models allow the operation of the turbine in a quieter mode. If a noise complaint is registered from NSD03 the closest wind turbines could be operated in a quieter mode as recommended by the manufacturer. » The use of quieter wind turbines (within 1 500 meters) near NSD03. It is important to note that this assessment made use of a worse-case scenario wind turbine that could generate relative high noise levels (3.0MW, worst noise emission levels); and » Relocating all turbines closer than 1 000 meters from NSD03.	
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.	

8.6.3. Implications for Project Implementation

Impacts during construction are expected to be of low significance, and therefore no mitigation is required. Impacts during operation are expected at NSD03 but if relocated no noise monitoring is recommended for this receptor. Where wind turbines are planned within 1 000 meters of an identified NSD, Eskom should either relocate the NSD or relocate the turbine in order to minimise the impact. The findings of this noise report should also be made available to all potentially noise-sensitive developments in the area, or the contents explained to them to ensure

that they understand all the potential risks that the development of a wind energy facility may have on them and their families.

8.7 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 (refer to **Figure 8.12**):

» **Stone Artefact Occurrences and Scatters**: eight large areas / sites were identified to contain denser distributions of cores and other stone artefacts, several isolated surface scatters of stone artefacts were identified over the entire area proposed for the development of the wind energy facility and associated infrastructure. The eight sites identified are considered as having a medium-high cultural significance, whilst the isolated stone artefact occurrences and scatters are considered as having a medium-low cultural significance. .

» **Stonewalling Farmstead Complex:** An historical stone-walling farmstead complex (Ab HS1) is situated adjacent to one of the existing internal farm roads and is not included within the proposed development. The complex comprises the remains of a relatively large dry-pack stone wall kraal, a house, and an intact stone wall kraal. The Stonewalling Farmstead Complex is considered as having a medium-high cultural significance.

» **Packed Stones**: A collapsed circular dry packed stone wall feature was identified within Sambokdoorns 5 area (Ab SW1). Packed stone seems to occur west and south around the circular feature. The packed stone features are considered as having a medium-low cultural significance.

» **Historical Artefacts**: Some pottery and broken glass fragments (AB H1) as well as No. 2 musket bullet casing was found within close proximity of the packed stone and stone walling feature. The historical artefacts are considered as having a medium-low cultural significance.

The above archaeological sites have been allocated a heritage grading of Grade III (NHRA 25 of 1999), being worthy of conservation by local authorities.

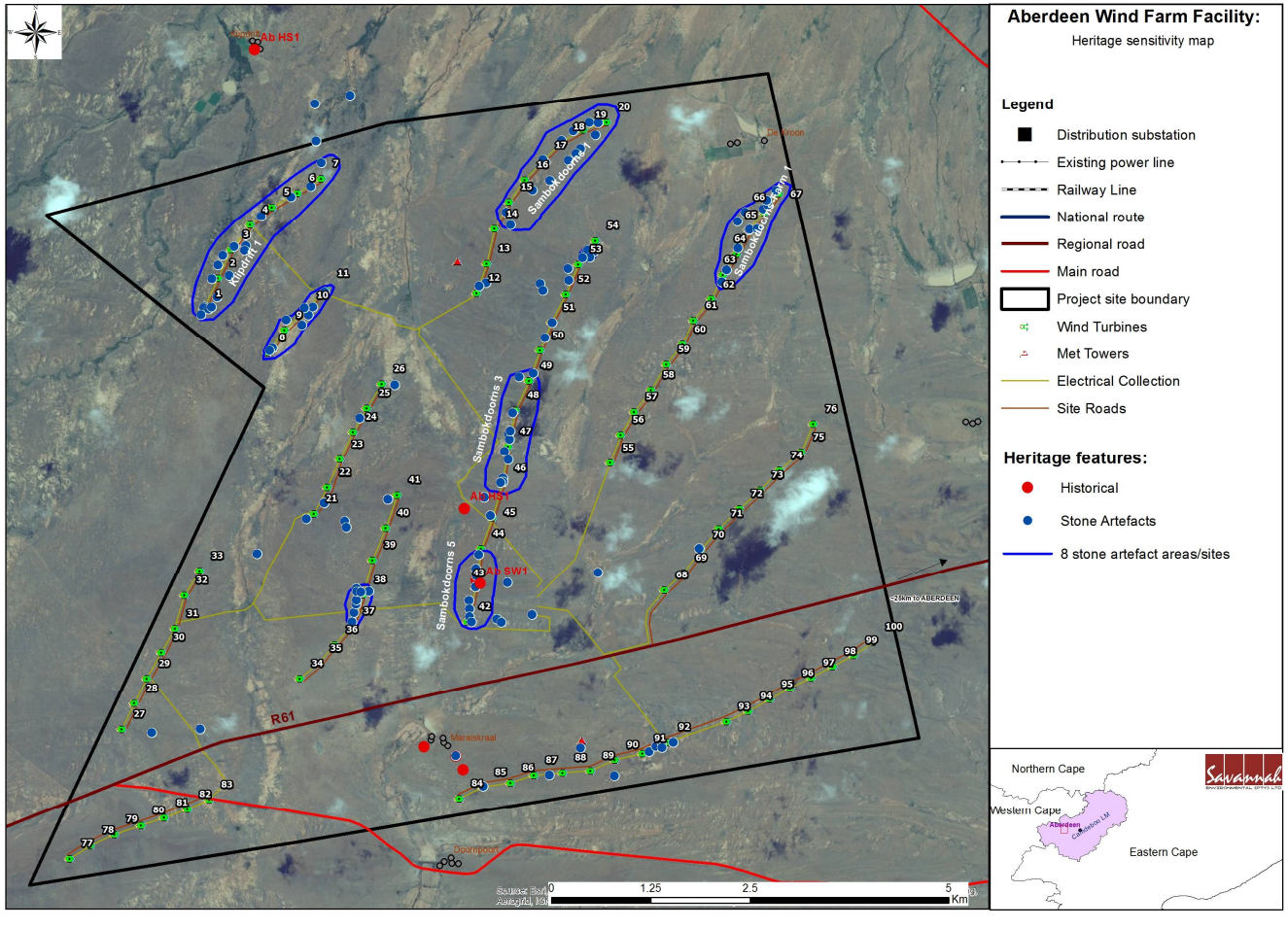


Figure 8.12: Proposed for the Eskom Wind Energy Facility showing the distribution of stone artefact scatters and other heritage resources.

***Nature*:** The destruction of the eight identified stone artefact sites.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (68)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	None	Low
Irreplaceable loss of resources?	Yes	Low
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Once the final layout (including the positions of the wind turbines; underground cabling; additional internal access roads, and the workshop area) of the proposed Aberdeen Eskom Wind Energy Facility has been finalised, an archaeological ground-truthing should be conducted and further recommendations made to protect the archaeological heritage within the area proposed for development, if required.

» A representative sample of stone artefacts should be collected during the archaeological walk-through for the final layout or before the construction activities begin to be housed at the Department of Archaeology's archaeological repository at the Albany Museum. A permit for this work must be obtained from SAHRA.

» A professional archaeologist must be appointed during all construction and development activities including vegetation clearing and the excavation activities to monitor and identify possible archaeological material remains and features that may occur below the surface and make further appropriate recommendations on removing and / or protecting the archaeological material remains and features.

» If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Albany Museum (046 622 2312) and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken.

» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

***Cumulative impacts*:**
Irreplaceable loss of archaeological heritage resources.

***Residual impacts*:**
Irreplaceable loss of archaeological heritage resources.

***Nature*:** The destruction of the stone artefact occurrences and scatters.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Low (4)
Probability	Highly Probable (4)	Probable (3)

Significance	**High (68)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	None	Low
Irreplaceable loss of resources?	Yes	Low
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Once the final layout (including the positions of the wind turbines; underground cabling; additional internal access roads, and the workshop area) of the proposed Aberdeen Eskom Wind Energy Facility has been finalised, an archaeological ground-truthing should be conducted and further recommendations made to protect the archaeological heritage within the area proposed for development.

» A representative sample of stone artefacts should be collected during the archaeological walk-through for the final layout or before the construction activities begin to be housed at the Department of Archaeology's archaeological repository at the Albany Museum. A permit for this work must be obtained from SAHRA.

» A professional archaeologist must be appointed during all construction and development activities including vegetation clearing and the excavation activities to monitor and identify possible archaeological material remains and features that may occur below the surface and make further appropriate recommendations on removing and / or protecting the archaeological material remains and features.

» If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Albany Museum (046 622 2312) and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken.

» Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.

Cumulative impacts:

Irreplaceable loss of archaeological heritage resources

Residual impacts:

Irreplaceable loss of archaeological heritage resources

Nature: The destruction of the Farmstead Complex.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (68)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	None	Low
Irreplaceable loss of resources?	Yes	Low
Can impacts be mitigated?	Yes	Yes

Mitigation:

» Once the final layout (including the positions of the wind turbines; underground cabling; additional internal access roads, and the workshop area) of the proposed Aberdeen

Eskom Wind Energy Facility has been finalised, an archaeological ground-truthing should be conducted and further recommendations made to protect the archaeological heritage within the area proposed for development. » An alternative internal access route should be established to avoid negative impact during the construction and development phases. » Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.
Cumulative impacts: Irreplaceable loss of archaeological heritage resources.
***Residual impacts*:** Irreplaceable loss of archaeological heritage resources.

