1 INTRODUCTION

1.1 Background to the study

Plan 8 (Pty) Ltd, a renewable energy company, plans to develop a wind powered electricity generation facility (known as a 'wind farm') approximately 30 kilometres outside of Grahamstown along the N2 in an easterly direction towards East London, in the Eastern Cape Province of South Africa. The proposed site is on the farms Gilead, Tower Hill and Peynes Kraal. The project area lies in the Makana Local Municipality's area of jurisdiction. The proposed wind farm is planned to comprise up to a maximum of 22 turbines, each with a nominal power output ranging between 2.4 and 3 MW (megawatts).

The total potential generating capacity of the wind farm will be approximately 66 MW, and will feed power into the national electricity transmission grid. In accordance with the requirements of the National Environmental Management Act No. 107 of 1998 as amended, and relevant Environmental Impact Assessment (EIA) regulations made in terms of this Act (Government Notice No R.543) and promulgated in 2010, the proposed project requires a full Scoping and EIA. Coastal & Environmental Services (CES) have been appointed by Plan 8 (Pty) Limited as Environmental Assessment Practitioner (EAP) to conduct the EIA.

1.2 The Environmental Impact Assessment Process

The International Association for Impact Assessment (1999) defines an Environmental Impact Assessment (EIA) as, "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made." The EIA process in South Africa is guided by regulations made in terms of Chapter 5 of NEMA.

The EIA regulations (Government Notice R. 543) set out the procedures and criteria for the submission, processing and consideration of and decisions on applications for the environmental authorisation of activities. Three lists of activities, published on 02 August 2010, as Government Notice Numbers R.544 to 546, the first two of which define the activities that require, respectively, a Basic Assessment (applies to activities with limited environmental impacts), or a Scoping and Environmental Impact Assessment (applies to activities which are significant in extent and duration). A third Government Notice, Number R.546, is province specific, and lists activities for which environmental authorisation is required if the activities take place in or in the vicinity of certain specified areas, including estuaries, protected or sensitive areas, and areas listed in international conventions such as the Ramsar Convention on Wetlands. The activities triggered by the proposed development are listed in Table 1-1 below.

Table 1-1: Listed activities potentially triggered by the proposed Plan 8 Grahamstown Wind Energy Project

Number and date of the relevant notice	Activity No(s)	Description of each listed activity
Listing Notice 1: R.544	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 275 kilovolts; (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
Listing Notice 1: R.544	11	The construction of: (xii) canals; (xiii) channels; (xiv) bridges; (xv) dams; (xvi) weirs; (xvii) bulk storm water outlet structures;

		(xviii) marinas; (xix) jetties exceeding 50 square metres in size; (xx) slipways exceeding 50 square metres in size; (xxi) buildings exceeding 50 square metres in size; or (xxii) 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, excluding where such construction will occur behind the development setback line.
Listing Notice 1: R.544	13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres;
Listing Notice 1: R.544	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock or more than 5 cubic metres from: (i) a watercourse; (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing , dredging, excavation, removal or moving; (c) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (d) occurs behind the development setback line.
Listing Notice 1: R.544	38	The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.
Listing Notice 1: R.544	40	The expansion of (iv) jetties by more than 50 square metres; (v) slipways by more than 50 square metres; or (vi) buildings by more than 50 square metres (iv) infrastructure by more than 50 square metres within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, but excluding where such expansion will occur behind the development setback line.
Listing Notice 1: R.544	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (iii) where the existing reserve is wider than 13,5 meters; or (iv) where no reserve exists, where the existing road is wider than 8 metres – excluding widening or lengthening occurring inside urban areas.
Listing Notice 2: R.545	1	The construction of facilities or infrastructure for the generation of electricity where the electricity is 20 megawatts or more.
Listing Notice 2: R.545	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; Except where such physical alteration takes place for: (iii) linear development activities; or (iv) agriculture or afforestation where activity 16 in this Schedule will apply.
Listing Notice 3: R.546	4	The construction of road wider than 4 metres with a reserve less than 13,5metres.
Listing Notice 3: R.546	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.

Listing Notice 3: R.546	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
Listing Notice 3: R.546	13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation:
Listing Notice 3: R.546	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation
Listing Notice 3: R.546	16	The construction of (iv) infrastructure covering 10 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, excluding where such construction will occur behind the development setback line
Listing Notice 3: R.546	19	(19) The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.
Listing Notice 3: R.546	24	The expansion of (d) infrastructure where the infrastructure will be expanded by 10 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, excluding where such construction will occur behind the development setback line.

Because the proposed development triggers a listed activity from GNR.545, it will require a full Scoping and EIA. This process is regulated by Chapter 3, Part 3 of the EIA regulations and is illustrated in Figure 1-1. It is described in further detail in Appendix A of this report.

The competent authority that must consider and decide on the application for authorisation in respect of the activities listed in Table 1-1 is the Department of Environmental Affairs (DEA), formerly the Department of Environmental Affairs and Tourism (DEAT), as the Department has reached agreement with all Provinces that all electricity-related projects, including generation, transmission and distribution, are to be submitted to DEA, irrespective of the nature of the applicant. This decision has been made in terms of Section 24(3) of the NEMA (Act No 107 of 1998). The decision is effective for all projects initiated before, and up until, approximately 2015.

It is important to note that, in addition to the requirements for an authorisation in terms of the NEMA, there may be additional legislative requirements which need to be considered prior to commencing with the activity, for example: the National Heritage Resources Act (Act No 25 of 1999), the National Water Act (Act No 36 of 1998), the Civil Aviation Act (Act No 74 of 1962) as amended, the White Paper on Energy Policy for South Africa (Energy White Paper), the White Paper on Renewable Energy Policy (Renewable Energy White Paper), and the Integrated Energy Plan for the Republic of South Africa (March, 2003) etc.

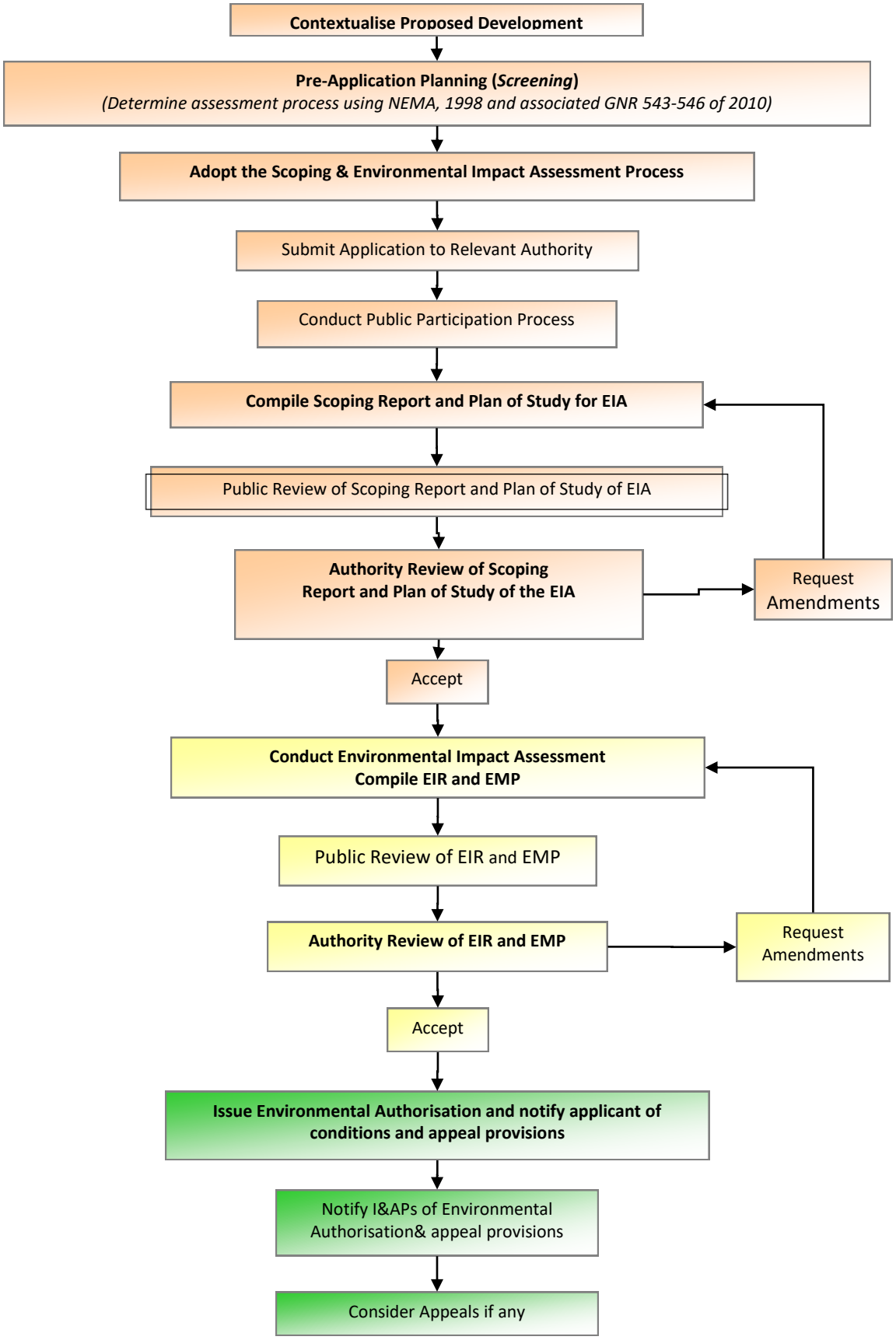

Figure 1-1: The EIA process under current legislation (NEMA 1998) as amended
Scoping Phase (orange), Environmental Impact Assessment Phase (yellow), and Environmental Authorisation Phase (green).

Scoping Phase

The main aim of the scoping process of an EIA is to inform the public of the proposed project and EIA process as well as to identify issues and concerns that need to be addressed in the Environmental Impact Assessment (EIA) phase of the EIA process. The Scoping phase therefore has the following key objectives:

- To encourage and allow for the involvement of Interested and Affected Parties (I&APs) in the identification of issues;
- To identify reasonable alternatives;
- To ensure that all key issues and environmental impacts that will be generated by the proposed project are identified; and
- To identify any Fatal Flaws.

The full involvement of Interested and Affected Parties (I&APs) in the process ensures an open participatory approach to the study. It also ensures that all the impacts are identified and that planning and decision-making are done in an informed, transparent and accountable manner.

The Scoping phase for the proposed Plan 8 Grahamstown Wind Energy Project took place between September 2011 and February 2012. The Draft Scoping Report was distributed to I&APs for comment for a period of 40 days between the 3rd fof November 2011 and the 13th of December 2011.

A detailed description of the Scoping phase for the proposed Plan 8 Grahamstown Wind Energy Project and the outcomes thereof are included in Volume 1: "*Final Environmental Scoping Report: Proposed Plan 8 Grahamstown Wind Energy Project, Makana Municipality*" (CES, January 2012) and is therefore not discussed further here.

Comments and the appropriate responses were included in the Final Scoping Report (FSR) which was submitted to the competent authority on the 20th of January 2012 and acknowledged by the DEA as being received on the 26th of January 2012 (see Appendix B).

A Plan of Study (PoS) for the detailed EIR phase was also submitted together with the FSR. This was in fulfilment of section 28 (1) (n) of the EIA regulations (2010) which states that, "*A Plan of Study for environmental impact assessment which sets out the proposed approach to the environmental impact assessment of the application, must be submitted and it must include –*

(i) A description of the tasks that will be undertaken as part of the environmental impact assessment process, including any specialist reports or specialised processes, and the manner in which such tasks will be undertaken;
(ii) An indication of the stages at which the competent authority will be consulted;
(iii) A description of the proposed method of assessing the environmental issues and alternatives, including the option of not proceeding with the activity; and
(iv) Particulars of the public participation process that will be conducted during the environmental impact assessment process.

The DEA approved the FSR and PoS (24 February 2012), and advised the EAP in terms of Regulation 31(1) to, "*proceed with the environmental impact assessment process in accordance with the tasks contemplated in the plan of study for environmental impact assessment*" i.e. the detailed EIA phase (Appendix A). CES released the Draft EIR for public review according to the aforementioned approval. The final EIR was received by DEA on 2nd August 2012. The DEA requested more information, and that the EIR be amended to present the additional information. The DEA requested that additional studies were undertaken to analyse the impacts that the project would have on the socio-economic environment and the local game farming industry. Additional information requested included:

1. Clarify whether a new overhead power line will be built on site. Provide the co-ordinates for the route alignment. If no alternatives have been considered, motivate why.
2. Provide co-ordinates for the position of the substation. Specify the size of the footprint.
3. Due to the objections from I&APs regarding site selection, explain why other site alternatives were not considered. Provide reasons for why the current site was chosen.
4. Provide the DEA with final comments from the Land Use and Soil Management Section of the Department of Agriculture, Forestry and Fisheries (DAFF).
5. Provide proof of delivery of the EIR to the Provincial Nature Conservation Department and Eastern Cape Parks Board.
6. Certain issues raised in a letter received by the DEA from Moll Property Trust dated 10 June, were not responded to in the Issues and Response Trail. Please respond to all issues raised by I&APs.
7. A second objection letter has been received from Moll Property Trust. Please respond to this letter in the Revised Final EIR.
8. On 2 October 2012 comments were received from the Provincial Department: Department of Economic Development Environmental Affairs and Tourism. Please give a response to these comments in your Revised Final EIR.
9. If there is a change of scope to the project, it is important that the report is released for public consultation.

The EIR was amended in accordance with these requirements, and resubmitted to DEA in November 2013..

Environmental Impact Assessment Phase

The EIA phase follows directly from the Scoping phase and has now been completed. The aim of the detailed EIA phase was to undertake a comprehensive evaluation and study that addressed all the issues raised during Scoping and produce a report that contains all the relevant information that is necessary for the competent authority to consider the application and to reach a decision contemplated in Regulation 35. More specifically, the EIA phase has seven key objectives:

- Describe the biophysical and socio-economic environment that is likely to be affected by the proposed development.
- Undertake specialist studies to address the key biophysical and socio-economic issues.
- Assess the significance of impacts that may occur from the proposed development.
- Assess the alternatives proposed during the Scoping Phase.
- Provide details of mitigation measures and management recommendations to reduce the significance of impacts.
- Provide a framework for the development of an Environmental Management Programme (EMPr).
- Continue with the public participation process.

This EIA phase includes the following steps –

1. **Specialist Studies,** which include the specialist assessments identified in the FSR and any additional studies required by the authorities. This requires the appointment of specialists to gather baseline information in their fields of expertise, and to assess the impacts and make recommendations to mitigate negative impacts and optimise benefits. The resulting information is synthesised into the Environmental Impact Assessment Report (EIR).
2. **Environmental Impact Assessment Report**. The main purpose of this report is to gather and evaluate environmental information, so as to provide sufficient supporting arguments to evaluate overall impacts, consider mitigation measures and alternative options, and make a value judgement in choosing the best development alternative. The EIR is made available for public and authority review. The availability of the report is advertised in at least one Provincial newspaper and a copy of the report is placed at an easily accessible location.
3. **Comments Report,** which compiles comments, issues and concerns raised by I&APs and

the authorities and the relevant responses to these comments.

4. **Environmental Management Programme,** which informs the client, technical team and contractor of the guidelines which will need to be followed during construction and operation to ensure that there are no lasting or cumulative negative impacts of these processes on the environment.

Procurement Process - Independent Power Producers

Under the Department of Energy's current procurement policy for renewable energy, Independent Power Producers (IPPs) have to comply with the requirements as detailed in the Request for Proposal (RFP) document that was released in August 2011. The RFP document underpins five rounds of a competitive bid process to which a total of 1850 MW of onshore wind power has been allocated. The fourth round of the REIPPP was in August 2014, the fifth is scheduled for August 2015.

In a substantial vetting process IPPs are required to meet the minimum requirements set out in five volumes of the RFP document covering legal, technical (of which the EIA process forms a part), financial and economic development criteria. A critical imperative of the procurement process is that all successful projects are operational by 2016. Over and above the necessary environmental authorisation for a project the aspects listed below also require review and the associated application, reporting and permitting processes to be conducted as part of the bid process.

Heritage

In terms of the National Heritage Resources Act (25 of 1999) the protection of archaeological and paleontological resources is the responsibility of a provincial (or national) heritage resources authority. All archaeological objects, paleontological material and meteorites are the property of the State. Where necessary the relevant permits need to be secured prior to project development. It is not applicable in this instance owing to the lack of heritage features of significance in the project study area. Regardless, copies of the EIR have been sent to the Eastern and Western Cape authorities for comment owing to a lack of capacity in the Eastern Cape offices to engage in these processes. Comment has been received from SAHRA and is attached in Appendix B. Mitigation measures suggested by SAHRA have been incorporated into the EMPr.

Water

Section 21 of the National Water Act (36 of 1998) defines various uses or activities that require the issuing of the relevant water use license, or general authorisation process, to be conducted for all projects whose activities trigger these. This relates to engineering structures constructed in watercourses for road access, abstraction of water in the construction or operational phases, etc. Section 21 (c) and (i) authorisations are needed whenever new roads and/or cables cross watercourses (even dry headwaters), and when upgrades to existing causeways/bridges (e.g. to allow transportation of long/heavy components and equipment) are required: This is defined as a "water use" in terms of the Act. The process of obtaining a Water Use Authorisation begins with an inception phase review and preliminary application. The purpose of this phase is to:

a) undertake a site visit to determine the number of crossings likely to require Section 21 (c) and (i) authorisation,
b) introduce the relevant DWA officials to the project at an early stage, and to
c) find out from them (based on the site visit and the initial findings of the Scoping Report) whether the water uses can be authorised in terms of a General Authorisation (appropriate when the impacts of the crossings are collectively low) or if a licence submission will be required (appropriate when there is greater ecological sensitivity).

For this project, the turbines and associated infrastructure have been designed so that no water use licences or general authorisations will be required. Cognisance of drainage lines and wetlands were taken when considering the layout submitted in this EIR. A non-binding commitment was

received from DWA stating that the water demand for construction and operational purposes (although far less during operational phase) could be accommodated from existing sources (boreholes on Tower Hill Farm) in the project area.

Civil Aviation Authority (CAA)

Section 14 of Aviation Act (Act No. 74 of 1962) - through the 13th Amendment of the Civil Aviation Regulations 1997 - deals with obstacle limitations and markings outside of aerodromes or heliports. The Act specifically deals with wind turbine generators (wind farms) and the requirements that they need to adhere to, to be approved by the CAA. All necessary permits will be procured form the CAA for the proposed facility. The CAA has granted conditional approval, final approval to be given pending the final site layout plan.

Agriculture

In terms of the Conservation of Agricultural Resources Act (43 of 1983) and the Subdivision of Agricultural Land Act (70 of 1970) all projects that impact on agricultural resources require at least comment from the national and/or provincial agriculture departments. When agricultural land is being subdivided, authorisation is required. Since subdivision will not be done for this project, only comment is required. Comment has been received from the Department of Agriculture, Forestry and Fisheries (DAFF) who have no objection to the proposed WEF (a copy of the letter is included in Appendix B). In addition to this, the re-zoning of land is dealt with in a separate application where the DAFF is a commenting authority.

1.3 The Environmental Assessment Practitioner

In terms of Section 31 (2) of the EIA Regulations (2010), ***an environmental impact assessment report must include-***

(a) The details of -
(i) The EAP who compiled the report; and
(ii) The expertise of the EAP to carry out an environmental impact assessment.

In fulfillment of the above-mentioned legislative requirement, as well as Section 17 of the EIA Regulations (2010) which states that, "*an EAP must have expertise in conducting environmental impact assessments, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity*", provided below are the details of the Environmental Assessment Practitioner (EAP) that prepared this Environmental Impact Assessment Report (EIR) as well as the expertise of the individual members of the study team.

Details of the EAP

Mr Marc Hardy, Coastal and Environmental Services (CES)
Marc is a Principal Consultant at CES. He holds a M.Phil in Environmental Management from Stellenbosch University's School of Public Management and Planning. His professional interests include environmental impact reporting for linear, energy and bulk infrastructure projects, strategic environmental policy development and reporting – mostly relating to Environmental Management Framework's (EMF's) - compliance monitoring and environmental auditing. Marc has, amongst others, been project manager for the Dinokeng EMF (Gauteng), the Milnerton Refinery to Ankerlig Power Station Liquid Fuels Transportation Infrastructure Project, numerous Eskom Transmission and Distribution power line and substation EIA's countrywide, mining EMPR compliance audits, compliance audits for Camden, Grootvlei and Komati Power Stations and the hazardous waste management facility for the Coega Development Corporation (Coega IDZ). Before entering the consulting field he gained extensive experience in the EIA regulatory field whilst in the employ of the Gauteng Department of Agriculture, Conservation and Environment - being responsible for the review of infrastructure projects like the Gautrain Rapid Rail system and representing the

Department on various EMF project steering committees. He is currently managing numerous EIA processes for wind energy developments countrywide, as well as renewable energy and mining projects throughout Africa.

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CES Expertise

CES is one of the largest specialist environmental consulting firms in southern Africa. Established in 1990, and with offices in Grahamstown, East London, Port Elizabeth, Cape Town, Johannesburg and Maputo, we primarily specialise in assessing the impacts of development on the natural, social and economic environments. CES's core expertise lies in the fields of strategic environmental assessment, environmental management plans, environmental management systems, ecological/environmental water requirements, environmental risk assessment, environmental auditing and monitoring, integrated coastal zone management, social impact assessment and state of environment reporting.

Provided below are short *curriculum vitae* (CVs) of each of the team members involved in the proposed Plan 8 Grahamstown Wind Energy Project EIA.

Mr. Bill Rowlston (Project Leader)
Bill graduated from the University of Salford, England, with a first class honours degree in civil engineering in 1971, after which he worked for more than 36 years in the English and South African water sectors. He spent 24 years with the Department of Water Affairs and Forestry in South Africa where, as a hydraulics specialist, he contributed to the development of approaches for protecting water resources, including the determination of the ecological Reserve of South Africa's National Water Act. Bill was closely involved with the development of the National Water Policy (1997) and the National Water Act (1998), and was responsible for compiling the National Water Resource Strategy, First Edition (2005), much of which he wrote. He also supervised the development of guidelines for the preparation of sub-national catchment management strategies. He joined CES in April 2007, where, in addition to managing a number of environmental impact assessments, he has co-authored a Technical Report on the determination and implementation of environmental water requirements for the Ramsar Convention on Wetlands and coordinated the determination of the riverine impacts of a proposed peaking hydroelectric power station in Zambia. He has contributed to the development of a new national water law for Vietnam, South Africa's National Groundwater Strategy, and catchment management strategies in South Africa.

Mr Jadon Schmidt (Project Manager and Report Production)
Jadon has departed CES but was a Senior Environmental Consultant and holds a BSc degree in Geology and Botany, a BSc Honours degree in Botany (both from NMMU), an MSc in Estuarine Ecology and an MBA from Rhodes University with a core environmental management and sustainability focus. His MBA thesis addressed resource economic issues of marine protected areas while his MSc dealt specifically with sea level rise impacts on sediment and vegetation dynamics of selected estuaries of the southern Cape. Climate change, wetland ecology, renewable energy and resource economics are among his professional interests.

Dr Chantel Bezuidenhout (Report Review)
Chantel holds MSc and PhD degrees in Botany (estuarine ecology) and a BSc degree in Botany and Geography from NMMU. Chantel's main focus is estuarine ecology and she has done extensive work on 13 systems from the Orange River Mouth in the Northern Cape to the Mngazi Estuary in the Transkei. As a result she has been involved in a number of ecological reserve determination studies including the Kromme, Seekoei and Olifants systems. Chantel has been an

Environmental Consultant for approximately 5 years and as such has been focused on environmental management and impact assessment. Chantel is well versed in environmental legislation and has been involved in number of environmental impact assessments and management plans in South Africa, Zambia and Madagascar. She is currently employed in the Port Elizabethoffice of CES.

Table 1-2: The Specialists involved in the EIA Phase

Specialist Study	Affiliation	Name of Lead Specialist(s)
Noise	Safetech	Mr Brett Williams
Heritage	Nilssen Archaeological Resources Management	Mr Peter Nilssen
Avifauna (Including long term monitoring)	Wildskies Ecological Services	Mr Jon Smallie
Visual	MapThis	Mr Henry Holland
Ecological	Coastal and Environmental Services	Prof. Roy Lubke
		Ms. Leigh-Ann De Wet/ Mr Roy De Kock
Bat (Chiroptera) (Including long term monitoring)	Animalia Zoological and Ecological Consultation	Mr Werner Marais
Palaeontological	Rob Gess Consulting	Dr Rob Gess
Agricultural	Isi-iXwiba Consulting	Mr Chris Bradfield
Socio-economic	Urban Econ	Mr Matthew Keeley, Mr Tatenda Mzezewa

The Environmental Impact Report

In accordance with regulation 31 (2) of the EIA Regulations (2010) which states that, "*an environmental impact assessment report must contain all information that is necessary for the competent authority to reach a decision contemplated in terms of regulation 35 - Decisions on applications*", the overall purpose of the EIR is to communicate the findings of the EIA to the authorities in order to inform the decision as to whether or not to authorise the proposed project.

More specifically, the objectives of the EIR are to

- Confirm which issues have been investigated further and addressed in the EIR;
- Identify and assess impacts of feasible alternatives within the development proposal;
- Provide a comprehensive assessment of predicted impacts that may result from the proposed project, in accordance with the specified impact assessment methodology;
- Where alternatives have been assessed, make recommendations for the best practice environmental option (BPEO);
- Recommend actions to mitigate negative impacts or enhance benefits; and
- Provide recommendations for monitoring programmes.

This report is the third of four reports produced for this EIA process.

This EIR has been produced in accordance with the requirements of Section 31 (2) of the EIA regulations (GNR 543), which clearly outlines the content of environmental impact assessment reports. Sections 54-57, which cover the activities necessary for a successful Public Participation Process (PPP), have also been adhered to.

Nature and Structure of this Report

In accordance with the EIA Regulations (2010), an EIA report must contain all the information that is necessary for the competent authority to consider the application and to reach a decision and must include those points laid out in Table 1-3. In order to facilitate review by the competent authority, this report, which forms Volume 3 of the suite of EIA documents related to the proposed project, is structured around these requirements.

Table 1-3: EIA regulation requirements and structure of the report

EIA Regulation Requirements	Section/Chapter
Details of the Environmental Assessment Practitioner (EAP) and their expertise	Section 1.3
A detailed description of the proposed activity	Chapter 2
A description of the property on which the activity is to be undertaken and the location of the activity on the property	Chapter 2
A description of the environment that may be affected by the activity and the manner in which it may be affected	Chapter 3
Details of the public participation process conducted including a register of I&APs and a comprehensive Issues and Response Trail	Appendix C
A description of the need and desirability of the proposed activity	Chapter 4
Identification of potential alternatives to the proposed activity	Chapter 5
An indication of the methodology used in determining the significance of potential environmental impacts	Appendix A
A description and comparative assessment of alternatives	Chapter 7
A summary of the findings and recommendations of specialist reports.	Chapter 8
A description of all environmental issues, 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 7
A description of any assumptions, uncertainties and gaps in knowledge	Chapter 1
An opinion as to whether the activity should or should not be authorised	Chapter 8
An environmental impact statement which contains a summary of the findings and a comparative assessment of the positive and negative implications.	Chapter 8
Environmental Management Programme (EMPr)	Volume 4
Copies of the Specialist Reports	Volume 2
Any additional information that may be required by the competent authority.	Appendices

In addition, DEA's rejection letter dated 8th April 2014, together with responses to the reasons for rejection, are included in an Addendum to the EIAR, which is Volume 3a of the suite of documents. This document includes all eight quarterly bird and bat monitorng reports, and a document prepared by Plan 8 relating to studies of the impacts of wind energy facilities on property values.

The structure of this report is therefore as follows:-

Chapter 1 - Introduction: Provides background information on the proposed project, a brief description of the EIA process required by NEMA and its regulations, and describes the key steps in the EIA process that have been undertaken. The details and expertise of the Environmental Assessment Practitioner (EAP) who compiled this report are also provided in this Chapter.

Chapter 2 – Project Description: Provides a detailed description of the proposed development, the property on which the development is to be undertaken and the location of the development on the property. The technical details of the process to be undertaken are also provided in this Chapter.

Chapter 3 – Description of the Affected Environment: Provides a description of the environment that may be affected by the proposed 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 4 – Need and Desirability: Provides a description of the need and desirability of the proposed.

Chapter 5 – Alternatives: Provides a description of the alternatives to the proposed development or parts of the proposed development.

Chapter 6 – Key Findings of the Specialist Studies: This Chapter summarises the findings of the specialist studies that were conducted for the project.

Chapter 7 – Assessment of Impacts: Provides:-

- A description of all environmental issues relating to all phases of the proposed development that were identified during the EIA 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.
- 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 – Conclusions and Recommendations: Provides -

- An 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.
- 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.
  - iii. Recommended further study and assessment.

References: Cites any texts referred to during preparation of this report.

Appendix A - The Environmental Impact Assessment Process and methodology
Appendix B - Copies of correspondence received from authorities.
Appendix C - Plan of Study approval from DEA.
Appendix D - Details of the Public Participation Process, including comprehensive I&R Trail.
Appendix E - Copies of title deeds.
Appendix F - Letter from DWA confirming availability of water during the construction phase.
Appendix G - Letter from Eskom confirming ability to connect facility
Appendix H - Plan 8 Grahamstown WEF Site Selection Methodology
Appendix I - Wind Energy facilities and Property Values

Volume 1 – Final Scoping Report

Volume 2 - Specialist Reports: Provides copies of any specialist reports and reports on specialised processes complying with Regulation 32 of the EIA Regulations (GNR 543).

Volume 4 - Environmental Management Programme: Provides an Environmental Management Programme (EMPr) that complies with Regulation 33 of the EIA Regulations (GNR 543).

Assumptions and limitations

This report is based on currently available information and, as a result, the following limitations and assumptions are implicit in it:

- Descriptions of the natural and social environments are based on fieldwork augmented by available literature.
- The originally proposed locations of the turbines (in the Draft Scoping Report) were adjusted to account for the recommendations made during the Scoping phase and again during the EIA phase. Further recommendations are made in the specialist reports based on studies carried out during the EIA phase. Should environmental authorisation be granted the layout will be subject to further refinement - micro-siting – to account for site-specific geotechnical conditions, the results of the bird and bat monitoring programmes, and detailed vegetation surveys.
- The final turbine layout will be contained within the property boundaries of the study area.

2 PROJECT DESCRIPTION

In terms of Section 31 (2) of the EIA Regulations (2010), ***an environmental impact assessment report must include-***

(b) A detailed description of the proposed activity;
(c) A description of the property on which the activity is to be undertaken and the location of the activity on the property……

In line with the above-mentioned regulatory requirement this chapter identifies the location and size of the site of the proposed Plan 8 Grahamstown Wind Energy Project, and provides a description of its various components and arrangements on the site.

2.1 Location and site description of the proposed development

The proposed Plan 8 Grahamstown Wind Energy Project is to be constructed on approximately 2,550 hectares (ha) of land, encompassing the farms described in the table below.

Table 2-1: SG numbers that comprise the farms proposed for Plan 8 Grahamstown Wind Energy Project

Farm Name	Erf Numbers	Surveyor General 21 digit code
Gilead	No 361, Portion 0, Division of Albany	C00200000000036100000
Tower Hill	No 363, Portion 0, Division of Albany	C00200000000036300000
Peynes Kraal	No 362, Portion 0, Division of Albany	C00200000000036200000

The total area of land disturbed by the project – the development footprint - will be established in two phases: construction, followed by operation, with a period of rehabilitation between the two phases.

During construction an estimated area of approximately 20 000 square metres (2ha) will be required for hardstandings for the cranes that will erect the 22 turbines, materials laydown and storage areas, and construction site offices.

Approximately 14.3km of ccess roads, with an average width of 4.5m, will be required to facilitate construction of the facility (6.4ha)

The total construction footprint is therefore 8.4ha, or 0.33% of the total area of the properties – 2 550 ha - on which construction will be taking place.

During operation of the facility, after rehabilitation of the temporary construction areas, the 20m-diameter turbine bases and the substation (approximately 100m by 65m) will together occupy a permamnent footprint of 1.4ha (0.055% of the total area of all properties).

For a limited period of time, between completion of construction and completion of rehabilitation of the temporary construction areas, the total disturbed area will be 9.8ha, which is a little less than 0.4% of the total area of the properties on whiuch the facility will be sited.

2.2 Detailed description of the Plan 8 Grahamstown Wind Energy project

The term “wind energy” describes the process by which wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power and a generator can then be used to convert this mechanical power into electricity.

The Plan 8 Grahamstown Wind Energy Project will be spread over three properties in the Grahamstown area of Makana Local Municipality, and is planned to host a total of up to 22 turbines, each with a nominal power output of between 2.4 and 3 MegaWatts (MW).

The total potential output of the Wind Energy Project would therefore be approximately 66 MW, which will serve to further support the regional and national power balance.

The final number of turbines and their placement on the site has been informed by the specialist studies and assessment conducted for the EIA phase, and will be further refined to account for detailed wind resource assessment, site-specific geotechnical conditions, the results of the bird and bat monitoring programmes, and detailed vegetation surveys after environmental authorisation.

2.2.1 Turbine specifications

The ultimate size of the wind turbines will depend on further technical assessments but will typically consist of horizontal axis rotor turbines (3 x ±50 m length blades) with rotor diameters of 100 to 117 metres mounted atop a 91.5 metre high steel (or hybrid steel/concrete) tower. Other infrastructure components associated with the proposed wind energy facility are *inter alia*:

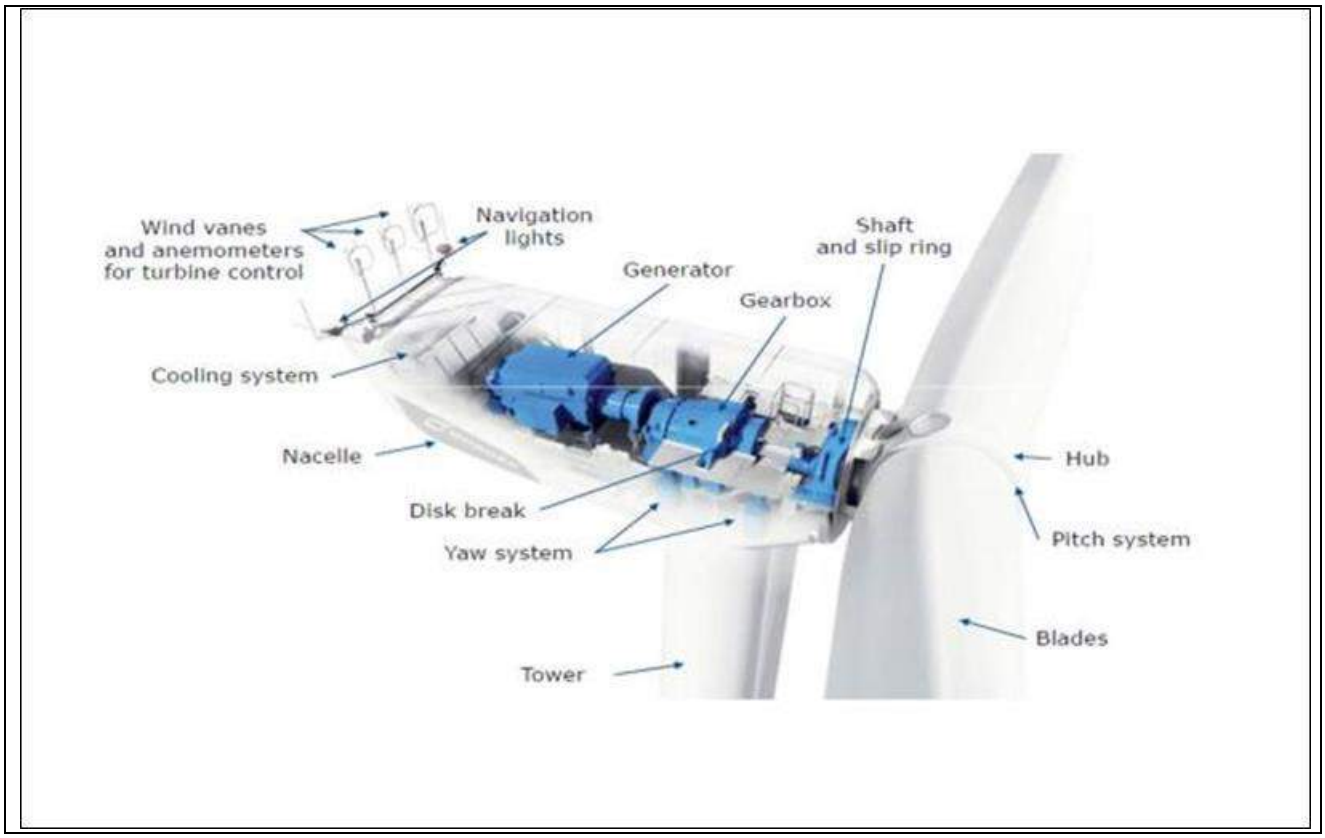


Figure 2-1: Principal components within and attached to the nacelle

- *Rotor and blades*

The rotor converts collected wind energy into rotational energy so as to turn the generator. The rotor has three blades that rotate at a constant speed, approximately 7.5 - 15 revolutions per minute (rpm) in the case of the turbines being considered for this facility. The rotor is pitch controlled. The blades are usually coloured light grey and, in the case of the proposed project, would be between 58.5 m long 117 m diameter).

- *Nacelle*

The nacelle is a fibre-glass housing for the generator, gearbox and control system (yaw and pitch). The speed of rotation of the blades is controlled inside the nacelle.

Larger wind turbines are typically actively controlled to face the wind direction measured by a wind vane situated on the back of the nacelle. By reducing the misalignment between wind and turbine pointing direction (yaw angle), the power output is maximised and non-symmetrical loads minimised. The nacelle can turn the blades to face into the wind (‘yaw control').

All turbines are equipped with protective features to avoid damage at high wind speeds. By turning the blades into the wind (‘furling’) the turbine ceases its rotation, accompanied by both electromagnetic and mechanical brakes. This would typically occur at very high wind speeds, typically over 72 km/hr (20 m/s). The wind speed at which shut down occurs is called the cut-out speed. The 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. Instrumentation and control devices inside the nacelle control the angle of the blades (‘pitch control') to make optimal use of the available wind and avoid damage at high wind speeds.