Nature: The destruction of the stonewalling features.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (68)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	None	Low
Irreplaceable loss of resources?	Yes	Low
Can impacts be mitigated?	Yes	Yes
Mitigation: » Once the final layout (including the positions of the wind turbines; underground cabling; additional internal access roads, and the workshop area) of the proposed Aberdeen Eskom Wind Energy Facility has been finalised, an archaeological ground-truthing should be conducted and further recommendations made to protect the archaeological heritage within the area proposed for development. » No development should occur within 50 m of stone walling features. » Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.		
Cumulative impacts: Irreplaceable loss of archaeological heritage resources		
Residual impacts: Irreplaceable loss of archaeological heritage resources		

***Nature*:** The destruction of the historical artefacts.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Very High (10)	Low (4)
Probability	Highly Probable (4)	Probable (3)

Significance	**High (68)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	None	Low
Irreplaceable loss of resources?	Yes	Low
Can impacts be mitigated?	Yes	Yes
Mitigation: » Once the final layout (including the positions of the wind turbines; underground cabling; additional internal access roads, and the workshop area) of the proposed Aberdeen Eskom Wind Energy Facility has been finalised, an archaeological ground-truthing should be conducted and further recommendations made to protect the archaeological heritage within the area proposed for development. » A representative sample of stone artefacts should be collected and during the archaeological walk-through for the final layout or before the construction activities begin to be housed at the Department of Archaeology's archaeological repository at the Albany Museum. A permit for this work must be obtained from SAHRA. » A professional archaeologist must be appointed during all construction and development activities including vegetation clearing and the excavation activities to monitor and identify possible archaeological material remains and features that may occur below the surface and make further appropriate recommendations on removing and / or protecting the archaeological material remains and features. » If concentrations of archaeological heritage material and human remains are uncovered during construction, all work must cease immediately and be reported to the Albany Museum (046 622 2312) and/or the South African Heritage Resources Agency (SAHRA) (021 642 4502) so that systematic and professional investigation/ excavation can be undertaken. » Construction managers/foremen should be informed before construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites.		
Cumulative impacts: Irreplaceable loss of archaeological heritage resources		
Residual impacts: Irreplaceable loss of archaeological heritage resources		

8.7.1. Implications for Project Implementation

The proposed development would have negative implications on the archaeological heritage remains documented within the proposed area during all phases of the development. The negative implications include the destruction of the surface scatters of stone artefacts and stone walling features and associated historical artefacts, as well as on further occurrences that are not immediately visible. The recommendations 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

8.8 Assessment of Potential Impacts on Palaeontology

Findings or Loss of Fossils during Construction

The study area for the proposed Aberdeen Wind Farm near Aberdeen is underlain by potentially fossiliferous sedimentary rocks of Permian and younger, quaternary to Holocene age. The construction phase of the proposed alternative energy development will entail surface clearance as well as substantial excavations into the superficial sediment cover and into the underlying bedrock as well. These include, for example, excavations for wind turbine foundations, turbine mounting areas, new access roads, the on-site substation, foundations for the office / workshop, borrow pits and underground cables. All these developments may adversely affect potential fossil heritage within the study area by destroying, disturbing or permanently sealing-in fossils at or beneath the surface of the ground that are then no longer available for scientific research or other public good. The operational and decommissioning phases of the wind energy facility are however unlikely to involve further adverse impacts on local paleontological heritage.

The entire wind farm study area is underlain at depth by fluvial sediments assigned to the lowermost part of the Teekloof Formation (Lower Beaufort Group) that are of Late Permian age (*c*. 260 million years old). The mudstone-rich succession of the Hoedemaker Member represented here is associated with moderately diverse fossil biotas of the *Tropidostoma* Assemblage Zone that include a range of mammal-like reptiles, true reptiles, fish, amphibians as well as plants and trace fossils. There are no previously identified fossil vertebrate finds within the study area, although a small lizard-like specimen was apparently found (probably preserved within a palaeocalcrete nodule) among surface gravels along its northern margin (Mnr Loots, pers. comm., Nov. 2014). The only fossil material recorded during the present field assessment comprises sparse blocks of well-preserved silicified wood that occur widely among surface gravels through much of the study area. Most of the fossil wood specimens have probably been downwasted from channel sandstones within the Hoedemaker Member itself, but some cherty fossil wood clasts may have been introduced from elsewhere within fluvial gravels. The general lack of fossil records in the Aberdeen *vlaktes* may well be due, in large part, to very low levels of bedrock exposure in this low-relief area, as well as due to local development of cleavage, near-surface calcrete veining and weathering. It is concluded that, while there is a significant chance that fossil vertebrate remains will be disturbed, destroyed or sealed-in by the proposed wind energy facility development, these are best mitigated by applying a chance find procedure. The operational and decommissioning phases of the wind farm are unlikely to involve further adverse impacts on local paleontological heritage.

The inferred impact of the proposed wind energy development on local fossil heritage resources is analysed in the table below, this assessment applies only to

the construction phase of the development since further impacts on fossil heritage during the operational and decommissioning phases of the facilities are not anticipated.

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

Nature: Potential paleontological heritage identified in the affected area could be negatively affected during the construction phase (excavations) of the development.		
	Without mitigation	**With mitigation**
Extent	Local High (5)	Local Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (6)
Probability	Probable (3)	improbable (2)
Significance	**Medium (50)**	**(Low) 24**
Status (positive or negative)	Negative	Positive
Reversibility	Improbable	Possibility
Irreplaceable loss of resources?	High	High
Can impacts be mitigated?	Yes	
Mitigation: » Monitoring of all substantial bedrock excavations for fossil remains by ECO, with reporting of substantial new paleontological finds (notably fossil vertebrate bones & teeth) to ECPHRA for possible specialist mitigation. » An ECO 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 ECO 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: Unknown (Insufficient data on local alternative energy and other developments available) but probably 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).		

8.8.2. Implications for Project Implementation

Given the low impact significance of the proposed Aberdeen Wind Farm near Aberdeen as far as paleontological heritage is concerned, no further specialist paleontological heritage studies or mitigation are considered necessary for this

project, pending the discovery or exposure of substantial new fossil remains during development. It should be noted that any new fossil remains discovered before or during construction should be reported by the responsible ECO to the responsible heritage management authority (ECPHRA) for professional recording and collection,

8.9 Assessment of Potential Social and Economic Impacts

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;
» Influx of job seekers;
» Loss of farm labour;
» 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.

8.9.1 Impact Tables - Impacts during the Construction Phase

***Nature*:** Creation of local employment and business opportunities during the construction phase associated with the wind energy facility.

Based on the information from Eskom, the capital expenditure associated with the construction of a 200MW wind energy facility would be in the region of R4.5 - 5 billion. The construction phase is expected to extend over a period of ~ 18-24 months and create approximately 300 construction related jobs. 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). The total wage bill with the construction of a 200 MW wind energy facility (300 employees X 20 months) is estimated to be in the region of R92 million (2012 values). This is based on the assumption that the average monthly salary for low, semi and skilled workers is R5 000, R12 000 and R30 000 respectively. The injection of income into the area in the form of wages will represent a significant opportunity for the local economy and businesses in Aberdeen and the CLM.

The work associated with the construction phase will be undertaken by contractors and will include the establishment of the access roads and services and the erection of the wind turbines and substations. 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. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in Aberdeen and the surrounding area this will represent a significant social benefit. 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. This is an issue that will need to be addressed during the recruitment process. Eskom will therefore need to demonstrate a commitment to local employment targets in order to maximise the opportunities and benefits for members from the local community. Implementation of the enhancement measures listed below can enhance these opportunities. This issue also highlights the importance of implementing a training and skills development programme before the construction phase commences.

In terms of business opportunities for local companies, expenditure during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and high import content associated with wind energy facilities, the opportunities for the local economy are likely to be limited. Opportunities are likely to exist for local contractors and engineering companies in Graaff Reinet and Port Elizabeth. The implementation of the enhancement measures listed below can enhance these opportunities.

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. associated with the construction workers on the site. The majority of construction workers are likely to be accommodated in Aberdeen. This will create opportunities for local hotels, B&Bs, guest farms and people who want to rent out their houses. However, based on the information collected during the site visit the accommodation opportunities in Aberdeen are limited. This is an issue that Eskom will need to discuss with the CLM.

	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)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Medium (36)**
Status	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impact be enhanced?	Yes	

Enhancement:

» Where feasible, Eskom should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi- and low-skilled job categories.
» Before the construction phase commences Eskom should meet with representatives from

the Local Municipality to establish what skills exist in the area and develop a database.
» Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.
» Eskom, in consultation with the Local Municipality, should develop a database of local companies, specifically companies that qualify as Black Economic Empowerment (BEE) companies that qualify as potential service providers prior to the commencement of the tender process for construction contractors.