The nacelle also contains the generator, control equipment, gearbox and wind speed measure (anemometer) in order to monitor the wind speed and direction (Figure 2.1).

- *Generator*

The generator converts the turning motion of the blades into electricity. A gear box is commonly used for stepping up the speed of the generator. Inside the generator, wire coils rotate in a magnetic field to produce electricity. Each turbine has a transformer located at the base of the turbine (outside) that steps up the voltage, in the case of the proposed project from 660 V to 33 or 22 KV, to match the line frequency and voltage for electricity evacuation/distribution

- *Tower*

The tower is constructed from tubular steel and supports the rotor and nacelle. For the proposed project, the tower would be 91.5 m tall. Wind has greater velocity at higher altitudes, therefore increasing the height of a turbine increases its ability to intercept greater wind speeds and produce more electricity.

- *Foundation*

Foundations are designed to factor in both weight (vertical load) and lateral wind pressure (horizontal load). Considerable attention is given when designing the foundations to ensure that the turbines are adequately grounded to operate safely and efficiently. The final foundation design of the proposed turbines is dependent on a geotechnical investigation: however; it is likely that the proposed turbine foundations would be made of reinforced concrete. The foundations would be approximately 20 m x 20 m and an average of 2 to 6 m deep. The foundation would be cast *in situ* and could be covered with top soil to allow vegetation growth around the 6 m diameter steel tower.

- *Crane Hardstanding*

A hardstanding will be required adjacent to each Wind Turbine Generator (WTG) upon which to stand the crane used for erecting the tower, nacelle and rotor. Figure 2-4 specifies the minimum requirements for the turbines proposed for this facility.

2.2.2 Additional Infrastructure requirements

In addition to the above, the following infrastructure will be required for the wind energy facility:

- Internal access roads
- Underground electricity reticulation cables connecting the wind turbines to one another;

- Existing and proposed 132 kilovolt (KV) overhead power lines traversing the farm;
- One sub-station will be constructed for the project to receive the generated power and transmit this to the point of interconnection; and
- Buildings to house the control instrumentation and backup power support, as well as a store room for the maintenance equipment.
- Office for maintenance crew

Two options are currently being considered for connecting to the existing 132 KV overhead powerline. Both alternatives would require an overhead 132 KV line from a metering and substation facility, which would tie in to the existing overhead 132 KV lines to the north (Figure 2-3).
The approximate co-ordinates of the lines are as follows:

Option 1 (approximately 580 m in length):

Start (metering and substation): 33°16'41.22"S, 26°50'18.69"E

End (connection to overhead132 KV line): 33°16'22.58"S, 26°50'17.82"E

Option 2 (approximately 370 m in length):

Start (metering and substation): 33°16'34.59"S, 26°49'51.89"E

End (connection to overhead132 KV line): 33°16'23.56"S, 26°49'51.17"E

The substation and metering point will be approximately 65 m x 100 m and founded on a RC base with safe access provided for construction and maintenance and safety. Figure 2-2 below details the layout of the substation:

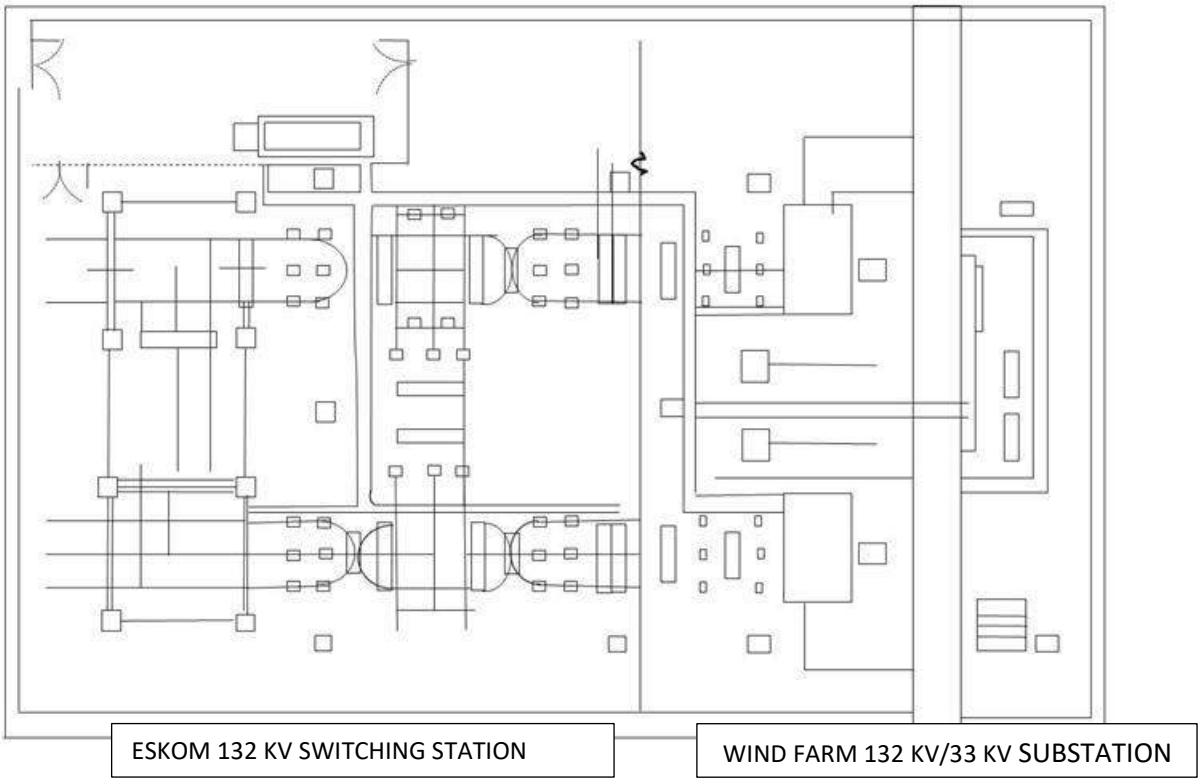


Figure 2-2: Schematic representation of the substation

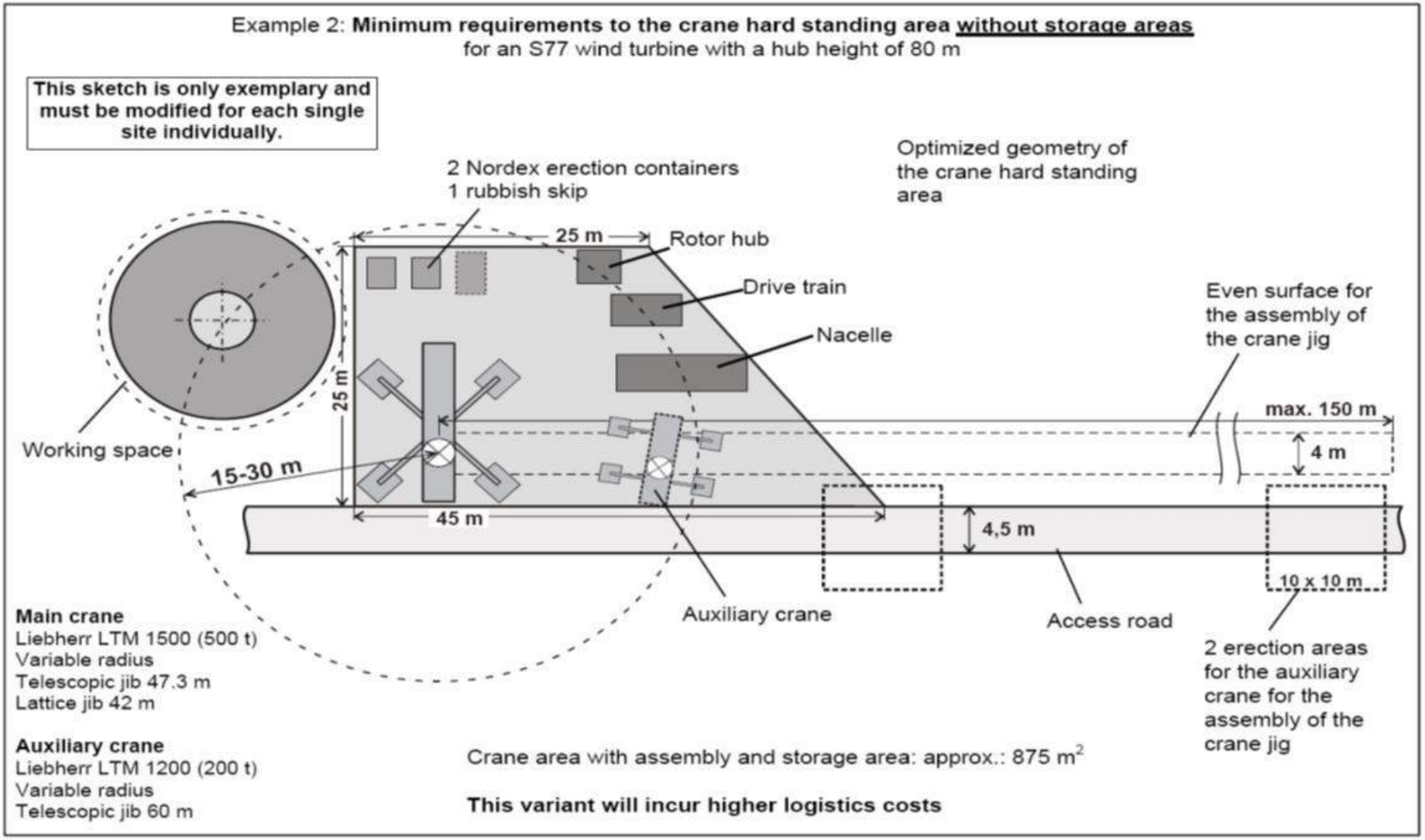
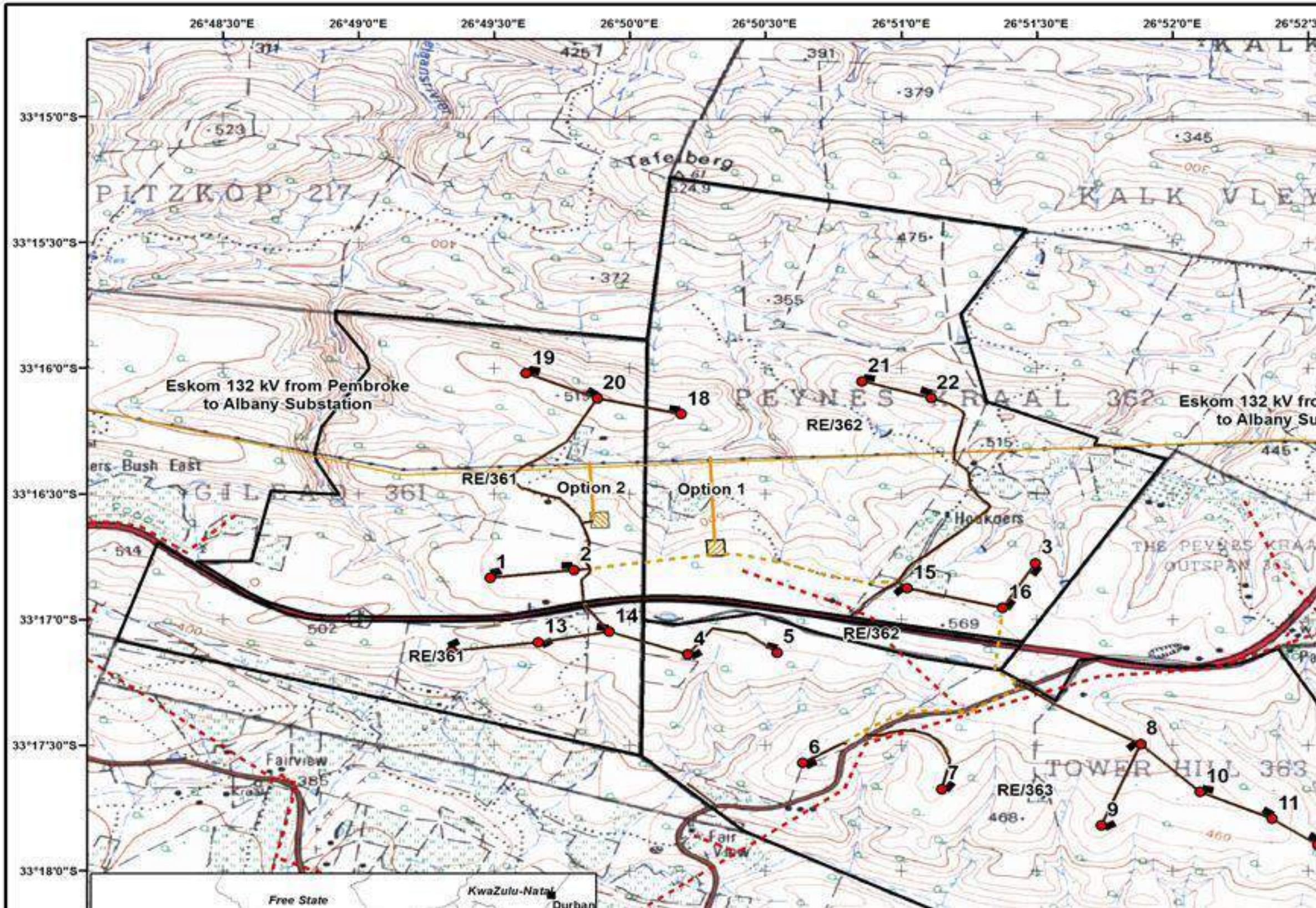


Figure 2-3: Typical illustration of the floor plan for the crane hardstanding area
(Ref: Transport, Access Roads and Crane Requirements Nordex N80/2500, N90/2500, N100/2500 Version gamma, Nordex Energy GmbH, Bornbarch 2, 22848 Norderstedt, Germany, K0801_011803_EN Revision 02, 2009-12-04


26°48'30"E
26°49'0"E
26°49'30"E
26°50'0"E
26°50'30"E
26°51'0"E
26°51'30"E
26°52'0"E
33°15'0"S
33°15'30"S
33°16'0"S
33°16'30"S
33°17'0"S
33°17'30"S
33°18'0"S
PITZKOP 217
KALK VLEY
Tafelberg
PEYNES KRAAL 362
GILEAD 361
TOWER HILL 363
Eskom 132 kV from Pembroke to Albany Substation
Eskom 132 kV from Pembroke to Albany Substation
RE/361
RE/362
RE/363
Option 1
Option 2
Hoekoers
Fairview
Free State
KwaZulu-Natal
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2.2.3 Construction Phase

This phase comprises of the following sub phases:

(a) Geotechnical studies and foundation works

A geotechnical study of the area is always undertaken for safety purposes. This comprises disturbed and undisturbed sampling (e.g. trial pitting), core drilling, penetration and pressure assessments. Please note that a preliminary walk over investigation has been conducted and that a detailed geotechnical investigation will only be conducted once (and if) the project receives environmental authorisation. The preliminary investigation has found no fatal flaws from a geotechnical perspective. For the purpose of the foundations, approximately 500 m^3 of substrate would need to be excavated for each turbine. These excavations will then be filled with steel-reinforced concrete. Approximately 221,000 m^3 of G5 (rock chips with diameter of between 53 mm & 63 mm) fill material is required from commercial sources or a borrow pit on site. The geotechnical desktop assessment has indicated G5 material is available from borrow pits on site. The foundation design and concrete requirements can vary according to the quality and characteristics of the soil and underlying geology.

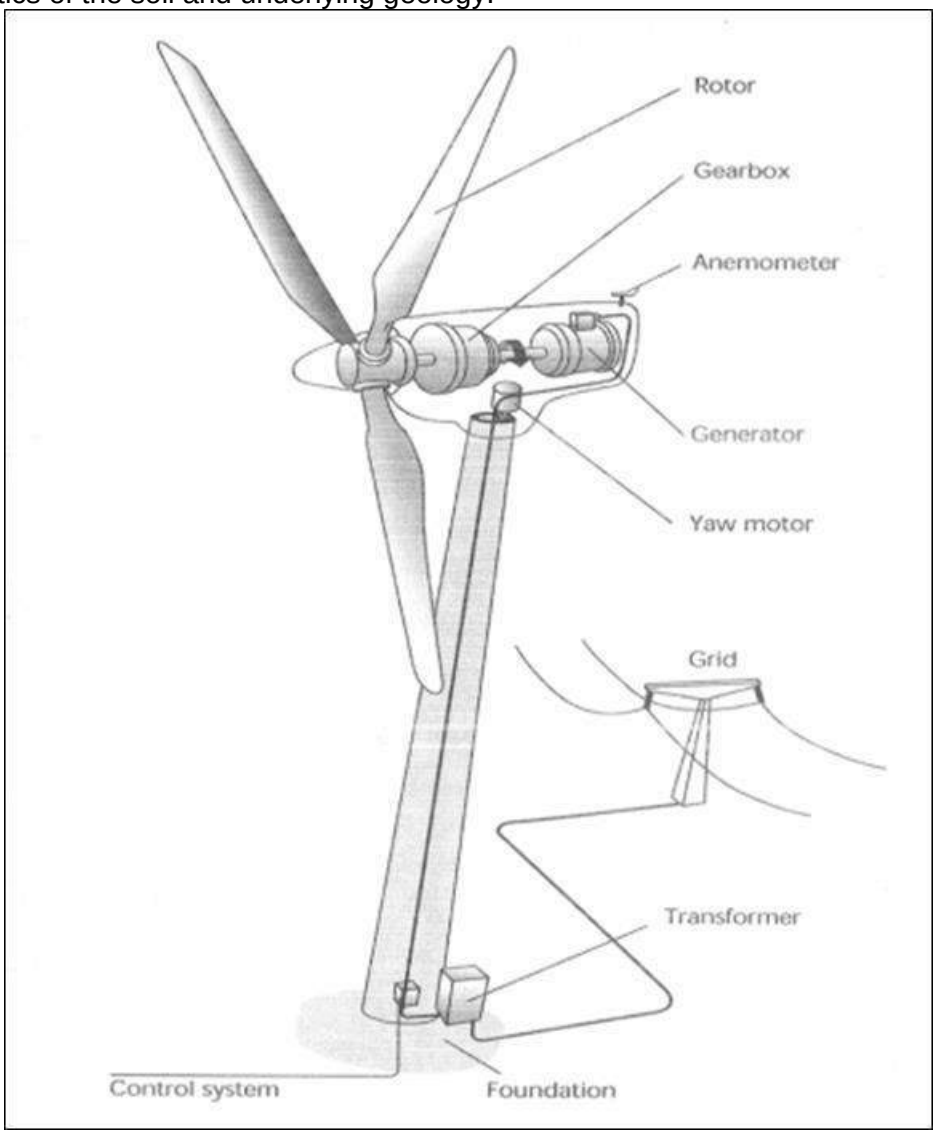


Figure 2-5: Illustration of the main components of a typical wind turbine (note that the transformer can be located inside the tower section of each turbine)

The main dimensions for the foundation of a 3MW/91.5 m high wind turbine are shown in the Figure 2-10 with underground foundation, tower base, above ground foundation, and ground level.