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 in the area, specifically local communities in Aberdeen. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can affect the local community. In this regard the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential 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 total number of employment opportunities associated with the construction phase will be in the region of 300. Of this total approximately 30% (90) will skilled personnel (engineers, technicians, management and supervisory), ~ 40% (120) semi-skilled personnel (drivers, equipment operators), and ~ 30% (90) low skilled personnel (construction labourers, security staff). It is reasonable to assume that the majority of the low skilled workers (120) and at least 60% of the semi-skilled workers (54) can be sourced locally. Employing members from the local community to fill the semi and low-skilled job categories will reduce the risk posed by construction workers to local communities. These workers will be from the local community and form part of the local family and social network. Eskom are committed to implementing a local employment policy, specifically for the low and semi-skilled employment opportunities associated with the construction phase. The total number of construction workers from outside the area that will need to be

accommodated will therefore be in the region of 126, the majority of which (90) will be skilled workers. Based on this the overall impact of construction workers on the local community with mitigation is likely to 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 lower than anticipated. This is an issue that will need to be addressed during the recruitment process. In addition, the accommodation opportunities in Aberdeen and the surrounding area are limited. This is an issue that Eskom will need to address.

While the potential threat posed by construction workers to the community as a whole is likely to be low, the impact on individual members who are affected by the behaviour of construction workers has the potential to be high, specifically if they are affected by STDs etc.

	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Medium Term for community as a whole (3) Long term-permanent for individuals who may be affected by STDs etc. (5)	Medium Term for community as a whole (3) 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. **(57)**	**Low** for the community as a whole **(24)** **Moderate-High** for specific individuals who may be affected by STDs etc**. (51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
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 Eskom 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. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community. The development of other solar energy projects in the area may exacerbate these impacts.

***Residual impacts*:**

Community members affected by STDs etc. and associated impact on local community and burden services etc.

***Nature*:** Potential impacts on family structures, social networks and community services associated with the influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. While the proposed Eskom wind energy facility may, on its' own, not result in influx of significant numbers of job seekers to Aberdeen and the surrounding areas, the establishment of a number of wind and other renewable energy projects in the CLM has the potential to attract job seekers to the area. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the manner in which they conduct themselves can affect the local community. There is also a concern that some of these job seekers may not leave town immediately and, in some cases, may stay indefinitely.

The potential social impacts associated with the influx of job seekers include:

» Impacts on existing social networks and community structures;
» Competition for housing, specifically low cost housing;

» Competition for scarce jobs;
» Increase in incidences of crime;
» An increase in sexually transmitted diseases (STDs).

These issues are similar to the concerns associated with the presence of construction workers as detailed in the table above. However, in some instances the potential impact on the community may be greater given that they are unlikely to have accommodation and may decide to stay on in the area. In addition, they will not have a reliable source of income. The risk of crime associated with the influx of job seekers it therefore likely to be greater.

It is possible that the families of job seekers may also accompany individual job seekers or follow them later. The influx of job seekers to the area and their families would also place pressure on the existing services in the area, specifically low income housing and schools. In addition to the pressure on local services the influx of job seekers can also result in competition for scarce employment opportunities, which in turn can result in tension with local residents. Further secondary impacts include an increase in crime levels, especially property crime, because of the increased number of unemployed people. These impacts can result in increased tensions and conflicts between local residents and job seekers from outside the area.

The key lesson from other large construction projects is the importance of developing and implementing a well-structured recruitment strategy aimed at employing locals and minimising the number of job seekers moving into the area. The CLM should also anticipate that the support for renewable energy projects in the CLM has the potential to result in the influx of job seekers to the area. This influx and the demand that it may have on local services should be borne in mind when the IDP is reviewed and up-dated.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Minor for the community as a whole (2) High-Very High for specific individuals who may be affected by STDs etc. (10)	Minor for community as a whole (2) 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)** **Medium -High** for specific individuals who may be affected by STDs etc. **(54)**	**Low** for the community as a whole **(27)** **Medium-High** for specific individuals who may be affected by STDs etc. **(51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
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*:**

» It is almost impossible to stop people from coming to the area in search of a job, specifically given that the CDM and CLM have identified renewable energy as a future growth sector. However, Eskom should ensure that the employment criteria favour local residents in the area.

» Implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in Aberdeen and other towns in the CLM.

***Cumulative impacts*:**

Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, 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 impact on local farmers associated with loss of farm labour to the construction phase.

Experience from other construction projects indicates that the loss of farm workers to the construction site is an issue of concern. In most instances local farmers are unlikely to be in a position to compete with the salaries offered by the renewable energy companies during the construction phase. As a result, farm labourer's may be tempted to resign from their current positions on farms to join the construction crew. The loss of skilled and experienced farm labour would have a negative impact on local farmers.

The potential impacts for the affected farmers associated with the loss of permanent farm labour to the construction phase are exacerbated by the security of tenure that permanent farm labourers who reside on the farms they work on enjoy in terms of the Extension of Security and Tenure Act (ESTA). Farm labourers who are eligible under ESTA and who take up jobs during the construction phase will be entitled stay on in their houses on the farms in question. The net effect is that the farmer may have to incur costs associated with the construction of new dwellings for new labour appointed to replace the labour lost to the construction phase. The farmer may also have to continue subsidizing services such as potable water to people who are no longer in his employ.

While the proposed wind energy facility on its own is unlikely to result in a significant loss of farm labour, the proposed establishment of a number of renewable energy projects in the area has the potential to impact on the farming sector. However, as farm labour can be replaced, the potential impacts on farm operations are likely to be temporary. In addition, the findings of the SIA indicate that the farming activities in the area are not labour intensive.

The farm workers that take up jobs during the construction phase are also at risk. While some farm workers may be re-employed once the construction has been completed, others may not be so fortunate. The low education levels generally associated with the farm worker community would effectively mean that alternative employment opportunities outside the agricultural sector will not be accessible to them. These farm workers and their families therefore stand to be negatively impacted upon in the medium to long term. The low education levels of local farm workers are however also likely to reduce the chances of them being employed during the construction phase.

On the positive side, some farm workers may view work associated with the construction phase as an opportunity to gain skills and relocate to Aberdeen and other towns in the area.

	Without Mitigation	**With Mitigation**
Extent	Local and Regional (2)	Local and Regional (1)
Duration	Medium Term (3) (Assumed that farm labour can be replaced)	Medium Term (3) (Assumed that farm labour can be replaced)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, if farm workers return or are replaced	Yes, if farm workers return or are replaced
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	

***Mitigation*:**
While Eskom can liaise with local farmers in the area and take steps not to employ local farm worker were possible, it is not possible to prevent farm workers from applying for work. There are therefore no recommended mitigation measures. Also it is assumed that farm labour can be replaced. The impacts would therefore be temporary.

Farm workers who apply for construction related work should also be informed by the contractors that the nature of the work is temporary. In addition they should be informed of the potential negative consequences of their actions, which include the potential loss of their permanent farm job.

***Cumulative impacts*:**
Impacts on farm operations due to loss of experienced farm labour to multiple developments in the area.

***Residual impacts*:**
Increase in unemployment amongst local farm workers who are not rehired once construction worker comes to an end. On positive side, may result in increased skills for local farm workers and improve their economic mobility.

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site

The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may be damaged. Livestock and game losses may also result from gates being left open and/or fences being damaged. All of the local farm owners in the area who were interviewed indicated that stock theft was a concern. However, concerns were raised regarding the presence of construction workers in the area. Mr McNaughton (adjacent landowner) indicated that measures should be taken to prevent opportunistic stock theft by construction workers. The local farmers also indicated that they would be able to move stock to camps located further away from the site in order to reduce the risk of stock theft.

	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 Eskom, 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 risk to the safety and security of local farmers posed by the presence of construction workers on the site and job seekers.

The presence of construction workers on the site can pose a threat to the safety and security of local farmers in the area. The movement of contractors on and off the site on a daily basis also provides an opportunity for outsiders to monitor the movement of famers and their activities. However, the findings of the SIA indicate that there are no occupied homesteads located on or in the immediate vicinity of the proposed wind energy. In addition, security was not raised as a key issue by the adjacent landowners. The potential risk can also be reduced by implementing the mitigation measures listed below.

	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 losses and damage etc.	
Irreplaceable loss of resources?	No, unless there is a loss of life	No, unless there is a loss of life
Can impact be mitigated?	Yes	

***Mitigation*:**

» The movement of construction workers on and off the site should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting workers to and from site on a daily basis.
» The contractor should make the necessary arrangements for ensuring that all non-local construction workers are transported back to their place of residence once the construction phase is completed.
» No construction workers, with the exception of security personnel, will be permitted to stay overnight on the site.

***Cumulative impacts*:**
No, provided losses are compensated for.

***Residual impacts*:**
Potential psychological damage and trauma associated with incidents that may involve acts of violence.

***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 poses an increased risk of veld fires that in turn pose a threat to the livestock, wildlife, and

farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The local farmers who were interviewed indicated that veld fires were not an issue, noting that veld fires in the area where the proposed wind energy facility is located were rare. The potential risk of fires associated with construction related activities is therefore likely to be low. This risk can be further reduced by implementing the mitigation measures listed below.

	Without Mitigation	**With Mitigation**
Extent	Local (3) (Rated as 3 due to potential severity of impact on local farmers)	Local (2) (Rated as 2 due to potential severity of impact on local farmers)
Duration	Short Term (2)	Short Term (2)
Magnitude	Moderate due to reliance on livestock for maintaining livelihoods (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and losses and damage 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 noise, dust and safety impacts associated with movement of construction

related traffic to and from the site

Each wind turbine is comprised of the wind tower (approximately 120m tall), the nacelle and rotor, and three blades. Abnormally sized vehicles will be required to transport these components to site, because of their size and weight. In addition, further trips will be required to transport construction equipment (graders, excavators and cement trucks), as well as electrical infrastructure where necessary (cables, substations and transformers) and construction materials (cement etc.). Based on information from other wind energy projects over the construction period of ~ 20 months there would be in the region of 250 vehicle trips per month. Of this total ~ 20% would be heavy truck traffic.

Based on the location of the site, the majority of the components associated with the proposed wind energy facility are likely to be transported to the site by road from Port Elizabeth via the N10 and then the N9. The movement of large, heavy loads during the construction phase has the potential to create delays and safety impacts for other road users travelling along the N10 and N9. Both the N10 and N9 are key tourist routes linking the Eastern Cape and Garden Route Cape with the inland provinces of Northern Cape, Free State, North West, Guateng and Limpopo. The potential impacts can, however, be mitigated by timing trips to avoid periods of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.

The option of transporting material along the R338 from Port Elizabeth to the site by rail should be investigated. This would reduce the potential impact on other road users along the N10. In terms of access to the site, the site will be accessed from the N9 via the R61, which links Aberdeen in the east with Beaufort West in the west. The findings of the SIA indicate that the volume of traffic on the R61 is relatively low. The social impacts associated with the movement of construction related traffic along this road are therefore likely to be low.

	Without Mitigation	**With Mitigation**
Extent	Local-Regional (2)	Local-Regional (1)
Duration	Medium Term (3)	Medium Term (3)
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*:**

The potential impacts associated with heavy vehicles and dust can be effectively mitigated. The aspects that should be covered include:

» Abnormal loads should be timed to avoid times of the year when traffic volumes are likely to be higher, such as start and end of school holidays, long weekends and weekends in general etc.

» The contractor must ensure that all damage caused to local farm roads by the 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 contractor.

- » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
- » All vehicles must be road-worthy and drivers must be qualified, made aware of the potential road safety issues, and need for strict speed limits.
- » In addition, it is recommended that Eskom investigate the option of using rail along the R338 road to transport materials and equipment from Port Elizabeth to site.

Cumulative impacts:

If damage to roads due to construction activities is not repaired then this will affect the farming activities and other roads used (such as the R61 and the N9/10) in the area and 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 roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind facility and power lines will damage farmlands and result in a loss of farmlands for future farming activities.

The activities associated with the construction phase have the potential to result in the loss of land available for grazing. However, the property on which the proposed wind energy facility is located has been purchased by Eskom. Mr Marx and Mr Terblanche, the previous land owners, lease the land from Eskom for grazing for their Angora goats and Merino sheep. The loss of income associated with livestock farming has therefore been offset by the income from the sale of the land. The final disturbance footprint can also be reduced by careful site design and placement of components. The impact on farmland 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.

	Without Mitigation	**With Mitigation**
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not effectively rehabilitated or compensation is not paid (5)	Medium Term if damaged areas are rehabilitated (3)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (28)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	Yes, loss of farmland. However, disturbed areas can be rehabilitated	Yes, loss of farmland. However, disturbed areas can be rehabilitated
Can impact be mitigated?	Yes, however, loss of farmland cannot be avoided	Yes, however, loss of farmland cannot be avoided

***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 affect the livelihoods of the affected farmer, and the workers on the farm and their families. However, disturbed areas can be rehabilitated.

Residual impacts:

Land would be available for farming once rehabilitation has been completed

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;
» Potential impact on tourism;
» Influx of job seekers to the area;
» Loss of farm labour;

8.9.2 Impact Tables: Impacts during operation

***Nature*:** Creation of employment and business opportunities associated with the operational phase

Based on information from Eskom, the establishment of a 200MW wind energy facility will create approximately 15-20 employment opportunities. The operational phase is expected to last 20 years. The employment opportunities 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. The majority of these employment

opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in the area this will represent a social benefit. The remainder of the semi-skilled and majority of the skilled employment opportunities are likely to be associated with people from outside the area.

Eskom has indicated that they are committed to implementing a training and skills development programme during the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the CLM IDP.

Given the location of the proposed facility, the majority of permanent staff is likely to reside in Aberdeen. In terms of accommodation options, a percentage of the non-local permanent employees may purchase houses in Aberdeen, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the monthly wage bill earned by permanent staff would be spent in the regional and local economy, which will benefit local businesses in Aberdeen. The benefits to the local economy will extend over the operational lifespan of the project.

The local hospitality industry in Aberdeen is also likely to benefit from the operational phase. These benefits are associated with site visits by Eskom staff members and other professionals (engineers, technicians etc.) who are involved in Eskom and the project but who are not linked to the day-to-day operations.

Mr Barrington (CLM Technical Services Manager) and Mr Coetzee (Ward Councillor) both indicated that proposed establishment of renewable energy facilities in the area was strongly supported by the CLM. In this regard the municipality has identified the establishment of a renewable energy as an economic opportunity for the area. The local farmers interviewed also indicated that they supported the proposed development and that the development of renewable energy was preferable to fracking to extract shale gas.

As a state owned company, Eskom also adheres to all relevant ASGISA and Skills Development Levy (SDL) requirements on the projects it is involved in.

	Without Mitigation	**With Enhancement**
Extent	Local (1)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (24)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	

Enhancement:

The enhancement measures listed in Section 8.9.1 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	Low (4)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems. The provision of renewable energy infrastructure is in itself a mitigation measure	
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*:** Potential impacts on family structures, social networks and community services associated with the influx of job seekers

While the proposed wind energy facility on its own is unlikely to result in a significant influx of job seekers during the operational phase, the proposed establishment of a number of renewable energy projects in and around Aberdeen is likely to attract job seekers to the area. These issues are similar to the concerns associated with the influx of jobs seekers during the construction phase and include:

» Impacts on existing social networks and community structures;
» Competition for housing, specifically low cost housing;
» Pressure on local services, such as schools, clinics etc.;
» Competition for scarce jobs;
» Increase in incidences of crime;
» Increase in transmission of STDs etc.

	Without Mitigation	**With Mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5) (For job seekers that stay on the town)	Permanent (5) (For job seekers that stay on the town)
Magnitude	Low for the community as a whole (4) High-Very High for specific individuals who may be affected by STDs etc. (10)	Minor for community as a whole (2) High-Very High for specific individuals who may be affected by STDs etc. (10)
Probability	Probable (3)	Probable (3)
Significance	**Medium** for the community as a whole **(33)** **Medium-High** for specific individuals who may be affected by STDs etc**. (51)**	**Low** for the community as a whole **(27)** **Medium-High** for specific individuals who may be affected by STDs etc. **(51)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
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:
It is impossible to stop people from coming to the area in search of work, specifically given that the CDM and CLM have identified renewable energy as key growth sector. However, Eskom should ensure that the employment criteria favour local residents in the area. In

addition implement a policy that no employment will be available at the gate. This should be linked to the establishment of employment offices in Aberdeen and other local towns in the CLM.

***Cumulative impacts*:**
Impacts on family and community relations that may, in some cases, persist for a long period. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, 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*:** Visual impact associated with the proposed wind facility and the potential impact on the areas rural sense of place.

The components associated with the proposed facility will have a visual impact and, in so doing, impact on the landscape and rural sense of the place of the area. The N9, which links Aberdeen and Graaff-Reinet in the north and the Garden Route in the south, is an important tourist route and a designated scenic route. However, the based on the findings of the site visit the wind turbines associated with the proposed Eskom Aberdeen wind energy facility will not be visible from the N9. The wind turbines will however be visible to motorists travelling along the R61 (Aberdeen-Beaufort West) and the R67, a secondary road that links the R61 with Murraysberg to the north.

The findings of the SIA also indicate that the area is sparsely populated. The number of visual receptors in terms of homesteads is therefore limited. In addition, none of the local farmers in the area interviewed indicated that the visual impact of the proposed wind turbines on the areas sense of place was a key issue of concern. Mr McNuaghton (adjacent landowner) indicated that the visual impacts would be significant, but went on to say that investment in renewable energy was necessary. The visual impacts were therefore acceptable. Mr E Marx (adjacent landowner) indicated that the potential visual impact was not a concern.

The findings of the SIA also found that none of the local landowners in the vicinity of the site who were interviewed indicated that they were opposed to the proposed development. In this regard a number of local landowners located to the north and north east of the site indicated that their farms had also been identified as potential sites for renewable energy projects.

	Without Mitigation	**With Mitigation**
Extent	Regional (3)	n/a
Duration	Long term (4)	n/a
Magnitude	High(8)	n/a
Probability	Probable (3)	n/a
Significance	**Moderate (45)**	**n/a**
Status	Negative	n/a
Reversibility	Recoverable (3)	n/a

Irreplaceable loss of resources?	No	n/a
Can impact be mitigated?	No	

***Enhancement*:**
According to the VIA undertaken for the project is likely to result in a partial loss of, or alteration to, the characteristics of the baseline environment with the introduction of elements that are prominent and uncharacteristic when set within the attributes of the receiving landscape.