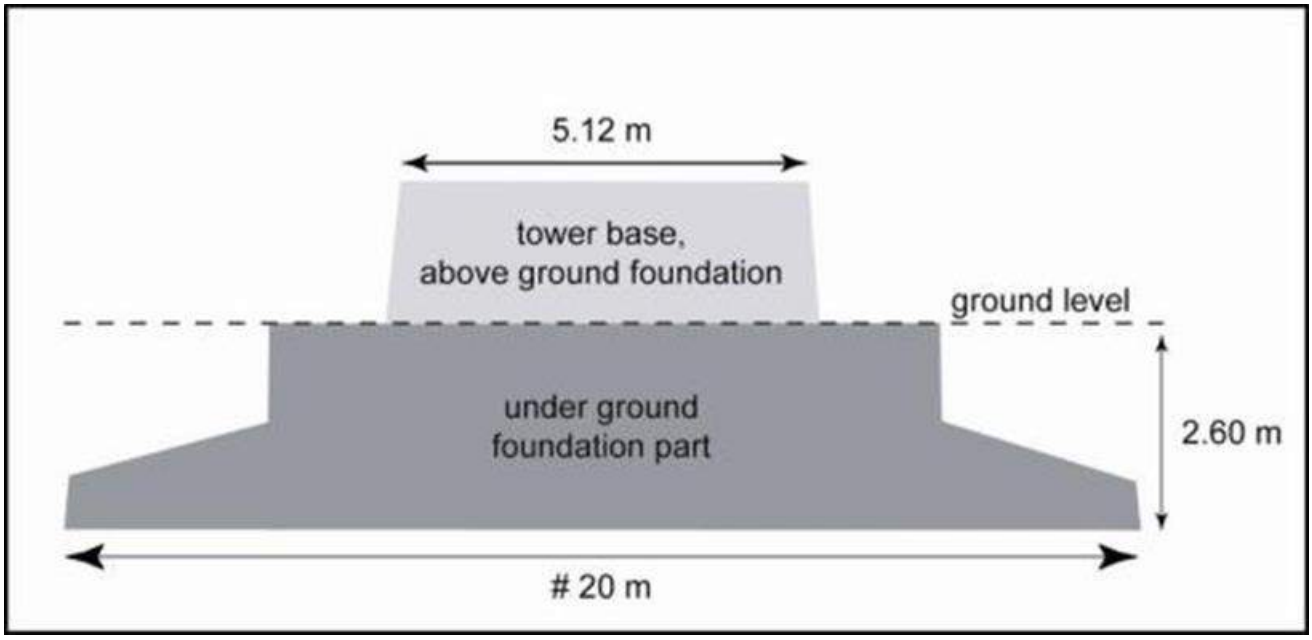


Figure 2-6: The main dimensions for the foundation of a 3MW/91.5 m high wind turbine

(b) Turbine erection

After excavation, foundations need to be laid and the concrete allowed to set to achieve its full design strength. This is the longest part of the process, and is typically 28 days from casting to erection. The process of erection is quick (around 3 days per turbine) if the weather conditions permit. This phase is also the most complex and costly and utilises heavy lift cranes in the assembly process (Figure 2-10).

(c) Roads

Internal roads, varying in width from 4.7 m - 8 m wide will connect each turbine, the substation and the N2 highway. These roads cannot be of a gradient of more than 6% otherwise trucks transporting the turbine components will not be able to reach their target sites. Steep roads may need to be concreted to prevent erosion. To a large extent existing farm roads will be utilised, although they will need to be upgraded. Some realignment will also be necessary to remove tight bends. Further conditions with which internal access roads must comply are the following:

- 40 cm thick crusher run sub-base and wearing course on 30 cm compacted sand
- Curve radius of at least 35 m

(d) Construction plant, cranes, lay down areas and construction platforms

A temporary ‘construction platform’ is required at each turbine foundation site to ensure safe and stable access by heavy machinery and equipment (bulldozers, trucks, cranes etc.) during the construction phase.

Plate 2-1: Assembly and erection of the tower sections

Once the wind farm is operational, the construction platforms can be partially rehabilitated to reduce the final cumulative area of the total development footprint of the individual turbines.

(e) Grid connection and substation

Each turbine is fitted with its own transformer (inside or outside the WTG) that steps up the voltage, usually from 660v to 22 KV or 33 KV. The substation to be constructed on site (refer to Figure 2-3, 2-7 and 2-8) will allow the interconnection of the electricity generated on site into the ESKOM grid.

All electrical and communication cables are run approximately 0.5 m – 1 m deep below ground level, adjacent to the access roads. An overhead 132 KV line will connect the project substation to the existing Eskom line that traverses the site in an east-west orientation.

(f) Water use requirements

It is likely that batch mixing of concrete will be conducted on site. Plan 8 has received confirmation of a non-binding agreement of water availability from the Department of Water Affairs to utilise 20,379m^3 of water during the planned 18-month construction phase of the project. The water source is a borehole on the farm Tower Hill.

(g) Transport routes and volumes

Turbine components will be transported from the Port of Ngqura at Coega via the N2 to the site. Transport of components will be arranged in conjunction with local traffic authorities to ensure safe transit and minimise disruption to normal traffic flow on this important highway. Turbine components may be transported at night when traffic volumes on the roads are less.

2.2.4 Operational phase

During the period when the turbines are up and running, on-site human activity drops to a minimum, and includes routine maintenance requiring only light vehicles to access the site. Only major breakdowns would necessitate the use of cranes and trucks.

2.2.5 Refurbishment and rehabilitation of the site after operation

Current wind turbines are designed to last for over 25 years (this figure can be extended by another 25 years if refurbishment takes place). Plan 8 (Pty) Ltd undertakes to dismantle all wind turbines and foundations to a depth of 1 metre underground at the end of the project's life. The excavation is backfilled with soil, and grass is replanted in order restore the site's appearance to its original state within a matter of weeks. The only residual material is the deeper concrete works below surface.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

In terms of section 31 (2) of the EIA regulations (2010), a*n environmental impact assessment report must include:-*
(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

In line with the above-mentioned regulatory requirement this chapter provides a description of the natural and socio-economic environments that could potentially be impacted by the proposed Plan 8 Grahamstown Wind Energy Project. Previous studies have included detailed descriptions of the general characteristics of the area in terms of climate, topography, hydrology, geology and hydro-geology, and a synthesis of this information is provided in this chapter. Descriptions of the flora and fauna are based on on-site investigations and a survey of the relevant literature to determine what could legitimately be expected to be found in the study area.

3.1 The Bio-physical Environment

3.1.1 Climate

Due to its the location at the confluence of the temperate and subtropical climatic regimes the Eastern Cape Province of South Africa has a complex climate. There are wide variations in temperature, rainfall and wind patterns, mainly as a result of movements of air masses, altitude, mountain orientation and the proximity of the Indian Ocean.

The region in which the project area is situated is at the heart of three major transitional climatic regions:

1. From the south-western region there is a maritime influence of winter rainfall. In this region it changes to spring and autumn rainfall with south easterly winds bringing torrential rains which are very variable and inconsistent.
2. From Grahamstown north–eastwards the rainfall changes to a general summer rainfall.
3. The interior south of the Winterberg is affected by both these climatic patterns, with cold fronts and little winter rain, but summer rain from sporadic thunder showers.

Winds and alternating cold and warm fronts thus make for a very variable climate throughout the region. Grahamstown normally receives about 470m of rainfall per year and, because it receives most of its rainfall during winter, it has a Mediterranean climate. On average Grahamstown receives the lowest rainfall (16 mm) in July and the highest (57 mm) in March. The monthly distribution of average daily maximum temperatures indicates that the average midday temperatures for Grahamstown range from 18.9°C in July to 26.8°C in February. The region is the coldest during July when the mercury drops to 5.6°C on average during the night.

3.1.2 Topography

The Eastern Cape Province contains a wide variety of landscapes, from the stark Karoo (the semi-desert region of the central interior of the country) to mountain ranges and gentle hills rolling down to the sea. The climate and topography give rise to the great diversity of vegetation types and habitats found in the region. The mountainous area on the northern boundary of the province forms part of the Great Escarpment. Another part of the escarpment lies just north of Bisho, Somerset East and Graaff-Reinet. In the south of the province the Cape Folded Mountains start between East London and Port Elizabeth and continue westward into the Western Cape. As is the situation in KwaZulu-Natal, the Eastern Cape is characterised by a large number of short, deeply incised rivers flowing parallel to each other. The area of the proposed wind energy facility comprises a series of ridges which are flat to undulating, surrounding deeply incised valleys and undulating hills (Plate 3.1).

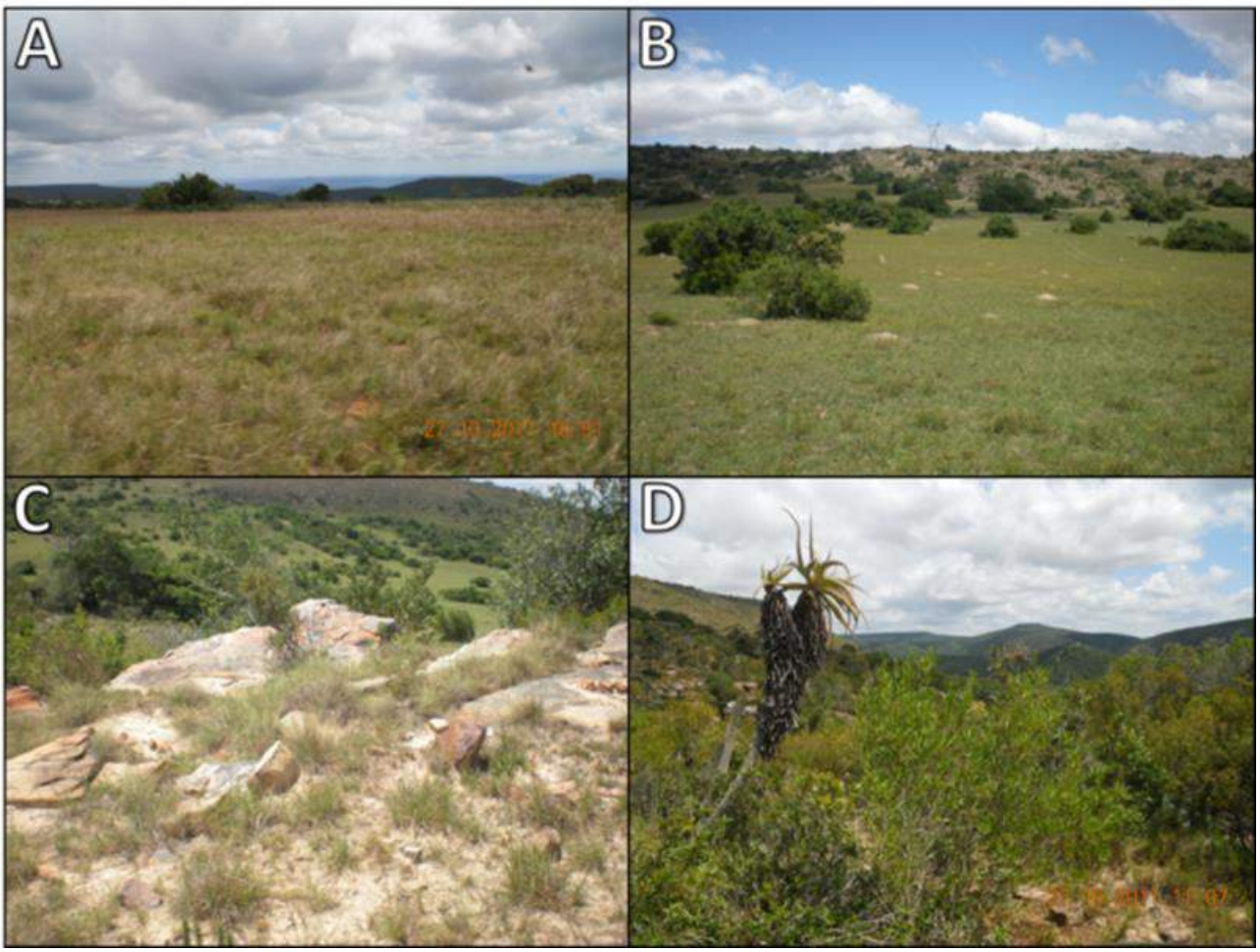


Plate 3-1: Topography of the site

3.1.3 Geology and Soils

Grahamstown is situated in the eastern part of the Cape Fold Belt and is underlain mainly by rocks of the Witteberg Group of the Cape Supergroup, and the Dwyka and Ecca groups of the Karoo Supergroup. In the general area the oldest rocks of the Cape Supergroup are the shales and sandstones of the Weltevrede Formation, overlain by resistant quartz arenites of the Witpoort Formation. These quartzites are overlain by fine-grained shales and thin sandstones of the Lake Mentz and Kommadagga subgroups (Jacob *et al*., 2004).

The published geological map of the Grahamstown region (Council for Geoscience, 1995) does not indicate the presence of the Kommadagga Subgroup in the Grahamstown area (Figure 3-1). However, the Miller, Swartwaterspoort and Soutkloof formations of the Kommadagga Subgroup crop out west of Grahamstown, as well as the lowermost Dirkskraal Formation, immediately below the Dwyka Group.

The rocks in the Kommadagga Subgroup are mainly shales, with minor greywacke and arenite sandstone units. Feldspar content increases upward in these rocks near the base of the Dwyka Group, reflecting cooler and drier conditions at the onset of glaciation. The Witteberg Group rocks are overlain by rocks of the Dwyka Group, the basal unit of the Karoo Supergroup. The contact generally is poorly exposed but probably is paraconformable (Jacob *et al.*, 2005).

The Dwyka consists mainly of glacial diamictite and is composed of a variety of angular to rounded clasts of various igneous and sedimentary rocks set in a fine-grained, dark, massive argillaceous matrix. The overlying argillaceous and arenaceous rocks of the Ecca Group occur mainly to the north of the area. In the area around Grahamstown, the Dwyka Group forms a syncline whose fold

axial trace trends East South East (ESE) (see Figure 3-1).

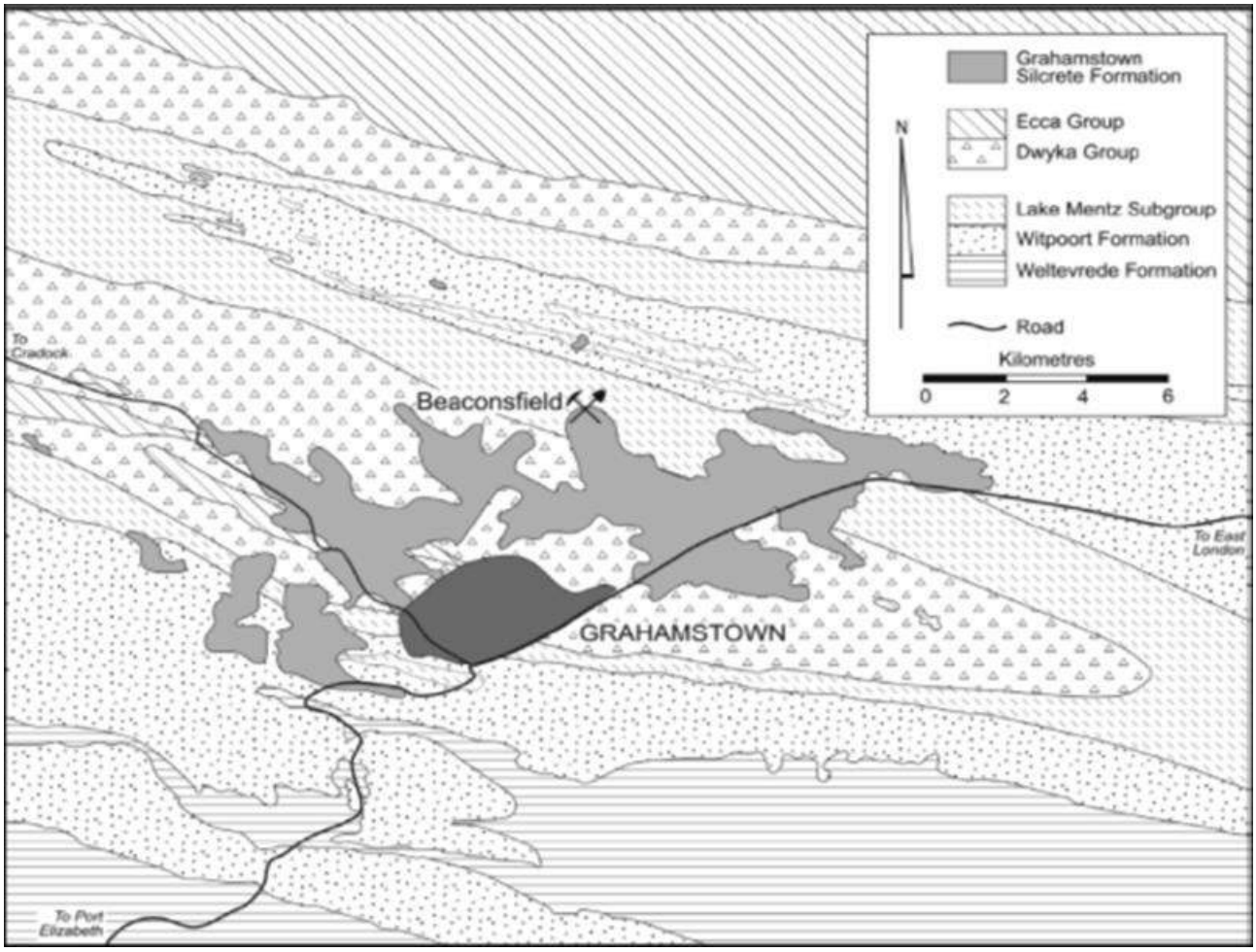


Figure 3-1: Simplified geological map of the area around Grahamstown
Adapted from 1:250000 scale sheet 3326 Grahamstown. Source:Jacob *et al.* (2004)

This syncline plunges at a low angle to the West North West (WNW). To the north and south of the syncline, quartzite ridges of the Witpoort Formation form the higher-lying hills that enclose the area where the Grahamstown peneplain was developed. The peneplain varies in altitude from 620 to 660m above sea level. The original peneplain extended more than 300 km^2. However, only a remnant, about 34 km^2, remains. Remnants of this peneplain owe their preservation to the resistant layer of silcrete, which hinders erosional destruction. Clay deposits underlie the peneplain and represent mainly the deeply weathered profile that developed during Cretaceous to Tertiary times.

3.2 Vegetation and Floristics

The vegetation of the Eastern Cape is complex and is transitional between the Cape and subtropical floras, and many taxa of diverse phytogeographical affinities reach the limits of their distribution in this region. The region is best described as a tension zone where four major biomes converge and overlap (Lubke *et al*., 1988). The dominant vegetation is Succulent Thicket (Spekboomveld or Valley Bushveld), a dense spiny vegetation type unique to this region. While species in the canopy are of subtropical affinities, and generally widespread species, the succulents and geophytes that comprise the understorey are of karroid affinities and are often localised endemics.

The Makana area is a region of floral transition and complexity, as it forms a major climatic, topographical, geological and pedological (soil) transition zone where four phytogeographical

regions (plant regions) converge. The Cape floral elements extend eastwards along the Cape Mountains and diminish in abundance from Grahamstown to the east. The Tongoland-Pondoland flora enters the region along the east coast, and thicket vegetation penetrates up the river valleys. The succulent and sub-desert shrublands of the Karoo-Namib region extend down the dry river valleys from the arid interior. Afromontane elements of grassland and forest vegetation types extend down the mountains of Africa. In many of the plant communities of the area, a great complexity of floral elements is evident, and the area is described as a phytochorologically mixed flora. This means that the area is rich in plant diversity, with numerous interesting plants from a range of plant regions.