The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be of moderate significance. There is no mitigation for this impact.

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 CLM is located approximately 270 km from Port Elizabeth (CBD) and forms part of an area known as the "Karoo Heartland" which defines a scenic route through the Karoo. The CLM is renowned for its pristine natural environment, rich heritage, diverse peoples and cultures. Tourism is one of the key economic sectors and visitors are drawn to the area by its scenic landscapes and climate. The town of Graaff-Reinet, which is the 4th oldest town in South-Africa, is also referred to as the "Gem of the Karoo". The town of Nieu-Bethesda, located to the north of Graaff-Reinet, is also an important tourist destination. The N9, which links the Garden Route with the inland provinces of Northern Cape, Free State, North West, Gauteng and Limpopo, is also an important tourist route and has been designated as a scenic route.

In terms of local planning documents, both the CDM and CLM IDPs highlight the importance of tourism. However, both IDPs also make reference to the need to investigate renewable energy options, such as wind energy.

There appear to be no tourist related facilities, such as B&Bs or guest farms, located in the immediate vicinity of the site and traffic volumes along the R61, which links Aberdeen and Beaufort West are low. In addition, a number of other renewable energy projects are proposed in the vicinity of the Aberdeen wind energy facility site. The significance of this issue is therefore rated as Low negative. The findings of the SIA also indicate that the establishment of the proposed wind energy facility may also attract tourists to the area. However, the significance of this potential benefit is also rated as Low positive.

	Without Mitigation	**With Enhancement / Mitigation**
Extent	Local (2)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (2)
Probability	Probable (3)	Probable (3)

Significance	**Low (24) (Applies to both – and +)**	**Low (27) (Applies to both – and +)**
Status	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)	Negative (Potential to distract from the tourist experience of the area) Positive (Potential to attract people to the area)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
***Enhancement*:** » Eskom should liaise with representatives from the CLM and local tourism representatives to raise awareness of the proposed facility. » Eskom should investigate the option of establishing a renewable energy interpretation centre at entrance to the site. The centre should include a viewing area where passing visitors can stop and view the site.		
***Cumulative impacts*:** Potential negative and/or positive impact on tourism in the CLM		
***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		

8.9.3 Implications for Project Implementation

The findings of the SIA indicate that the development of the proposed Aberdeen wind energy facility will create employment and business opportunities for locals during both the construction and operational phase of the project. The enhancement measures listed in the report should be implemented in order to enhance these benefits. In addition, the proposed establishment of a number of other renewable energy facilities in the area will create significant socio-economic opportunities for Aberdeen and the CLM, which, in turn, will result in a positive social benefit. The establishment of a Community Trust funded by revenue generated from the sale of energy from the proposed wind energy facility also creates an opportunity to support local economic development in the area. Given the size of the proposed facility (200 MW) this will represent a significant social benefit for an area where there are limited opportunities.

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. The establishment of the

proposed Aberdeen wind energy facility is therefore supported by the findings of the SIA.

However, the potential impacts associated with wind energy facilities on the areas sense of place and landscape cannot be ignored. These impacts are an issue that will need to be addressed by the relevant environmental authorities, specifically given the large number of applications for renewable energy facilities in the area.

8.10 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 is 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 social cost.

In addition, the No-Development option would compromise the objectives of the CLM IDP and LED to create employment and support economic development.

However, at a provincial and national level, it should be noted that the Aberdeen wind energy facility is not unique. In that regard, a significant number of wind energy facility developments are currently proposed in the Eastern Cape Provinces. Foregoing the proposed Aberdeen wind energy facility would therefore not necessarily compromise the development of renewable energy facilities in the Eastern Cape or South Africa. However, the benefits to the DLM and the Aberdeen 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 has 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.

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 - and more so when social and environmental costs are taken into account.

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 Aberdeen 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 Aberdeen area

A number of renewable energy developments have been proposed within less than 40km of the proposed Aberdeen Wind Energy Facility, as described in Table 9.1 and indicated on Figure 9.1.

Table 9.1: Renewable 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)
Aberdeen Wind Energy Facility	Subject of this report	In process
Camdeboo wind energy facility	Adjacent	In process
BioTherm Aberdeen solar energy facility	10km south	Authorised
Poortjie Wes wind energy facility	40km north-west	In process

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.

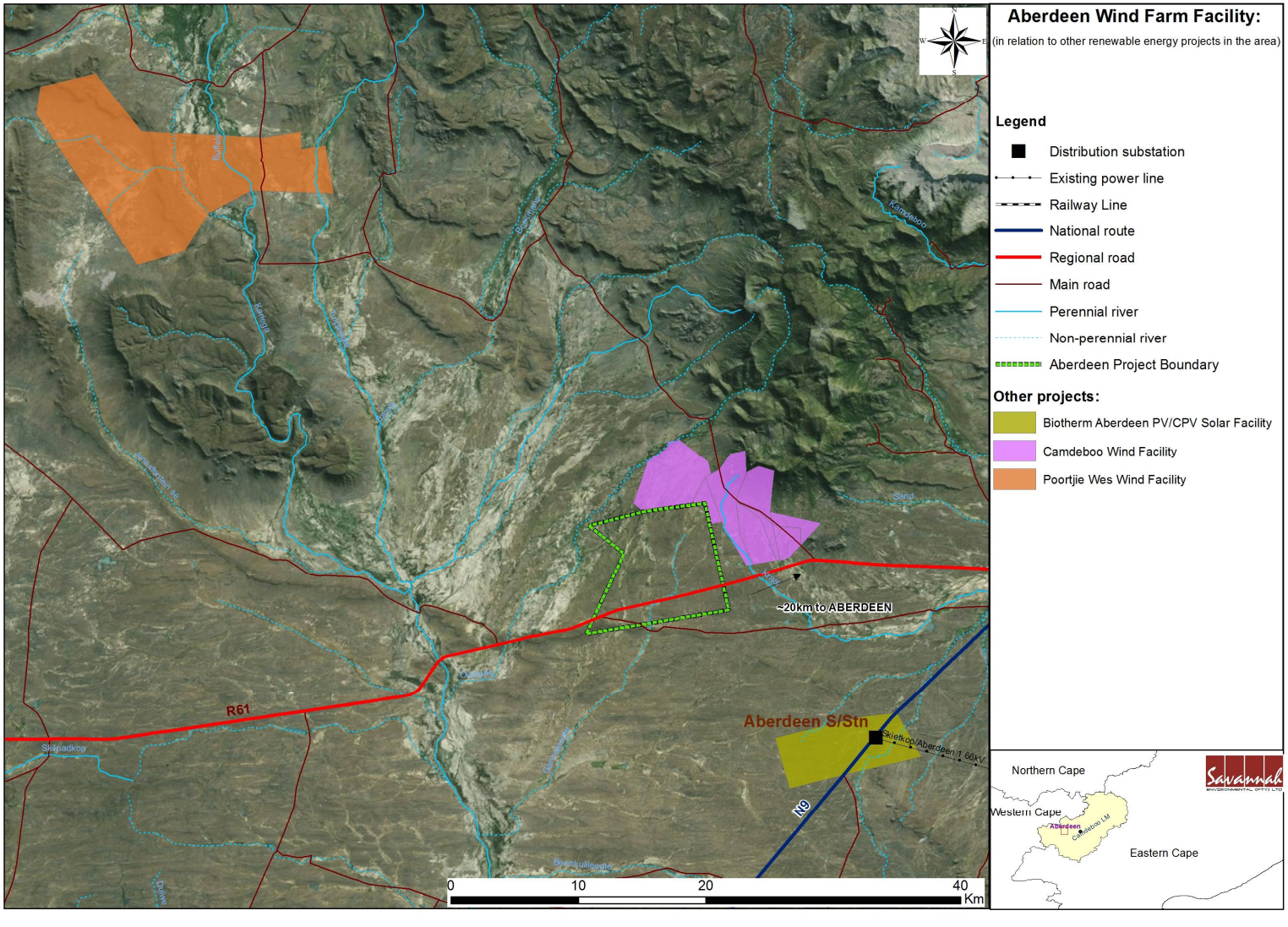


Figure 9.1: Map showing other projects in the region

9.2.1 Cumulative Impacts on Ecological Processes

The main cumulative impacts on ecological processes as a result of the construction of numerous projects include:

» The loss of habitat within the CBA will potentially impact the ecologically functioning of the CBA
» The cumulative loss of unprotected vegetation types from the broad area may impact the countries' ability to meet its conservation targets.
» Transformation of intact habitat would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations.

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 Aberdeen wind energy facility, sensitivities have been considered within the proposed layouts in order to minimise impacts as far as possible.

9.2.2 Cumulative Impacts on Avifauna

The cumulative impact of bird collisions in the area is likely to be moderately significant should the proposed projects be developed. Many of the target species for this study area are species that are in all likelihood already significantly impacted upon by collisions/electrocutions with any existing overhead cables in the area as a result of their flight patterns and physical characteristics. If other proposed wind energy and solar projects in the broader area are built, they may further impact on these target species' populations. An additional mortality factor such as collision with turbines may prove detrimental to local populations of these species, specifically the already endangered Ludwig`s Bustard. Additional wind energy facilities in the area will also increase the overall distance and spans of overhead lines in the area to connect with the nearest substation.