Albany, honouring the Duke of York, was the name given to the region (formerly called Zuurveld) around Grahamstown in 1814. This name has been used by botanists and phytogeographers to recognise a centre of endemism, an area with unusually high concentrations of plant species with restricted distributions (van Wyk and Smith, 2001). The Albany Centre is an important area of succulent endemism, many of which are associated with the xeric thicket vegetation in the region.
As described above, Grahamstown falls within the Albany Centre of Floristic Endemism; also known as the Albany Hotspot (Figure 3-2). This is an important centre for plant taxa, and, according to van Wyk and Smith (2001), contains approximately 4000 vascular plant species with approximately 15% either endemic or near-endemic (Victor and Dold, 2003). This area was delimited as the 'region bounded in the west by the upper reaches of the Sundays and Great Fish River basins, in the east by the Indian Ocean, in the south by the Gamtoos–Groot River basin and in the north by the Kei River basin' (Victor and Dold, 2003)

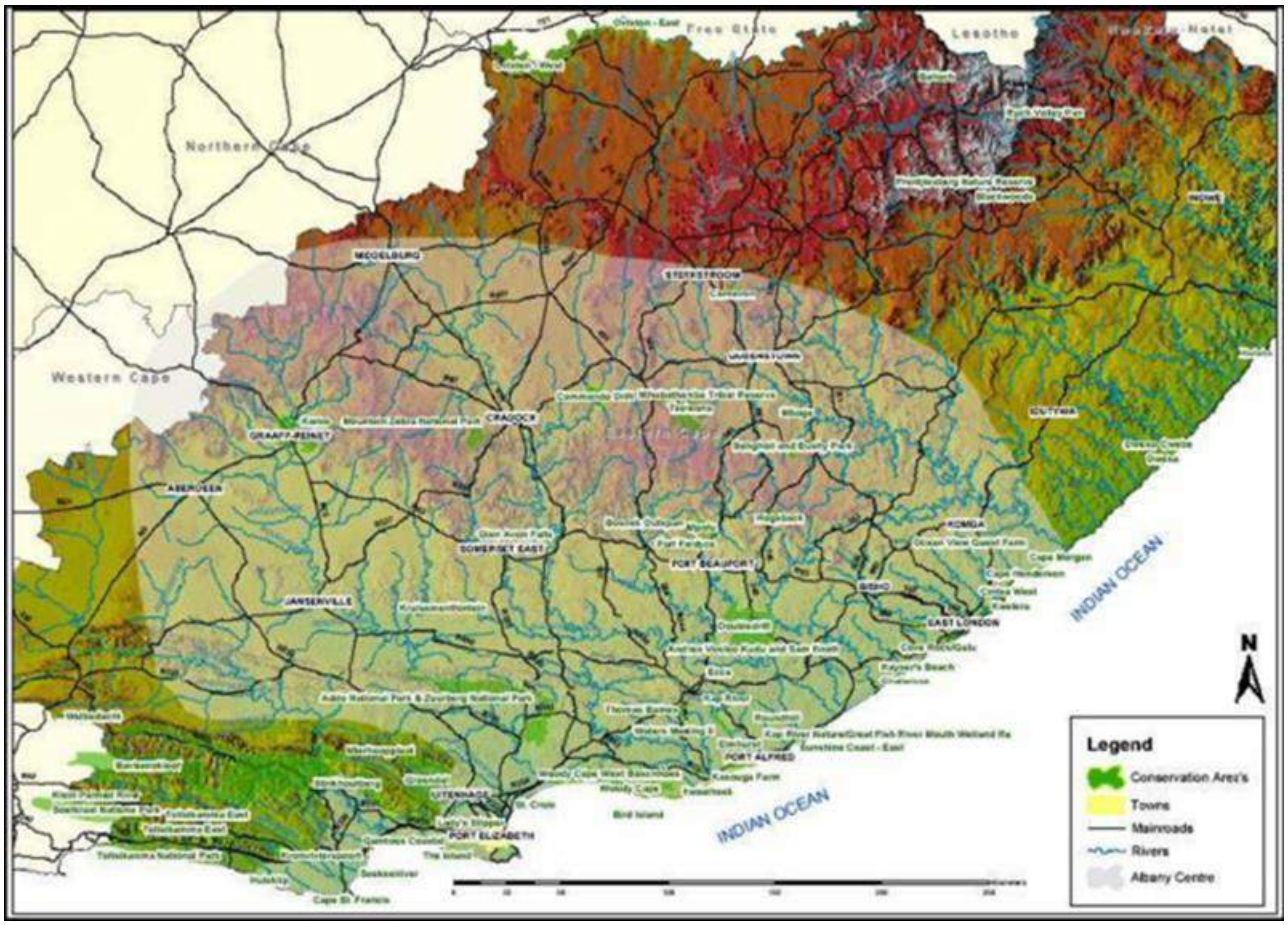


Figure 3-2: The Albany Centre of Endemism, also known as the 'Albany Hotspot', has long been recognised as an important centre of plant species diversity and endemism
(From van Wyk and Smith 2001).

3.2.1 Species of Special Concern (SSC)

Species endemic to the area are described by Mucina and Rutherford (2006). In addition to the endemic taxa there are also a number of species expected to be found in the study area, some of which are listed as protected by various conservation bodies. The list is not complete, as many species and taxa require additional study. The taxa with many data deficient species include specifically the Mesembranthemaceae family, which Victor and Dold (2003) estimate would have 72 species that should, but do not, occur on the list.

Thus all species of the family are included as Species of Special Concern (SSC). Victor and Dold (2003) also include a number of other taxa as important; including members of the Amaryllidaceae (Amaryllids), Iridaceae (Irises), Orchidaceae (Orchids) and Apocynaceae (Lianas), as well as members of the genus Aloe. Potential Species of Special Concern (PSSC) include all those plants listed in terms of the IUCN, CITES and both national and provincial legislation that may occur in the area of study. If any of these species are found to occur on site, they are given the status of Confirmed Species of Special Concern (CSSC).

The list of PSSC includes over 130 species which are listed individually by Victor and Dold (2003), the IUCN red data list, the South African National Biodiversity Institute (SANBI), the Forests Act and the Provincial Conservation Ordinance (PNCO) 16 of 1974 for the Eastern Cape. In addition, the PNCO lists eight plant families and six plant genera that are afforded blanket protection throughout the province. Confirmed Species of Special Concern (CSSC) were identified from the ecological assessment (Table 3-1).

Table 3-1: Confirmed Species of Special Concern recorded on site

Species name	Protection
Sideroxylon inerme	Forest Act (Protected trees)
Pelargonium reniforme	IUCN
Aloe africana	PNCO, CITES
Aristea abyssinica	PNCO
Aloe maculata	PNCO, CITES
Watsonia sp.	PNCO
Leucospermum cuneiforme	PNCO
Protea repens	PNCO
Bobartia orientalis	PNCO
Satyrium sp.	PNCO
Aloe ciliaris	PNCO, CITES
Aloe striata	PNCO, CITES
Moraea sp.	PNCO

3.2.2 Alien invasive species

It is likely that a number of alien invasive species already occur on site, some of these are shown in Plate 3.3 below. It is important that these are properly controlled. Additional information is available in the Ecological Impact Assessment.

3.2.3 Regional Vegetation

The vegetation types described by Mucina and Rutherford (2006) for the area are Kowie Thicket and Bisho Thornveld (Figure 3-3):

Kowie Thicket

This vegetation type is restricted to the Eastern Cape Province, in river valleys (Mucina & Rutherford 2006). It occurs on mainly steep and north-facing (dry) slopes. Tall thickets dominated by succulent euphorbias and aloes with a thick understory composed of thorny shrubs, woody lianas (*Capparis, Secamore, Rhoicissus, Aloe*), and shrubby succulents (Crassulaceae,

Asphodelaceae). Moister south-facing slopes support thorny thickets dominated by low evergreen trees (*Azima, Carissa, Gymnosporia, Putterlickia*) with fewer succulent shrubs and trees. The herbaceous layer is poorly developed (Mucina & Rutherford 2006).

This vegetation type is listed as Least Threatened, with a conservation target of 19% (Mucina & Rutherford 2006). 5% is statutorily conserved and 14% in private conservation areas. 7% is transformed, primarily by cultivation. This vegetation type is the core of the Albany Thicket Biome and the major floristic node of the Albany Centre of endemism (Mucina & Rutherford 2006).

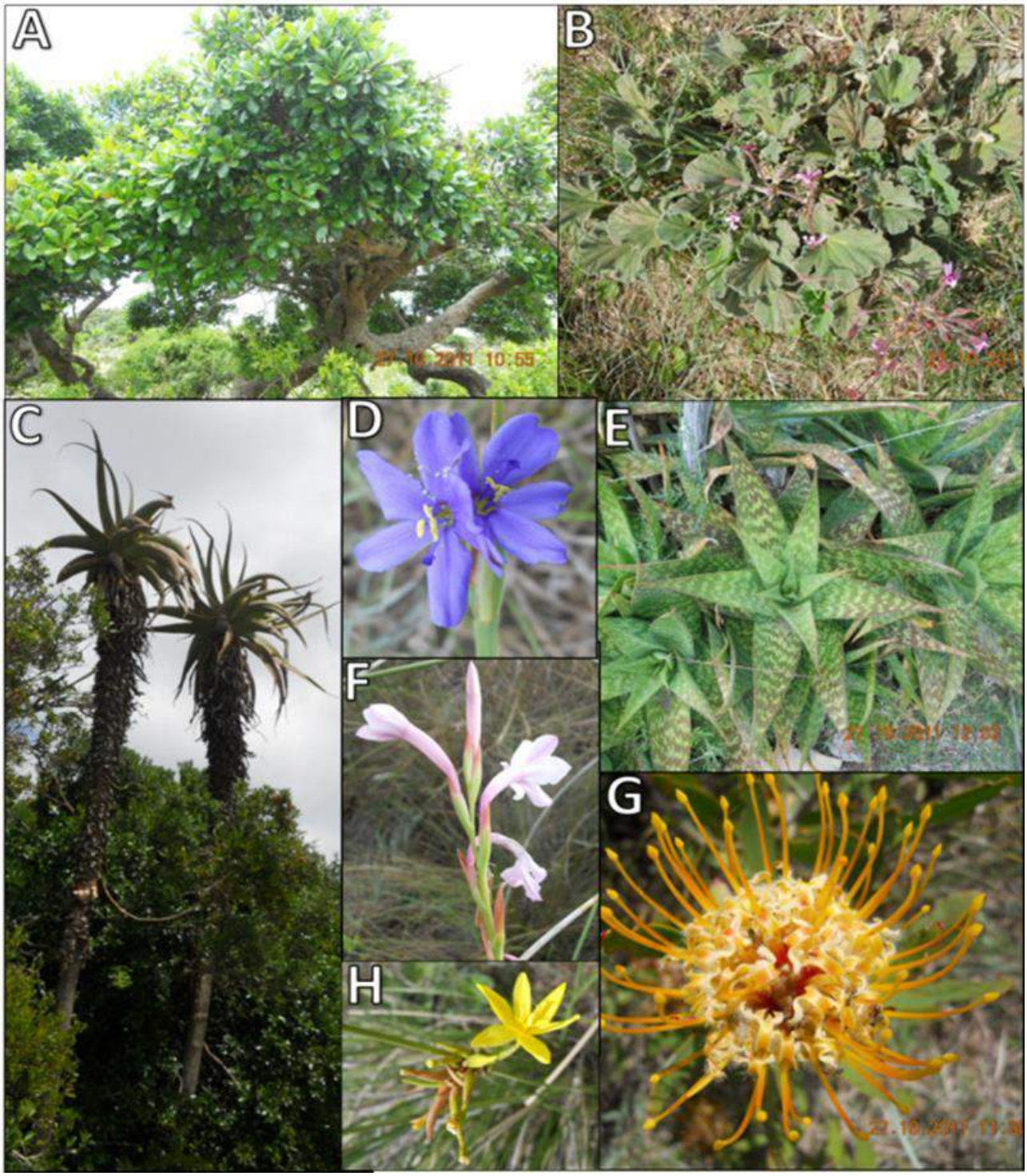


Plate 3-2: Confirmed Species of Special Concern (CSSC).

A: *Sideroxylon inerme* (Forest Act), B: *Pelargonium reniforme* (IUCN), C: *Aloe africana* (PNCO, CITES), D: *Aristea abyssinica* (PNCO), E: *Aloe maculata* (PNCO, CITES), F: *Watsonia sp* (PNCO), G: *Leucospermum sp* (PNCO) and H: *Bobaria orientalis* (PNCO).

Plate 3-3: Some alien invasive species
A: *Echinopsis spachiana* (Schedule 1), B: *Eucalyptus grandis* (Schedule 2), C: *Agave Americana* (Schedule 2), D: *Opuntiaficus-indica* (Schedule 1) and E: *Acacia mearnsii* (Schedule 2).

Bisho Thornveld

This vegetation type occurs in the Eastern Cape Province inland from the coast from Mthatha to North of East London as far as Fort Beaufort and occurring near Grahamstown (Mucina &

Rutherford 2006). Bhisho Thornveld occurs on undulating plains and shallow drainage valleys. It comprises open savannah characterised by small trees *of Acacia natalitia* with a short to medium, dense, sour grassy understory, usually dominated by *Themeda triandra*. A diversity of other woody species may occur, increasing under conditions of overgrazing. The vegetation type is wide-ranging, and fire and grazing are important determinants (Mucina & Rutherford 2006).

This vegetation type is listed at Least Threatened by Mucina and Rutherford (2006). The conservation target is 25%, with only 0.2% statutorily conserved and 2% privately conserved. 20% has been transformed, mainly for cultivation, urban development or plantations (Mucina & Rutherford 2006).

STEP describes the vegetation types of the area as Grahamstown grassland thicket, Albany Coastal Thornveld and Albany Valley Thicket (Figure 3-4).

Grahamstown Grassland Thicket

Thicket clumps are typical of Albany Thicket, and contain taaibos (*Rhus pallens*), katdoring (*Scutia myrtina*), kiepersol (*Cussonia spicata*) and poison peach (*Diospyros dicrophylla*) (Pierce & Mader 2006). The grassland matrix has many fynbos elements (*Erica* sp and *Restio triticeus*) as well as numerous species of rare localised endemic species, such as the genus *Brachystelma*.

Grahamstown Grassland Thicket is listed as Least Threatened by STEP (Pierce & Mader 2006).

Albany Coastal Thornveld

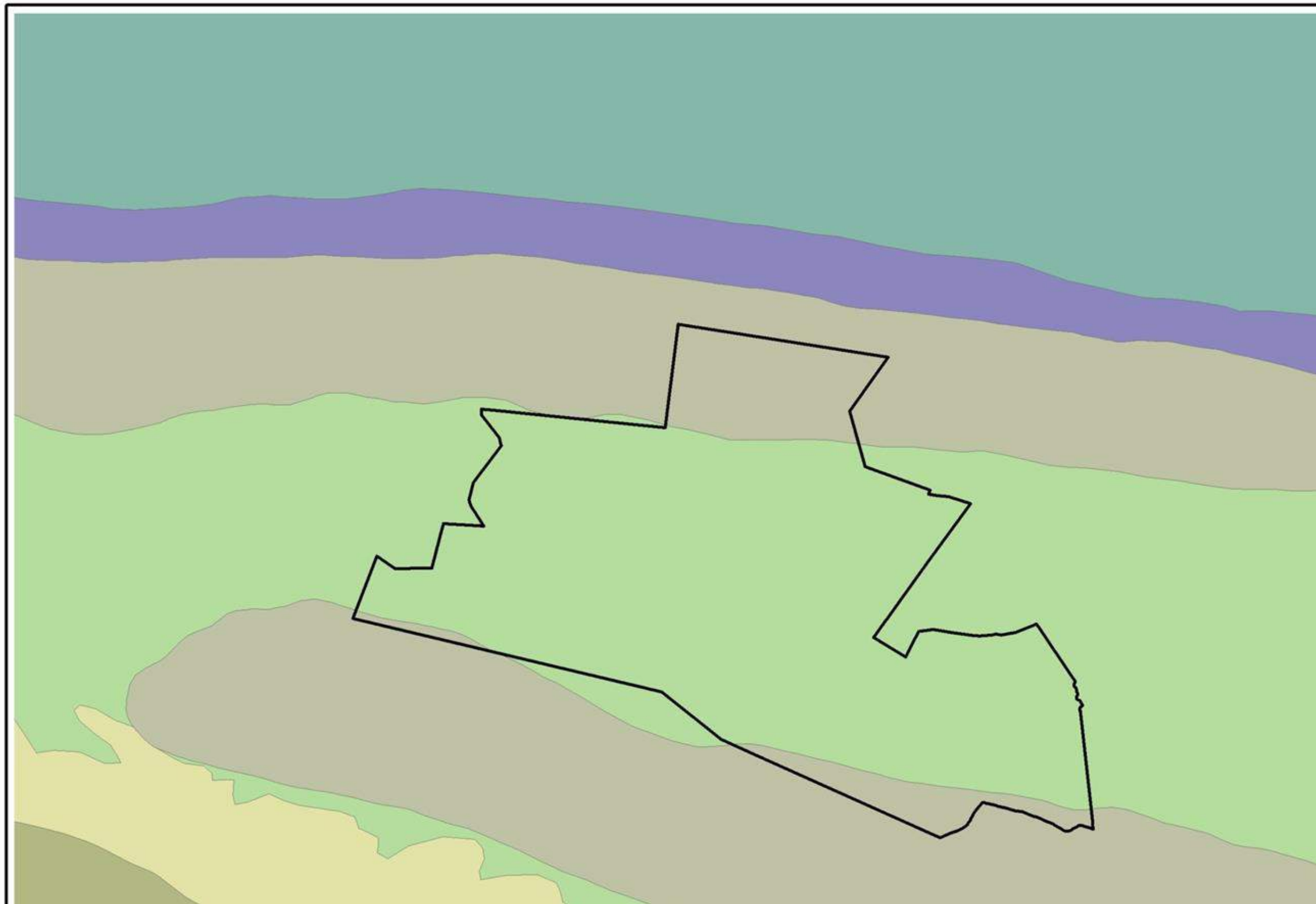
Albany Coastal Thornveld is dominated by sweet thorn trees (*Acacia karroo*) and dense grassland dominated by *Themeda triandra*, *Heteropogon contortus* and *Tristachya leucothrix* with an admixture of fynbos elements (Pierce & Mader 2006).

This vegetation type is listed at Least Threatened by STEP (Pierce & Mader 2006).

Albany Valley Thicket

The dominant tree species of Albany Thicket include doppruim (*Pappea capensis*) and qwarrie (*Euclea undulata*) (Pierce & Mader 2006). Characteristic species include the succulents *Aloe African*a and *Kalanchoe rotundifolia*. The most distinguishing feature is the tall *Euphorbia tetragona* plants emerging above the canopy.

Albany Valley Thicket is listed as Vulnerable by STEP (Pierce & Mader 2006). Refer to figure 3.4 to view the extent of this vegetation type over the project area.