Cumulative effects are however uncertain due to the complexities of wind farm and solar facility development and the likelihood that not all planned projects in the area will ultimately be constructed. Furthermore, 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

Two additional proposed wind energy facilities within a 40km radius were considered in terms of potential cumulative impacts on bats. For all the sites, the areas with the greatest habitat heterogeneity are thought to have the highest roost and species diversity potential. However, lower lying areas associated with drainage lines, wetlands and irrigated agriculture are anticipated to have the highest foraging potential. More turbines in a given area will obviously present higher fatality risk to bats, however, owing to the low roosting potential of the Eskom Aberdeen wind farm site, when combined with the other two facilities within a 40km radius of the site, the cumulative impact is considered to be of Medium significance.

9.2.4 Cumulative Impacts on Soil, Geology and Agricultural Resources

The cumulative impact 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 and will have an increasing impact on the geological and hydrological environment but 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. 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 during all phases of the development. 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 Aberdeen 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 Aberdeen 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 Aberdeen region predominantly consists of flat terrain surrounding the site and its environment. It is evident from the viewshed that the facility will have a large core area of potential visual exposure within a 5km offset. The entire area within 5km will potentially be visually exposed to the Aberdeen and the Camdeboo wind facilities. Additional receptors that will be impacted upon as a result of the Aberdeen facility include the R61, two secondary roads and a number of farms and homesteads. The south western tip of the Kamdeboo Mountains also lies within this zone, and the south western slopes will be visually exposed. The Poorties wind farm is situated 20km beyond from the two mentioned wind facility, and will not add to the visual cumulative impact. The facility would constitute a high visual prominence within this environment, especially within a 10km radius, potentially resulting in a visual impact.

Therefore, in terms of cumulative impact, the proposed Aberdeen 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 noises as well as other noisy activities conducted in the same area. Noise modelling of the Aberdeen 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 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 are required 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 Aberdeen 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 Aberdeen 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
» 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.

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 Aberdeen 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 Aberdeen 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 built 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 Aberdeen Wind Energy Facility.

CONCLUSIONS AND RECOMMENDATION CHAPTER 10

Eskom Holdings SOC (State Owned Company) **Limited** is proposing to establish a commercial wind energy facility and associated infrastructure on a site located approximately 24 km west of the town of Aberdeen in the Eastern Cape Province, within the Camdeboo Local Municipality. This proposed project will be referred to as the Aberdeen 200 MW Wind Farm. This development is proposed to comprise a cluster of up to 100 wind turbines (typically described as a wind energy facility or a wind farm) to be constructed over an area of approximately 8 198 ha in extent.

The site is proposed on the following farm portions:

» RE of Portion 3 of Sambokdoorns 92
» RE of Portion 4 of Sambokdoorns 92
» RE of Sambokdoorns 92
» Portion 2 of Klipdrift 73
» Portion 2 of Farm 94, and
» RE of Portion 2 of Farm 94

The project will include the following infrastructure:

» A cluster of up to **100 wind turbines** to be constructed over an area of ~ **8 198 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 (100 m x 100 m (including HV yard))
» An overhead power line (400kV) feeding into Eskom's electricity grid at the Droërivier Substation, approximately 140 km from the site[10]

[10] The proposed power line is being assessed within a separate Basic Assessment process (DEA ref #:14/12/16/3/3/2/357) and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

- Internal **access roads** between each wind turbines (permanent roads of approximately 6 m wide and 7m during construction)
- **Borrow pits** within the site for the construction of access roads
- **Office/Workshop** area for operations, maintenance and storage (approximately 100m x 100m).
- **Information centre**
- Ablution facilities and temporary **water storage** for construction and small storage for operation drinking water will be required at the site.

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 - L** 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 Draft 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. 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 100 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 M**.

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 100 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 Ecology		
Impacts on vegetation and protected plant species	Medium	Low
Soil erosion and associated degradation of ecosystems	Medium	Low
Direct Faunal Impacts	Medium	Medium

Nature	Without mitigation	With mitigation
		(construction) Low (operation)
Alien Plant Invasion	Medium	Low
Impacts on Critical Biodiversity Areas and Broad-Scale Ecological Processes	Medium	Low
Impacts on Avifauna		
Disturbance of birds	Medium	Medium
Habitat destruction	High	Medium
Collision with turbines	Medium	Medium
Collision with associated overhead power lines (within the facility)	Medium	Medium
Electrocution on associated overhead power lines(within the facility)	Medium	Medium
Disturbance during operation and maintenance	Medium	Low
Disturbance of birds during operational activities and routine maintenance at Aberdeen	Low	Low
Disruption in local bird movement patterns	Medium	Medium
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	Medium	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	High	Medium
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		
Soil degradation (soil removal, mixing, compaction, etc) due to the construction of foundations for structures (turbines, buildings, substations).	Low	Low
Soil degradation (soil removal, mixing, compaction, etc) due to the construction	Medium	Medium

Nature	Without mitigation	With mitigation
of new access roads.		
Soil degradation due to pollution of soil by contaminants used on site during construction (e.g. fuel, oil, chemicals, cement).	Low	Low
Soil degradation due to increased soil erosion by wind and/or water on construction areas.	Low	Low
Impact on existing land-use.	Low	N/A
Reduction in agricultural potential.	Low	Low
Degradation of watercourses due to increased siltation downstream from site	Medium	Low
Increased dust pollution from construction sites affecting surroundings.	Low	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase (Positive Impact)	Medium	Medium
Impact of the presence of construction workers in the area on local communities	Low	Low
Risk of Stock theft and damage to farm infrastructure	Medium	Low
Increased risk of fires during construction	Medium	Low
Increases traffic on roads due to construction	Low	Low
Damage to and loss of farmland during construction	Medium	Low
Benefits associated with the establishment of a community trust	Medium	Low
Operational Phase -Creation of Long- Term employment and business opportunities	Low	Medium
Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa	Medium	Medium
Long-Term Impact of the project on Existing Farming Activities on the Site	Low	Low
Impact of the wind energy facility on tourism in the region	Low	Low
Health Impacts due to the Operation of the wind energy facility	Low	Low
Visual Impacts		
Visual impact on sensitive visual receptors	High	N/A

Nature	Without mitigation	With mitigation
within the region		
Potential visual impact on residents of farmsteads in close proximity to the proposed wind energy facility	High	N/A
Potential visual impact on sensitive visual receptors within the region.	Medium	N/A
Potential visual impact of the Ancillary infrastructure (access roads, substation)	Low	Low
Potential visual impact on of lighting at night on visual receptors in close proximity to the proposed wind energy facility	Medium	Medium
Potential visual impact of construction on visual receptors in close proximity to the proposed Aberdeen Wind Energy Facility.	Medium	Low
Potential visual impacts 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 within the region.	Low	N/A
Noise Impacts		
Noise impacts due to construction activities	Medium	Low
Noise impacts from the wind turbines – operational phase (NSD03)	High	Medium
Impacts on Heritage Artefacts		
The destruction of the eight identified sites	High	Medium
The destruction of the stone artefact occurrences and scatters	High	Medium
The destruction of the Farmstead Complex	High	Medium
The destruction of the stonewalling features	High	Medium
The destruction of the historical artefacts.	High	Medium
Potential Impacts on Palaeontology		
Disturbance, damage, destruction or sealing-in of fossil remains	Low	Low

10.1.2. Assessment of Potential 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 Aberdeen 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 built 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 Aberdeen Wind Energy Facility.

10.2 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed Aberdeen Wind Energy Facility development site, a number of potentially sensitive areas were identified (refer to **Figure 10.1 and A3 map in Appendix N**). The following sensitive areas/environmental features have been identified on the site and are able to be mapped:

» ***Ecology***: The larger drainage systems with associated floodplains fall within the Southern Karoo Riviere vegetation type. The drainage systems are considered to be ecologically significant and vulnerable to disturbance. As a result, the areas of Southern Karoo Riviere are considered sensitive ecosystems that should be avoided as far as possible. In terms of the layout assessed in the EIA, a number of turbines are located within these areas (i.e. **T1, 3, 4, 5, 9, 10, 11, 26 and 52**). It was recommended that these should be relocated to adjacent less sensitive plains.

  Overall, the development would be likely to generate moderate ecological impacts during construction and low impacts during operation. There are no long-term impacts associated with the development that cannot be mitigated to a low level and no impacts which are likely to represent a fatal flaw or red flag for the development. Although the site is located within a CBA and this is certainly a significant concern for the development, the ultimate impact of the

development on the CBA is not likely to compromise the overall ecological functioning of the CBA or impact on any features of high potential concern that warrant longer-term protection in order to retain biodiversity pattern.

» ***Bird Habitat and Sensitive Areas –*** The proposed site was found to be moderately sensitive in terms of avifauna, with areas of high, medium and sensitivity being present on site and a large number of sightings of priority birds, specifically Bustards species and Blue Crane. The flight modelling and risk mapping undertaken as part of this monitoring should been used to guide the final positioning of the turbines. This will reduce the impact on bird species in the area. The proposed facility has the potential to significantly impact on avifauna in the area. Priority species were observed flying in the rotor swept area and where this has happened regularly, buffers have been indicated. This however does not mean that birds will collide with turbines as collision rates may vary from species to species. There are no foreseeable fatal flaws associated with the site, however the project should proceed in line with the recommendations and mitigations provided stating that the proposed turbine placements must be critically revised with the key objectives of moving the Turbines located in area of High Avifaunal Sensitivity (i.e. **T57-63, 8-11, 37-37 and 64-66**) to an alternative location outside of high sensitivity areas.

» ***Bat sensitive areas -*** With the exception of the areas delineated with higher sensitivities (i.e. areas around **T3-6, 8-11, 23, 46, 52, 53, 55, 56, 66, 67, 77-84, 94 and 95**), the Aberdeen wind energy facility is considered a low-medium bat sensitive site, with certain seasons considered as highly sensitive. It has medium to high bat activity compared with other sites for the Nama 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 within the EIA report.

» ***Heritage artefacts -*** Eight large areas / sites comprising several cores and surface scatters of stone artefacts were identified on the site. These areas comprise several micro-sites that were difficult to determine individually, therefore the demarcation of the larger areas. Mainly isolated surface scatters of Middle Stone Age stone artefacts were observed distributed across the proposed development area. It is unlikely that the stone artefact surface scatters that occur on the exposed surface areas are positioned in situ; however, stone artefacts may occur between 50 – 80 cm below the surface. One stone walling farmstead complex was documented outside of the area

proposed for the wind turbines, however, caution must be taken if the existing internal road farm will be upgraded for access to the turbines and associated infrastructure, and otherwise it is preferable that an alternative route be established. One collapsed circular stone walling feature with possible associated historical artefacts was documented near to the proposed positions of wind turbines, underground cabling, and access route. The appropriate mitigation measures should be implemented as outlined in the heritage report (refer to **Appendix H**) to protect and conserve the significant archaeological and historical heritage resources.

» ***Noise sensitive receptors -*** The input data as used this assessment indicated that the potential noise impact would be insignificant during the construction phase but there could be an impact of medium significance during the operational phase considering the noise impact on NSD03. Noise measurements are recommended at NSD02, NSD03[11] and NSD04 over a period of at least 24 hours during a period that the wind turbines are operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer. If a valid and reasonable noise complaint is registered relating to the operation of the facility additional noise monitoring should be conducted by an acoustic consultant during the quarterly noise measurements. Noise monitoring must be continued as long as noise complaints are registered. The developer should re-evaluate the layout if any wind turbines are added within 1,000 meters from any NSD.

» ***Visual receptor -*** The study area has a natural character and is located within a picturesque part of the country. The character of the landscape is one of undeveloped, wide open spaces and scenic topography in the form of the Camdeboo Mountains. The visual quality is generally considered to be high due to these factors. Potential visual exposure remains high in the core and medium distance (i.e. within 5 and 10km), this areas includes the R61, two secondary roads and a number of farms and homesteads. The south western tip of the Kamdeboo Mountains also lies within this zone, and the south western slopes will be visually exposed Even though the facility may appear to be quite prominent in the landscape, the facility would be considered to be acceptable from a visual perspective.

Final turbine positioning and placement of associated infrastructure should take cognisance of sensitive areas (as indicated on **Figure 10.1**). Should recommendation made in this EIA and mitigation measures in the EMPr be adhered to, impacts on the identified sensitive areas can be adequately managed.

[11] If relocated no noise monitoring is recommended for this receptor.

Micro-siting of turbines

The following areas identified as a 'no go' areas for the construction of infrastructure (including turbines) must be considered in the final layout of the facility:

» A 1.5km buffer around an identified Blue Crane roost site as well as a 500m buffer around wetlands and/or farm dams.
» In terms of the 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.
» Development within the drainage lines and floodplain habitat should be minimised and while it may be necessary for roads to traverse some of these areas, no turbines should be located within these higher sensitivity areas.
» Heritage sites - an alternative access route should be established to avoid negative impact to the stone walling complex (Ab HS1) during the construction and development phases. No development should occur within 50 m of stone walling features. No development should occur within 100 m of the areas marked Ab SW1 and Ab H1.

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 areas of environmental sensitivity identified during this environmental assessment. This revision of the layout includes 82 proposed and has considered this assessment as well as technical aspects of the project.

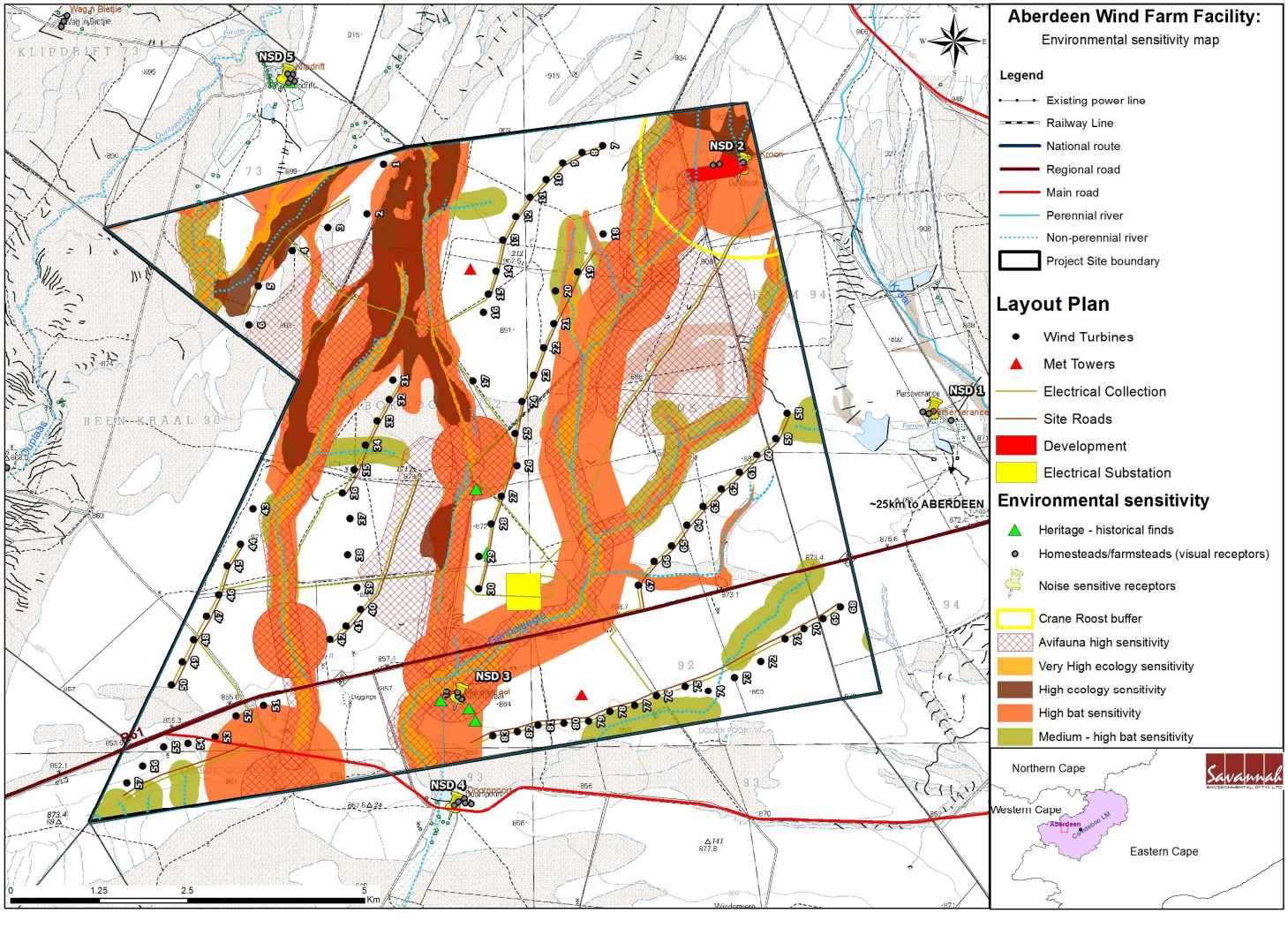


Figure 10.1: Environmental sensitivity map for the project study area illustrating sensitive areas in relation to the proposed **original development footprint** for the Aberdeen Wind Energy Facility **(Appendix N contains A3 map)**