3.2.4 Subtropical Thicket Ecosystem Planning (STEP) Project

The STEP Project covers the south-eastern Cape region, which extends from the Kei River to Riversdale. The project area covers the unique, indigenous vegetation type known as thicket, with the aim being to assess the region's biodiversity. The assessment measured how much of the thicket vegetation had been damaged or destroyed through anthropogenic impacts and determined the degree to which biodiversity is endangered in different areas. The project aims to guide the necessary but destructive development away from areas of endangered biodiversity and promote sustainable land use.

In terms of STEP (2004) a feature that has much more extant habitat than is needed to meet its target is considered Currently Not Vulnerable OR Least Threatened (Table 3-2).

For Currently Not Vulnerable vegetation, STEP recommends three Land use management procedures, these include:

a) Proposed disturbance or developments should preferably take place on portions which have already undergone disturbance or impacts rather than on portions that are undisturbed or unspoilt by impacts.
b) In response to an application for a non-listed activity which will have severe or large-scale disturbance on a relatively undisturbed site (unspoilt by impacts), the Municipality should first seek the opinion of the local conservation authority.
c) For a proposed "listed activity", EIA authorisation is required by law.

From a Spatial planning (forward planning – Spatial Development Framework (SDF's)) point of view, for Currently Not Vulnerable vegetation, STEP presents two restrictions and gives examples of opportunities. The two spatial planning restrictions are as follows:

- Proposed disturbance or developments should preferably take place on portions which have already undergone disturbance or impacts rather than on portions that are undisturbed.
- In general, Class IV land can withstand loss of disturbance to natural areas through human activities and developments.

Opportunities depend on constraints (such as avoidance of spoiling scenery or wilderness, or infra-structure limitations) Class IV land can withstand loss of, or disturbance to, natural areas. Within the constraints, this class may be suitable for a wide range of activities (e.g. extensive urban development, cultivation, tourist accommodation, ecotourism and game faming).

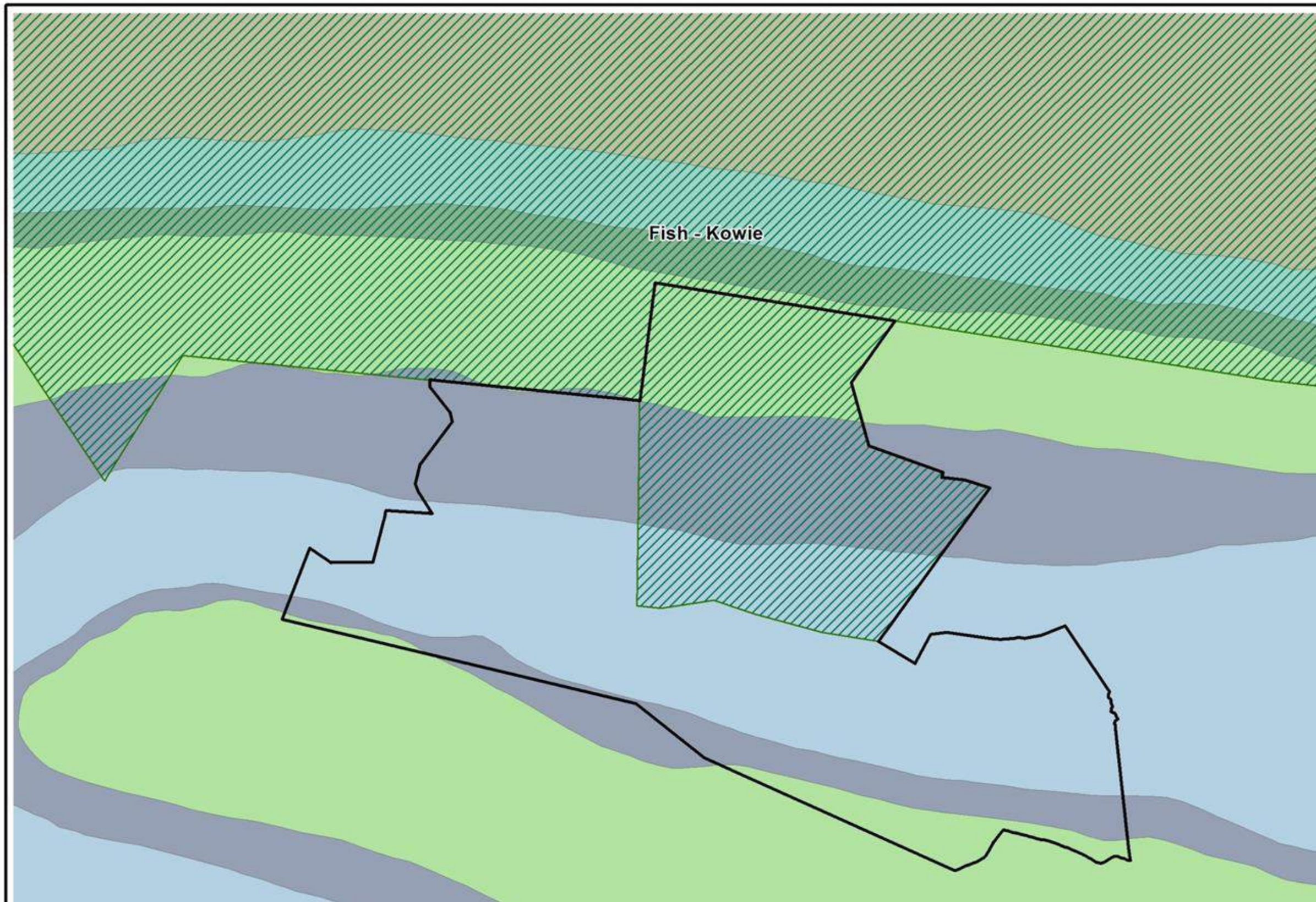
Table 3-2: Summary of the STEP Project conservation priorities, classifications and general rules

Conservation priority	Classification	Brief Description	General Rule
IV	Currently not vulnerable area	Ecosystems which cover most of their original extent and which are mostly intact, healthy and functioning	Depending on other factors, this land can withstand loss of natural area through disturbance or development
III	Vulnerable area	Ecosystems which cover much of their original extent but where further disturbance or destruction could harm their health and functioning	This land can withstand limited loss of area through disturbance or development
II	Endangered area	Ecosystems whose original extent has been severely reduced, and whose health, functioning and existence is	This land can withstand minimal loss of natural area through disturbance or development

Conservation priority	Classification	Brief Description	General Rule
		endangered	
I (Highest Priority)	Critically endangered area	Ecosystems whose original extent has been so reduced that they are under threat of collapse or disappearance. Included here are special ecosystems such as wetlands and natural forests	This Class I land can NOT withstand loss of natural area through disturbance or development. Any further impacts on these areas must be avoided. Only biodiversity-friendly activities must be permitted.
High Priority	Network Area	A system of natural pathways e.g. for plants and animals, which if safeguarded, will ensure not only their existence, but also their future survival.	Land in Network can only withstand minimal loss of natural area through disturbance and developments
Highest Priority	Process Area	Area where selected natural processes function e.g. river courses, including their streams and riverbanks, interfaces between solid thicket and other vegetation types and sand corridors	Process area can NOT withstand loss of natural area through disturbance and developments
	Municipal reserve, nature reserve, national parks	Protected areas managed for nature conservation by local authorities, province or SA National Parks	No loss of natural areas and no further impacts allowed
Dependant on degree on existing impacts	Impacted Area	Areas severely disturbed or destroyed by human activities, including cultivation, urban development and rural settlements, mines and quarries, forestry plantations and severe overgrazing in solid thicket.	Ability for this land to endure further disturbance of loss of natural area will depend on the land's classification before impacts, and the position, type and severity of the impacts

Source: Pierce, 2003

The northern part of the project area falls within a STEP megaconservancy corridor (Figure 3-5). According to STEP, "The Megaconservancy Networks (MCN) comprise corridors of land along major river valleys and the coast which were identified as needing special safeguarding to ensure the sustainability of socio-economic systems and biodiversity".


Fish - Kowie

3.2.5 Vegetation of the study area

Several different vegetation types occur on site. These are shown in Plate 3.4. Thicket occurs on steep slopes and down to valley bottoms, Grassland occurs on top of ridges where overgrazing is apparent by the overpopulation of *Bobartia orientalis* and *Pteroni incana.*

In much degraded thicket, grassland occurs between overgrazed thicket clumps. In some areas on slopes tending to the tops of ridges, fynbos occurs. This fynbos supports a wide variety of species of special concern and it is expected that several species of the Protea and Iris families will be recorded from this area.

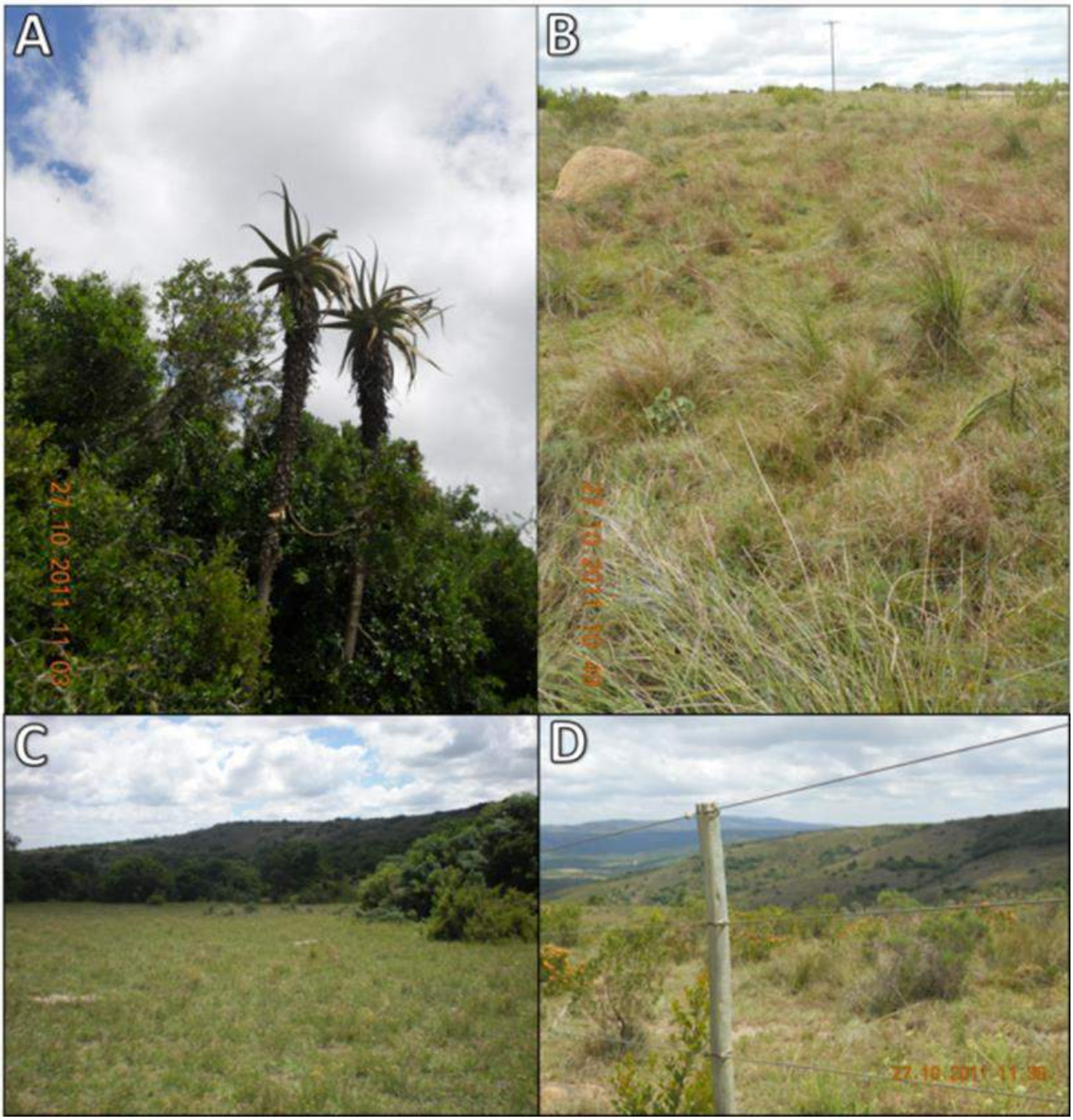


Plate 3-4: Vegetation types from the study area
A: thicket, B: grassland with evidence of overgrazing, C: degraded thicket and D: grassy fynbos.

3.3 Fauna

3.3.1 Habitats

Lack of pristine terrestrial habitat in the Grahamstown area, particularly due to loss of natural vegetation caused by infestation by alien invasive species, urban development and farming, has impacted on terrestrial fauna. Despite this, a few large mammals occur in the region, along with small and medium sized animals. Reptile and amphibians occurring in the area include many species of frogs, tortoises and terrapins, lizards and snakes. Important mammals occurring in the study area include five IUCN Red Data listed species.

3.3.2 Vertebrates

Amphibians and Reptiles

Over one hundred species of reptiles and amphibians occur on the Eastern and Southern Cape Coastal Belt (Branch, 1998). Most are generalists, and represent the transition from temperate to tropical fauna, some montane forms occur in the Cape Fold Mountains (Branch 1998). Amphibians are an important and often neglected component of terrestrial vertebrate faunas. They are well represented in sub-Saharan Africa, from which approximately 600 species have been recorded (Frost, 1985). Currently amphibians are of increasing scientific concern as global reports of declining amphibian populations continue to appear.

Although there is no consensus on a single cause for this phenomenon, there is general agreement that the declines in many areas, even in pristine protected parks, are significant and do not represent simple cyclic events.

Frogs have been aptly called bio-indicator species, whose abundance and diversity is a reflection of the general health and well-being of aquatic ecosystems. They are important components of wetland systems, particularly ephemeral systems from which fish are either excluded or of minor importance. In these habitats, they are dominant predators of invertebrates, many of which may impact significantly on humans as, for instance, vectors of disease. A relatively rich amphibian fauna occurs in the Eastern and Southern Cape coastal region, where 27 species are found, only three of which are endemic (Branch 1998).

The Eastern Cape is home to 133 reptile species including 21 snakes, 27 lizards and eight chelonians (tortoises and turtles) (Branch, 1998). Five species of land tortoises occur in the Eastern Cape, three of which occur within the coastal belt. The Eastern Cape has the richest diversity of land tortoises in the world. These three coastal belt species include the leopard tortoise (*Geochelone pardalis*), the angulate tortoise (*Chersina angulata*) and the parrot-beaked tortoise (*Homopus areolatus*). All three of these tortoise species are listed on the CITES Appendix II list. The cape terrapin *(Pelomedus asubrufa)* is also found in the region (Branch 1998). Over 30 species of snakes occur in the coastal region, of these, only six species are dangerous (Branch,1998).

Birds

Several birds of conservation importance occur in the study area which includes: 11 Vulnerable, and 9 Near Threatened species (IUCN, 2008), 15 CITES Appendix II, and one CITES Appendix I bird species (CES, 2009). Four Species of Special Concern (SSC), all of which are rated as “Vulnerable” may occur in the study area, these include: Denham’s Bustard, Martial Eagle, Black Harrier, and Blue Crane (CES, 2009).

Mammals

Large game makes up less than 15% of the mammal species in South Africa and a much smaller

percentage in numbers and biomass. In developed and farming areas this percentage is greatly reduced, with the vast majority of mammals present being small or medium-sized. Of the 62 mammal species known or expected to occur in the region, none are now considered endemic to the coastal region. Although historical records show that many large animals such as various antelope, elephants, hippopotamuses and lions did occur in the region, they no longer do (Perrin 1998).

The conservation status of South African mammals has recently been re-assessed. The conservation status of some has been downgraded, with the African wild cat, Aardvark, Blue duiker, and Honey badger are no longer considered threatened.

3.3.3 Animal species of special concern

The following reptile species which are relevant to the proposed project site are of conservation concern:

- Endemic and Endangered
  - Albany dwarf adder (*Bitisal banica*)
- IUCN Red Data Species
  - Southern dwarf chameleon (*Bradypodion ventrale*)
  - Cape girdled lizard (*Cordylus cordylus*)
  - Leopard or Mountain Tortoise (*Geochelone pardalis*),
  - Angulate Tortoise (*Chersina angulata*), and
  - Parrot-beaked tortoise (*Homopus areolatus*)
  - Yellow-bellied house snake (*Lamprophis fuscus*)

The following mammals which may occur in the proposed project area are of conservation concern (IUCN):

- Black-footed Cat (*Felis nigripes*)
- Duthie's golden mole (*Chlorotal paduthieae*)
- Straw-coloured fruit bat (*Eidolon helvum*)
- Schreiber's long-fingered bat (*Miniopterus schreibersi*)
- Mountain zebra (*Equus zebra*)

3.4 Terrestrial Invertebrates

Of nearly 650 butterfly species recorded within the borders of South Africa 102 are considered of conservation concern and are listed in the South African Red Data Book (RDB) for Butterflies. According to the most recent IUCN red data list there are no members of the Athropoda (insects, arachnids and crustaceans) Phylum in the area that can be defined as SSC.

3.5 Land Use and the Eastern Cape Biodiversity Conservation Plan (ECBCP)

The Eastern Cape Biodiversity Conservation Plan (ECBCP) is responsible for mapping areas that are priorities for conservation in the province, as well as assigning land use categories to the existing land depending on the state that it is in (Berliner *et al*, 2007).

Critical Biodiversity Areas (CBA) are defined by Berliner *et al.* (2007) as:"CBAs are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning". Biodiversity Land Management Classes (BLMCs) are also used in the plan: "Each BLMC sets out the desired ecological state that an area should be kept in to ensure biodiversity persistence. For example, BLMC 1 refers to areas which are critical for biodiversity persistence and ecosystem functioning, and which should be kept in as natural a condition as possible". Table 3.2 shows how the BLMCs relate to the CBAs. Figure 3-5 indicates the CBAs occurring in and around the proposed project boundary.

Table 3-2: Terrestrial Critical biodiversity Areas and Biodiversity Land Management Classes as described by the Eastern Cape Biodiversity Conservation Plan.

CBA map category	Code	BLMC	
Terrestrial CBAs and BLMCs:			
Protected areas	PA1	BLMC 1	Natural landscapes
	PA2		
Terrestrial CBA 1 (not degraded)	T1		
Terrestrial CBA 1 (degraded)	T1	BLMC 2	Near-natural landscapes
Terrestrial CBA 2	T2		
	C1		
	C2		
Other natural areas	ONA T3	BLMC 3	Functional landscapes
	ONA		
Transformed areas	TF	BLMC 4	Transformed landscapes

Table 3-3: Terrestrial BLMCs and Land Use Objectives

BLMC	Recommended land use objective
BLMC 1: Natural landscapes	Maintain biodiversity in as natural state as possible. Manage for no biodiversity loss.
BLMC 2: Near natural landscapes	Maintain biodiversity in near natural state with minimal loss of ecosystem integrity. No transformation of natural habitat should be permitted.
BLMC 3: Functional landscapes	Manage for sustainable development, keeping natural habitat intact in wetlands (including wetland buffers) and riparian zones. Environmental authorisations should support ecosystem integrity.
BLMC 4: Transformed landscapes	Manage for sustainable development.

3.6 Protected Areas Expansion Strategy

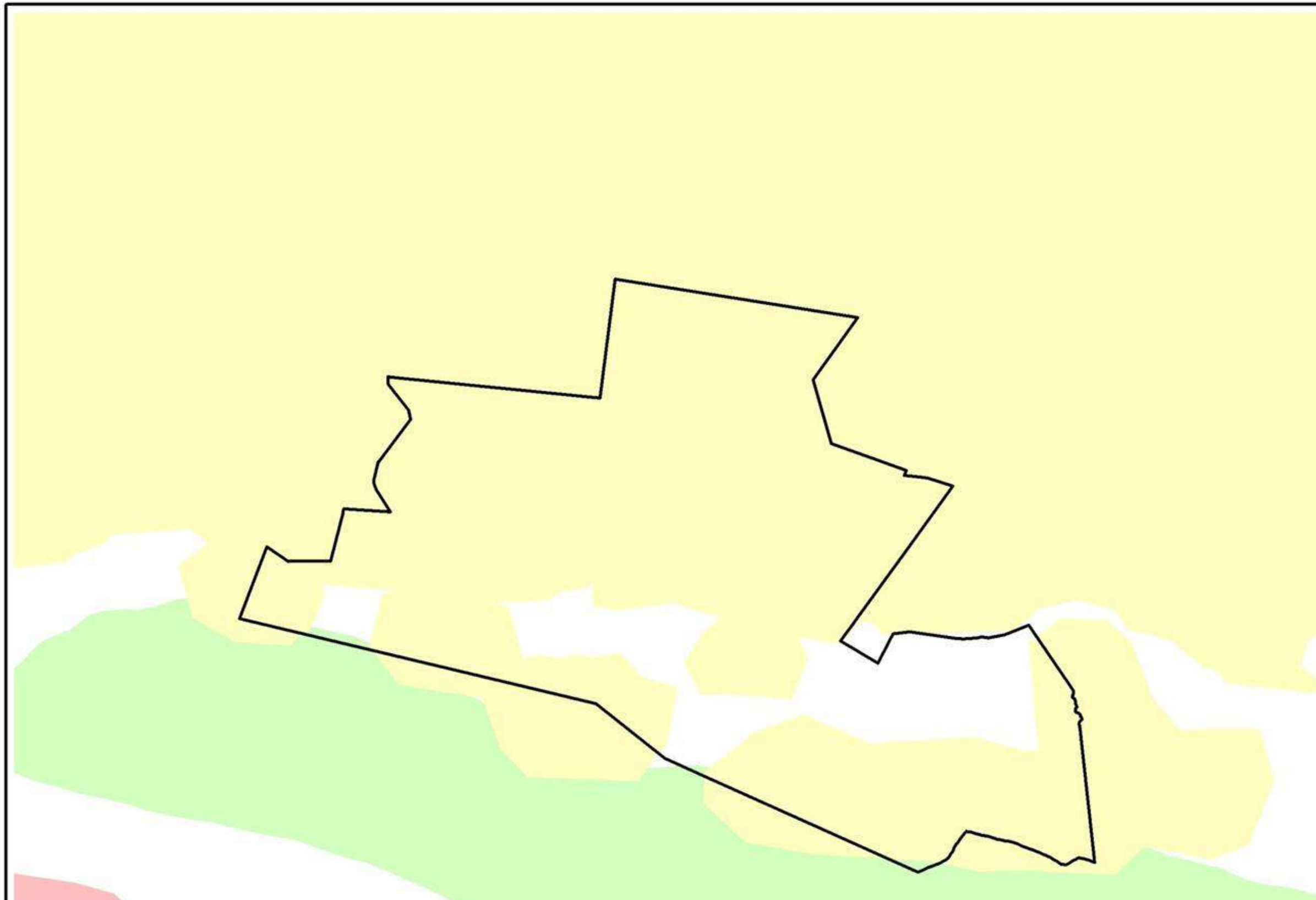
A National Spatial Biodiversity Assessment was conducted in 2004, revealing a lack of protection for a representative sample of the country's biodiversity, nor conserving adequate process areas. The Protected Areas Expansion Strategy allows for increased conservation of these aspects of the country in order to meet national biodiversity targets. The strategy outlines two methods of expanding the current National Protected Areas:

- For public land, the declaration of available, under-utilised and strategic parcels of public land in concordance with the relevant legal requirements for disposal of such land;
- For private land, contractual agreements with the affected landowners.

Areas earmarked for expansion should not be developed as they could constitute National Parks in the future. Protected areas in the region of the project area include (shortest distance to border of project area included brackets):

- Great Fish River Nature Reserve (12.78 km)
- Kowie State Forest (18.3 km)
- Blaauwkrantz Local Authority Nature Reserve (11.5 km)
- Waters Meeting Nature Reserve (17.2 km)
- Roundhill Oribi Local Authority Nature Reserve (10.1 km)
- Kap River Nature Reserve (23.9 km)

Protected Areas and Focus Areas under the Protected Areas Expansion Strategy are shown in the Figure below.



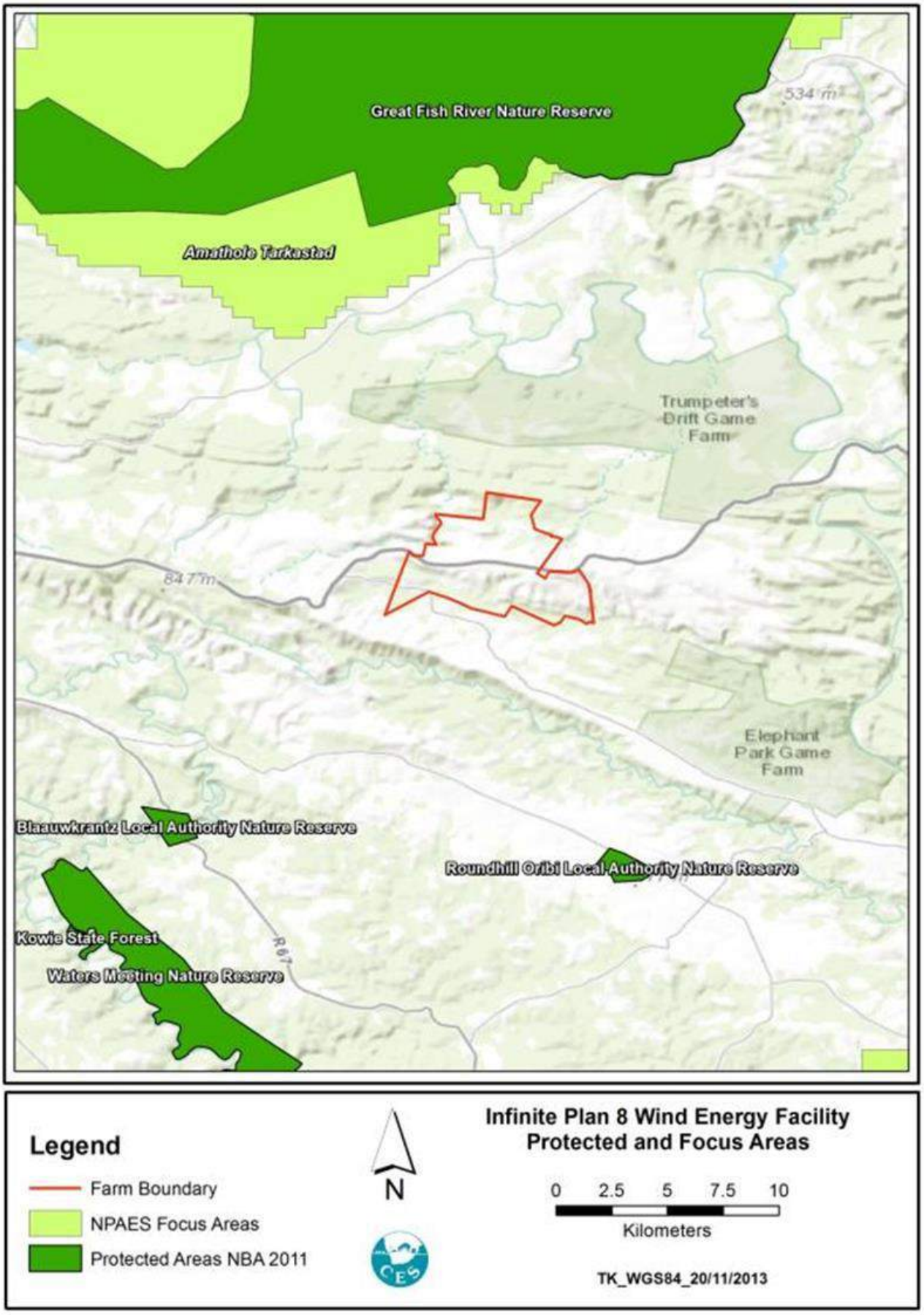


Figure 3-6: Map of the study area in relation to Protected Areas and the National Protected Areas Expansion Strategy Focus Areas

Ten principles of land use planning for biodiversity persistence:

- Avoid land use that results in vegetation loss in critical biodiversity areas.
- Maintain large intact natural patches – try to minimise habitat fragmentation in critical biodiversity areas.
- Maintain landscape connections (ecological corridors) that connect critical biodiversity areas.
- Maintain ecological processes at all scales, and avoid or compensate for any effects of land uses on ecological processes.
- Plan for long-term change and unexpected events, in particular those predicted for global climate change.
- Plan for cumulative impacts and knock-on effects.
- Minimise the introduction and spread of non-native species.
- Minimize land use types that reduce ecological resilience (ability to adapt to change), particularly at the level of water catchments.
- Implement land use and land management practices that are compatible with the natural potential of the area.
- Balance opportunity for human and economic development with the requirements for biodiversity persistence.

3.7 Heritage characteristics

The cultural landscape qualities of the study area essentially consist of a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. A variety of heritage sites occur in the study area including a cave with rock paintings, burial sites, homesteads and farmsteads. The cave provides evidence of the earliest human habitation while the recent past is linked to white farmers that settled in the region and took up farms.

Cave with Rock Art

The cave is situated in a gorge and is not readily visible until one is relatively close to it. Within the drip-line the cave is approximately 8 metres in length and about a maximum of 5 metres deep. The most common paintings are hand prints in red ochre. Most paintings are in red or orange ochre and no polychromes were identified. However, the presence of “hook heads” suggests that human faces were probably painted in lighter colours which have since faded. A few depictions of antelope were also noted.

Burial sites

Two graves were identified in the study region. The graves do not have headstones and consist of rock mounds. These burials, irrespective of whether they were for land owner or farm labourers (with a few exceptions where they were integrated), are family orientated. They therefore serve as important ‘documents’ linking people directly by name to the land.

Homesteads

The term homestead is used to distinguish this from farmsteads, with the former being occupied by farm labourers. As such there are many more of them in the landscape. Similarly to farmsteads these are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house that is extended in an ‘organic’ manner as the family expand. The building material used in construction is low technology, based on locally available sources. In addition gardens, outbuildings and sheds are included. An impact on one element therefore impacts on the whole. Locally it seems as if they can be grouped into two distinct categories.

Some of these date to early historic times and were probably erected soon after the farm was formally surveyed. A smaller number date to recent times and have been occupied until recently.

Farmsteads

Farmsteads are complex features in the landscape, being made up of different yet interconnected elements. Typically these consist of a main house, gardens, outbuildings, sheds and barns, with some distance from that labourer housing and various cemeteries. In addition roads and tracks, stock pens and wind mills complete the setup. An impact on one element therefore impacts on the whole. Farmsteads in the study area range from those of the first white farmers going back to the 1880s, to contemporary ones. The older ones have been abandoned and are in ruin. Later ones are still in use.

3.8 Palaeontology

The area intended for development overlies strata of the Cape Supergroup and lowermost portion of the unconformably overlying Karoo Supergroup. In addition, portions of the Cape Supergroup rocks are capped by relict patches of Silcrete formed as a product of deep leaching during the Cretaceous Period. Specifically, the Witpoort Formation of the Witteberg Group (the uppermost group of three subdivisions within the Cape Supergroup) consists primarily of quartzitic ridges which are not significantly fossiliferous at surface. Potentially important interbedded black shales within the quartzites are kaolinised to a deep depth (Gess, 2011). There is therefore only a low likelihood that palaeontological resources will be discovered/ destroyed as a result of the proposed project.

3.9 Socio-economic profile

Figure 3.7: An indication of the locality of the project; stretching across the boundaries of both the Makana and Ndlambe local municipalities.

The proposed Plan 8 Grahamstown Wind Energy Project is to be developed in the Makana Local Municipality (MLM). It is approximately 30km outside of Grahamstown along the N2 in an easterly direction towards East London, in the Eastern Cape Province of South Africa. More specifically, the proposed site is on the farms Gilead, Tower Hill and Peynes Kraal, situated approximately 30km east of Grahamstown. The surrounding area is not densely populated. However, it is still highly likely that the development of the project will have direct socio-economic impacts on the municipal areas and their populations. Accordingly, the discussion that follows provides a brief socio-economic profile of the municipal area, and the neighbouring Ndlambe Local Municipality.

The MLM is located in the Eastern Cape Province and falls within the eastern boundary of the

Cacadu District Municipality. The municipal area extends over 4 379 km^2 and is bounded by the cities of Port Elizabeth to the west, and East London to the east. According to the South African Community Survey of 2007 (StatsSA, 2007), the municipality's population declined from an estimation of 75 302 in 2001 to about 70 059 in 2007.

The area primarily consists of three nodal points namely Grahamstown, Riebeeck East and Alicedale. Grahamstown is the largest of the nodes both economically and in terms of population size, and serves as the administrative hub. Rhodes University (RU) is a dominant feature in the economic social landscape of the city, and therefore the MLM at large. By contrast, Alicedale is a small town that used to serve as an important national railway juncture in the past, but current economic activity is restricted to tourism primarily in the form of the Bushman Sands Hotel. Lastly, Riebeeck East has traditionally been an agrarian economy, which is still reflected in the current status quo.

The Ndlambe Local Municipality (NLM) borders the project site on the southern side. The municipality is bordered by the MLM within the Cacadu District Municipality to the north, the Sundays River Valley to the west and the Ngqushwa Local Municipality within the Amatole District Municipal Area to the east. The NLM consists of nine wards and extends an area of about 1 840 km^2, forming part of the Eastern Coastal Zone.

To a large degree, the municipal area comprises coastal settlements such as Kenton-on-Sea and Port Alfred, as well as more inland towns such as Bathurst and Alexandria. Although the area has seen a steady growth rate between 1996 to 2001, according to the South African Community Survey of 2007, it is estimated that this municipality's population has declined dramatically from about 54 717 people in 2001 to 46 359 in 2007. The fact that both municipal areas have seen a population decline serves to highlight the need for an economic boost in the area to spur development and produce attractive incentives for additional developers to settle in the area.

According to the South African Census of 2001 (which provides the most accurate data to date), in terms of age distributions, 68% of the MLM's total population are estimated to be between the ages of 15 and 64. This figure is very similar for the NLM (64%). This is the segment of the population that is considered to be the working age group. These relatively large percentages therefore indicate that the wind farm will be developed in areas where most people are within the working age population, and hence employment opportunities will be needed in the area. Few local employment opportunities, together with the relatively large young age population groups can also explain the population decline in both municipal areas, as youth may be searching for work in different municipal areas. Again, then, the wind farm will undoubtedly economically boost the area with opportunities to be further developed in this and additional fields. Also, various employment opportunities will be created during the construction phase of the development, which is highly needed in these areas.

Education levels have a direct impact on economic development and the quality of life enjoyed by residents of an area. This is because it influences the skills profile and thus the employability of a population. Education affects the potential that workers have, their productivity and also income levels. Education is therefore linked to the economic development of an area. In terms of education, the 2001 census indicates that both municipal areas seem to have a significant percentage of residents who have no schooling. For example, when considering the NLM, about 12% fall in this bracket. This is followed by 16% who have some primary and 5% some secondary school. A low 10% of the population have Grade 12, while only a mere 5% have a higher education.

These figures are very similar for the MLM, where approximately 7% have no schooling, 13% some primary school, 5.4% some secondary school and a higher 19% a Grade 12. A significantly low 6% of the population of this municipality have a higher education. These statistcs are illustrated in the tables below.

Table 3-4: Educational status of the NLM and MLM

CATEGORY	NLM (%)	MLM (%)
No schooling	11.7	7.3
Some primary	15.7	13.0
Complete primary	4.8	5.4
Some secondary	16.3	19.0
Std 10/Grade 12	9.5	10.3
Higher	5.0	6.3
Unspecified/not applicable	37.0	38.8
TOTAL	100 (%)	100 (%)

As per the 2001 data, employment rates for both districts are low, although higher for the NLM. For example, it is estimated that about 51% of the economically active population of the MLM is employed, while this percentage increases for the NLM, which is about 59%. This data again reinforces the need to create not only employment nodes in the area, but in so doing keep the educated youth in the municipal areas to stimulate the economic sectors of the larger districts.
As the wind farm will be supplying electricity and indirectly produce new economic nodes, it is necessary to assess the area's general standard of living. A good indicator for 'buying power' (and hence standard of living) is household income. As can be seen by the figure below, within the NLM, most residents who earn an income earn above R9 601 per month (64.3%). For the same category, this percentage is dramatically lower for the residents of the MLM (36%), of who the largest income earners earn less than R9 601 per month. This therefore indicates that the small portions of the wind farm that will be developed in the jurisdiction of the NLM will be amidst possibly more affluent municipal communities.

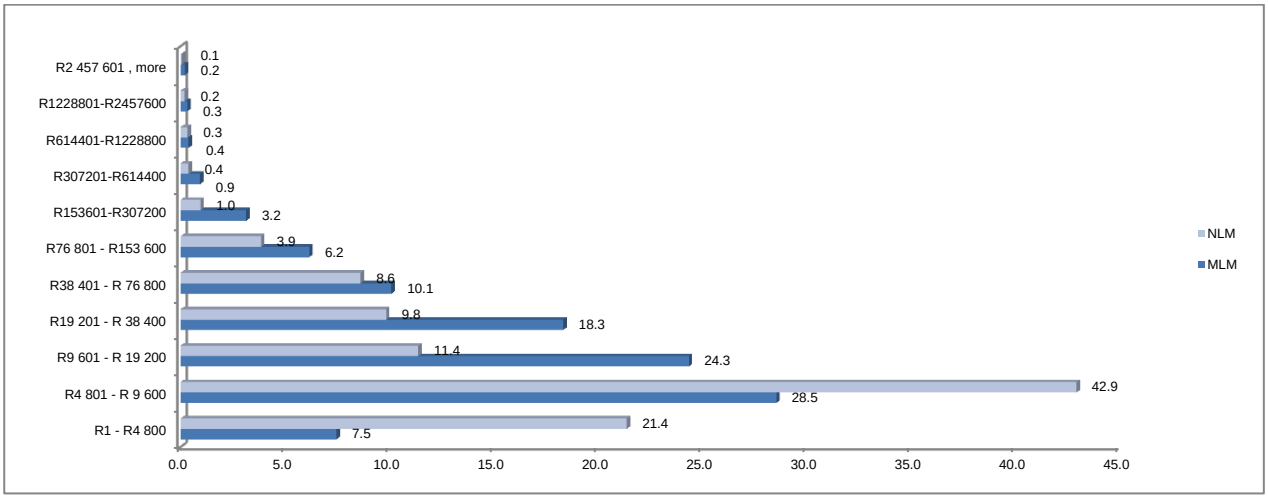


Figure 3.8: Household Income Levels of the NLM and MLM

The specific employment sectors of these two municipalities need to be considered by the wind farm project to determine its impact on employment sectors and general economic boost on the region. As is illustrated in the table below, the 2001 statistics shows that, of all the employment sectors mentioned for these two municipalities, those related to community services, agricultural work, wholesale and retail and construction are the most predominant. This needs to highlight the fact that the wind farm will most definitely stimulate the construction sector of the region, which is notable as an employment provider.