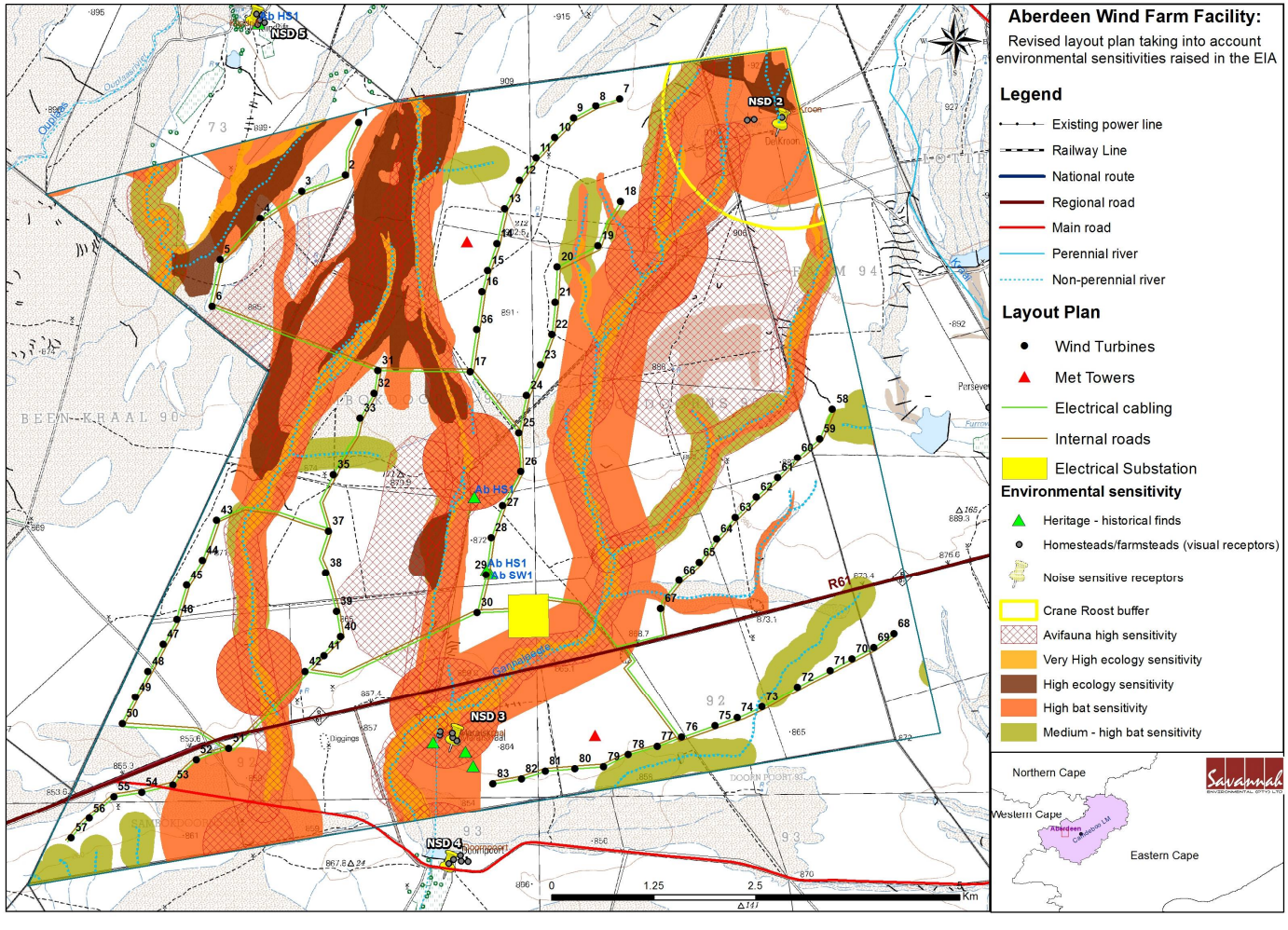


Figure 10.2: Map indicating revised layout to avoid placement of turbines and infrastructure in areas of high sensitivity. **(Appendix N contains an A3 map)**

In terms of this revised layout, the following changes have been made:

1. Turbines **1, 3, 4, 5, 9, 10, 11, 26 and 52** have been shifted outside the drainage systems (Southern Karoo Riviere) which are considered to be ecologically significant and vulnerable to disturbance. As a result, the areas of are considered sensitive ecosystems that should be avoided as much as possible.
2. Turbine **57-63, 8-11, 37-37 and 64-66** previously located within High Avifaunal Sensitive areas have been relocated to lower sensitivity areas.
3. Turbines located in the areas of Higher Bat sensitivities (i.e. **T3-6, 8-11, 23, 46, 52,53,55,56, 66, 67, 77-84, 94 and 95**) have been shifted or relocated to lower bat sensitive areas based on the outcome of the 12 Month bat monitoring programme undertake for the project..

This revised layout, as indicated in Figure 10.2 is the preferred layout for implementation.

10.3 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 8 198 ha was considered for the facility, of which ~0.5% 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 82 turbine footprints (82 foundation areas of 22m x 22m), access roads (up to 6m in width for permanent roads), one 400kV 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)**
82 turbine footprints (each 22m x 22m)	39 688
Permanent access roads within the site (6m width and 45 000m in length)	270 000
One on-substation footprint (100m x 100m)	10 000
Operations and service building area (100m x 100m)	10 000
TOTAL	329 688 m^2 (of a total area of 81 980 000 m^2) **i.e. 0.4%of site**

Approximately 0.4% of the entire extent of the site can be anticipated to be permanently disturbed during the construction/operation of the Aberdeen Wind Energy Facility.

Temporarily affected areas during the construction phase comprise 82 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 6 m (i.e. taking the total roadway to be used during construction to 13m in width)). The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
82 turbine laydown areas (40m x 40m per turbine)	131 200
Temporary crane travel track and construction access roads utilising the same route as the permanent access road (additional 7m in width) and 45 000m in length	315 000
TOTAL	446 200 (of a total area of 81 980 000m^2) = **~0.5% of site**

Therefore, ~0.5% of the entire extent of the site can be anticipated to be temporarily disturbed to some extent during the construction of the Aberdeen Wind Energy Facility.

Considering permanent and temporary footprints, approximately 1% of the total extent of the 8 198 ha will be disturbed by the construction and operation phases of the project.

10.4 Environmental Costs of the Project versus Benefits of the Project

Other 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 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, 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 operation.

These costs are expected to occur at a local and site level 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.

10.5 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. Through pre-feasibility assessments and research, the viability of establishing the Aberdeen Wind Energy Facility in the Eastern Cape has been established by Eskom. The positive implications of establishing the Aberdeen 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 National electricity grid in the Eastern 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 benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should 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 also 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 Aberdeen Wind Energy Facility site is located directly adjacent to the proposed Camdeboo wind facility. This 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.

The significance levels of the majority of identified negative impacts can generally 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**.

10.6 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 Aberdeen 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 following infrastructure would be included within an authorisation issued for the project:

» The site is proposed to accommodate up to 100 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 200MW. In terms of the preferred layout indicated in Figure 10.2, 82 wind turbines area 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 decided upon) and three blades.
» Permanent internal and access roads (up to 6 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 new overhead power line (400kV) feeding into Eskom's electricity grid at the Droërivier Substation, approximately 140 km from the site[12]

[12] The proposed power line is being assessed within a separate EIA process (DEA ref #:14/12/16/3/3/2/357) and is not further discussed or evaluated in this EIA Report. Reference to the power line connecting the facility to the grid

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 L must be implemented.
- The draft Environmental Management Programme (EMPr) as contained within **Appendix M** 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.
- 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.
- A monitoring program must be set up on post construction to monitor for the real impact the facility will have on birds. This should be done in accordance with the BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation impact mitigation at proposed wind energy development sites in southern Africa.
- Operational monitoring is to commence as soon as the first turbines start to rotate and should fatalities be discovered, mitigation approach is recommended for the entire year (refer to **Appendix F** – Bat Impact Assessment).
- Noise measurements are recommended at NSD02, NSD03[13] and NSD04 over a period of at least 24 hours during a period that the wind turbines are

is provided in the interest of fully describing all infrastructures associated with the project, such that a holistic picture of the project is provided.

[13] If relocated no noise monitoring is recommended for this receptor.

operational. Measurements should be collected in 10 minute bins and co-ordinated with the wind speeds as measured by the developer.

» Once the final 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. A representative sample of stone artefacts should be collected and during the archaeological walk-through for the final layout or before the construction activities begin to be housed at the Department of Archaeology's archaeological repository at the Albany Museum. An alternative access route should be established to avoid negative impact to the stone walling complex (Ab HS1) during the construction and development phases. No development should occur within 50 m of stone walling features. No development should occur within 100 m of the areas marked Ab SW1 and Ab H1.

» 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.

REFERENCES CHAPTER 11

» Todd, S. 2014. Fauna & Flora assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» Endangered Wildlife Trust- Wildlife and Energy Programme2014. Pre-construction Bird Monitoring Report and Avifaunal impact assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» McEwan, K. 2014. Pre-construction Bat Monitoring Report and bat impact assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» Paton, I & Robertson, D. 2013. Geology, D And Soil Impact Assessment Report for The Proposed Aberdeen Wind Energy Facility Near Aberdeen In The Eastern Cape Province Of South Africa

» Booth, C. 2013. Heritage Impact Assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» John E. Almond. 2014: Paleontological Impact Assessment - Desktop Study: Proposed Aberdeen 200 MW Wind Farm, Camdeboo Local Municipality, Eastern Cape.

» de Jager, M.2013 Noise Assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» Barbour, T. and Rogatschnig, D. 2013 Social Assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process

» du Plessis, L. 2013. Visual Impact Assessment for the Proposed Aberdeen Wind Energy Facility, near Aberdeen in the Eastern Cape, as Part of an Environmental Impact Assessment Process