In addition, as the wholesale and retail sectors are also noticeably high, the wind farm will add value in terms of stimulating this sector and providing additional employment opportunities for the region.

Table 3-5: Employment Sectors of the NLM and MLM

CATEGORY	NLM (%)	MLM (%)
Community services	31.2	50.9
Agricultural-related work	21.9	17.7
Wholesale, retail	15.7	12.8
Construction	12.6	5.2
Manufacturing	7.7	4.5
Business services	7.5	5.9
Transport, communication	2.7	2.3
Mining, quarrying	0.4	0.1
Elec,gas,water etc.	0.4	0.6
TOTAL	**100 (%)**	**100 (%)**

4 NEED AND DESIRABILITY ASSESSMENT

In terms of section 31 (2) of the EIA regulations (2010), ***an environmental impact assessment report must include:-***
(f) A description of the need and desirability of the proposed activity…….

In accordance with the above-mentioned legislative requirement, this Chapter of the report identifies the need and desirability of the proposed Plan 8 Grahamstown Wind Energy Project. Please note that this has been largely based on information provided by the project proponent. According to Plan 8 (Pty) Ltd the motivation for the proposed project in general terms arose from the following potential benefits:

- **Electricity supply**
  The establishment of the proposed Plan 8 Grahamstown Wind Energy Installation will contribute to strengthening the existing electricity grid for the area and will aid the government in achieving its goal of a 30% share of all new power generation being derived from Independent Power Producers (IPP).
- **Social upliftment**
  The landowners approached by the Applicant to be part of this wind energy project expressed their commitment to the project in the hope that utilisation of portions of their land for wind turbines will be a source of additional income to supplement their farming income. Plan 8 (Pty) Ltd also intends to identify community development projects, in conjunction with local government, local community organisations and stakeholders, which will be implemented with the aim of improving the socio-economic environment in Makana and Ndlambe Municipalities and the surrounding areas. These initiatives will at least meet the minimum requirements as defined by the Department of Energy in their qualification criteria for independent power producers (IPPs) in South Africa. The project could, amongst other things, contribute to job creation, local economic development, BBBEE employment opportunity, localised enterprise development and community upliftment projects.
- **Climate change:**
  Due to concerns over the potential impacts of climate change, and the ongoing exploitation of non-renewable resources, there is increasing international pressure on countries to increase their share of renewable energy generation. The South African Government has recognised the country's high level of renewable energy potential and has placed targets of 10 000GWh of renewable energy by 2013. In order to kick start the renewable energy sector in South Africa, a Feed-in Tariff (Renewable Energy Feed in Tariff or REFIT) for various renewable energy technologies was established. This system was recently amended to allow developers to submit bids for the price of electricity they would accept for their particular renewable energy installation.

Further, in addition to the above-mentioned benefits, the proposed project site was selected due to:

- Good wind resources suitable for the installation of a large wind energy facility.
- Proximity to connectivity opportunities such as the High Voltage (HV) overhead lines traversing the proposed development site. This allows for the siting of a project substation immediately adjacent to the 132 KV powerlines, thereby significantly reducing the length of powerline required for the point of interconnection to the national Eskom grid.
- The surrounding area is not densely populated.
- There is potential and desire within the Makana Local Municipality (MLM) to engage with new technologies and industries.
- Proximity of the site to the N2 and the Port of Port Elizabeth.

5 ALTERNATIVES

In terms of section 31 (2) of the EIA regulations (2010), ***an environmental impact assessment report must include:-***

(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.

(i) A description and comparative assessment of all alternatives identified during the environmental impact assessment process.

Note: A detailed description of Plan 8's approach to site selection is provided in Appendiox H, which is description of the site selction methodology used in investiagting potential sites for wind enrgy projects, togther with a selctionj of other sites considered for such developments, and a rational for the selction of the Grahamstown site. .

It is important to note for projects of this nature that developers investigate a large number of sites, using the criteria described below, both via desktop studies and site investigations. These sites must not be regarded as alternative sites, meaning that only one or perhaps two will be selected for development, since South Africa's requirement for renewable energy sources is such that all available sites be considered. The Applicant has already received Environmental Authorisation for the development of a wind energy facity at Copperton, and has submitted a tender for the project in Round 4 of the REIPPPP, but this does not mean that no further sites will be investiagted for other facilities.

One of the objectives of an EIA is to investigate alternatives to the proposed project. There are two types of alternatives - Fundamental Alternatives and Incremental Alternatives.

The EIA regulations define 'alternatives' as, "*different means of meeting the general purpose and requirements of the activity"* which includes alternatives to:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;
(d) The technology to be used in the activity; and
(e) The operational aspects of the activity.

The NEMA EIA Regulations state that Alternatives discussed in the EIAR must be:

- Different means of meeting the general purpose and requirements of the activity.
- Reasonable; and
- Feasible.

5.1 Fundamental alternatives

Fundamental alternatives are developments that are totally different from the proposed project and usually involve a different type of development on the proposed site, or a different location for the proposed development.

A different type of development

Since the core business area of the project proponent is the development of wind energy facilities, the fundamental alternative of a development other than the proposed facility is therefore neither feasible nor reasonable in this case, and will not be considered further in the EIA.

The development of a project that would develop another form of renewable energy (such as solar photovoltaic, solar concentrated or hydroelectric) would meet the criterion of meeting the general

purpose and requirements of the activity, but since the business of the Applicant is the development of wind energy this is also not an alternative that can be considered further.

A different location

During the planning phase, Plan 8 assessed a number of different locations in South Africa prior to settling on the current project area. Initially, there are three main determinants in selecting a proposed location for further assessment:-

- Wind speed;
- Proximity to a grid connection point, and;
- Available land.

Once a parcel of land has been identified that meet these criteria, the following basic considerations are included in a desktop analysis to further refine the alternatives:

In this regard, a study was conducted by Plan 8, prior to commencement of the EIA, to consider, *inter alia*, the anticipated risks associated with securing the obligatory environmental authorisations and other associated permitting and licensing requirements that are potentially applicable for each of the site alternatives. This study was a desktop study, which considered various parameters. These parameters are:

- Wind speed ;
- Annual average energy production ;
- Logistics (availability of existing access roads, ease of transportation of equipment from ports, etc.);
- Environmental sensitivity;
- Botanical features of the site;
- Fauna (including avifauna and bats);
- Proximity to rivers and dams;
- Proximity to residential areas;
- Visual;
- Noise;
- Flicker (the rotating blades of turbines cause shadows which ‘flicker’);
- Proximity to transmission and distribution grid and the ability of the grid to absorb evacuated power;
- Proximity to railways, roads, coast-line and mines (a minimum distance is required);
- Civil aviation requirements;
- Heritage of the area;
- Radio and cellular communications networks, and
- Overhead telephone communications networks.

The above parameters were then rated for each potential site on an equal weight basis. Parameters are rated according to statutory requirements and documented best practice guidelines. Note that many of the statutory requirements and documented best practice guidelines in South Africa are in a draft state, owing to the fact that wind energy is a new technology in the South African context. Where no guidelines exist, German requirements are used by Plan 8, owing to the advanced state of the wind industry in Germany. Plan 8 requires that each parameter is satisfactory in meeting statutory requirements and documented best practices guidelines and that there are no fatal flaws or significant issues, prior to pursuing a project. Sites are then compared and the most favourable selected. The 70/30 apportionment in bid criteria demanded a site selection focus on highest need for socio-economic ‘upliftment’. Bearing all of the above in mind, Plan 8 identified 29 sites and is currently pursuing 3 sites, of which this proposed site is one. With regard to electricity distribution infrastructure, there is an existing 132 KV transmission line

traversing the site.

Other sites in South Africa that have been considered by the Applicant are:

- Port Nolloth: Discarded for several reasons including proximity to coast and possible grid constraints, but may be reconsidered in future.
- Konkoonsieskop: Discarded for several reasons including proximity to conservation areas and possible grid constraints, but may be reconsidered in future.
- Blinkwaterbaai: Discarded for several reasons including proximity to coast and possible grid constraints, but may be reconsidered in future.
- Hopefield: Discarded for several reasons including proximity to Langebaan and airport. Will not be reconsidered.
- Laingsburg: Discarded for several reasons including proximity to conservation areas and possible grid constraints. Will not be reconsidered.
- Aggeneys: Discarded, mainly because of limited wind resource. Will not be reconsidered

Further details of these sites is provided in Appendix H.

For this project at least three sites were assessed before two were discarded in favour of the current project area. The two sites that were not selected were:

- Brack Kloof/ VD Merwe's Kraal (coordinates X: 26.37 Y: -33.19)
- Farm 253 /255 (Coordinates X: 26.46 Y: -33.33)

Br ack Kloof/ VD Merwe's Kraal was discarded due to:

- Wind resource not as good as other sites
- Lack of interest from local residents
- Lack of traditional farming activities
- Proximity to game farms
- Potential for competition on high voltage line (other developers in area)

Farm 253 /255 was discarded due to:

- High visual impact on Grahamstown
- Potential for grid constraints
- Nearby waterways
- Potential competition on high voltage line (other developers in area)

5.2 Incremental alternatives

Incremental alternatives are modifications or variations to the design of a project that provide different options to reduce or minimise environmental impacts. There are several incremental alternatives that can be considered, including:

- The design or layout of the activity
- The technology to be used in the activity
- The operational aspects of the activity

5.2.1 Design/Layout Alternatives

At the start of the Scoping phase of this assessment Plan 8 intended to install a maximum of 32 turbines on the project site. This number was subsequently reduced to a maximum of 27 turbines – the number that was reported in the Final Scoping Report and in this EIR – as a result of technical considerations (such as quality of wind resources, steepness of slopes and difficulty of access), as well as environmental and social concerns that arose during the Scoping phase.

A revised layout was presented in the Final EIR (submitted to DEA on the 2nd August 2012)

utilising the N100 turbines at 100 m hub height and a rotor diameter of 99.8 m. The layout was revised again to reduce the visual impact of adjacent landowners on the western border of the project, and now incorporates 22 Nordex N117 turbines at a hub height of 91.5 m and a rotor diameter of 100 m - 117 m. Prior to the commencement of construction activity, should the project be authorised, Plan 8 (Pty) Ltd will be required to provide the competent authority (DEA) with a final layout informed by detailed wind resource assessment, geotechnical investigations, bird and bat monitoring, and detailed vegetation surveys of all turbine locations.

5.2.2 Technology Alternatives

The nature of the proponent's business is to develop wind energy projects. As such, no alternative power-generating technologies were considered as part of this study. Final selection of the specific make and design of turbine will be informed by the final analysis of wind resources to optimise power production potential. Two options exist to connect to the existing 132 KV Eskom distribution grid. Overhead 132 KV lines will be constructed from the substation to the connection point, which in both cases is within 1km of the existing 132 KV distribution lines. The best option will be determined when detailed design is completed. The determining factors will be ease of connection and construction, flooding of the substation, access, safety and cost.

5.2.3 Scheduling Alternatives

The Department of Energy's requirement that all renewable energy projects are operational by the end of 2016 means that construction will need to commence as soon as possible after all relevant approvals have been obtained. Under these circumstances there will be very little flexibility in rescheduling the project timelines.

5.3 The 'No-Go' alternative

According to the EIA Regulations, the option of doing nothing i.e. not proceeding with the proposed development (the No Go Option) must be assessed during the EIA. The impacts of not proceeding with the project have been assessed and are reported in this EIR. The implications of the No-Go option are discussed in detail in section 8.2.

In summary, the developer considered several fundamental alternatives through a detailed site selection process as well as incremental alternatives evident by the revised layout and design specifications throughout the EIA process.

6 KEY FINDINGS OF THE SPECIALIST STUDIES

In terms of section 31 (2) of the EIA regulations (2010), a*n environmental impact assessment report must include:*
(j) A summary of the findings and recommendations of any specialist report or report on a specialised process

6.1 Ecological Impact Assessment

Wetlands and rivers constitute features of conservation concern as they are process areas. They are essential for ecosystem function and process and provide niche habitats for a variety of plants and animals.

Steep slopes and **rocky areas** also constitute important features for conservation concern as they provide areas that are difficult to rehabilitate and are easily affected by changes in land use, with erosion being an important impact factor.The results of the sensitivity assessment have been summarised into one habitat sensitivity map for the study area (Figure 8-1). The vegetation sample sites within the study area were identified and assessed in terms of the sensitivity criteria described in the specialist report.

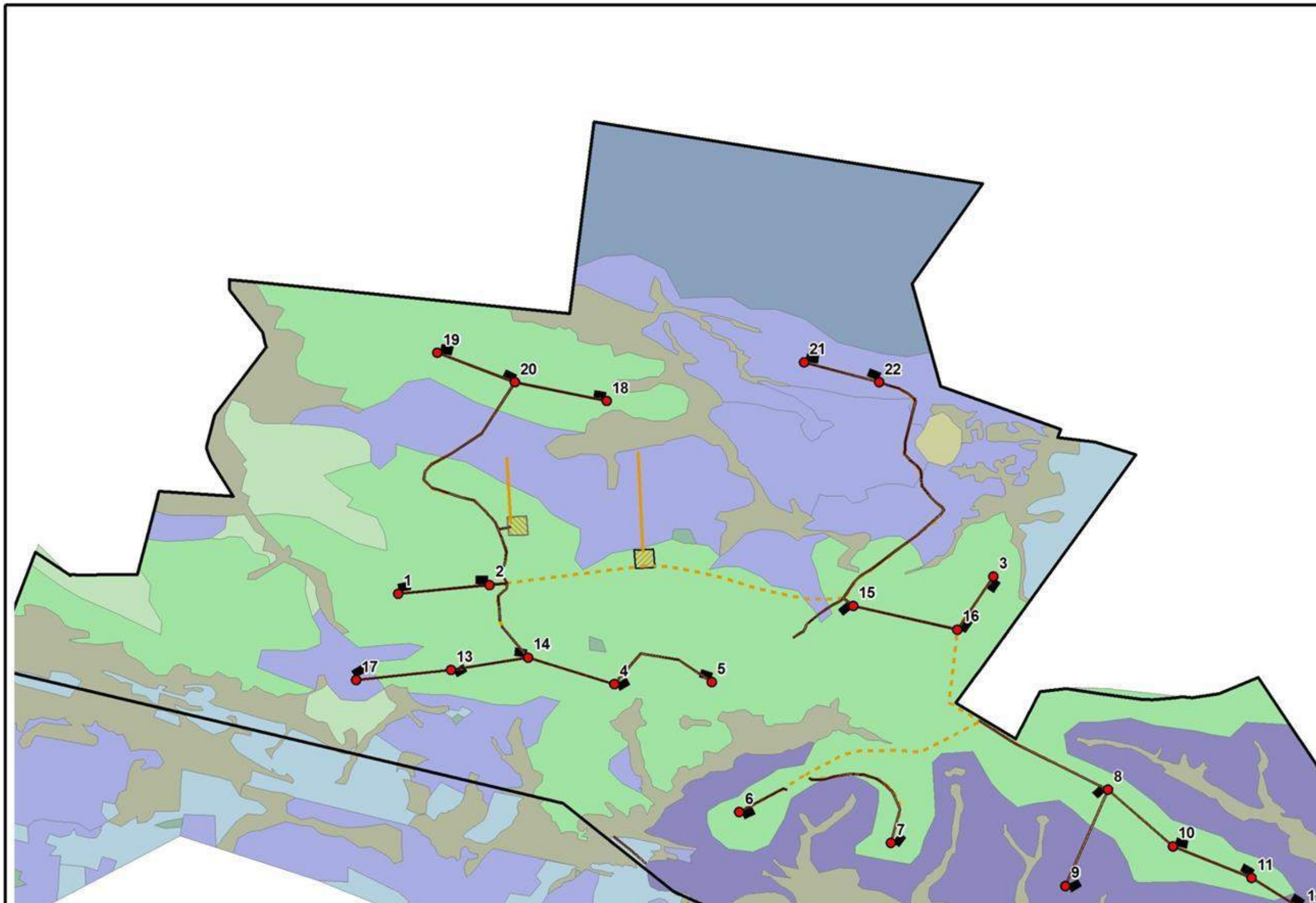
Low sensitivity
Low sensitivity is given to areas that are highly impacted by current land use and thus highly degraded and provide little value to the ecosystem and are highly unlikely to harbour any species of special concern.

Medium sensitivity
Medium sensitivity is given to areas that, despite being somewhat degraded, still provide a valuable contribution to biodiversity and ecosystem functioning as they are not very degraded and have a relatively high species richness, these areas may also contain species of special concern.

Careful attention should be placed on having as little impact as possible on these areas as they may still form a valuable role in ecosystem functioning.

High sensitivity
Areas of high sensitivity include process areas such as rivers, wetlands and streams that are important for ecosystem functioning including surface and ground water as well as animal and plant dispersal. High sensitivity is also given to areas that have high species richness and are not hugely impacted by current land use and are not degraded. High sensitivity areas also contain the majority of species of special concern found in the area. As wind farms have very little impact on the vegetation post construction, it may be possible to retain the areas of moderate sensitivity as corridor areas.

It should be noted that the sensitivities were based on the flora and vegetation encountered on site, which showed varying degrees of ecological integrity and thus influenced the impact rating scores accordingly.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6.2 Avifauna Impact Assessment

Note: This is the opriginal summary assessment based on the short-term avifaunal mpact assessment undertaken in 2011, and has been left in place for completeness and comparison with an updated summary assessment, based on the results of the 12-month monitoring programme, which is included in new section 6.12.

Avoiding areas of high bird use or sensitivity is the most important means of mitigating the effects of wind turbines (and associated infrastructure) on birds. At this proposed site it is difficult to identify any areas of truly high sensitivity. With the exception of the small drainage lines, which sometimes contain small dams and wetlands, as well as pristine thicket and woodland, the site is relatively uniform in sensitivity. This study has classed the study area into medium and low sensitivity areas. The medium sensitivity areas are mostly the drainage lines, and steep ground immediately adjacent to them. Construction of infrastructure should take place only within the low sensitivity areas. The delineation of these sensitivity zones in this report should be interpreted as indicative only. The exact edge of these zones cannot always be drawn as a line on a map, and is better determined on site in the EMPr phase if there are any areas of conflict. Several current turbine positions fall within the medium sensitivity areas, but only slightly. These turbines should ideally be moved into low sensitivity areas, although this would best be done during the EMP, or after pre-construction monitoring has produced some useful data in order to inform the new placement.

The site is on the plateau of a minor ridge line, with the ground falling away to the north and south. The areas where turbines are currently planned are predominantly relatively flat and with open vegetation. Numerous small drainage lines drain from the plateau down into the valleys. Most of the site is classified as “Bhisho Thornveld”.

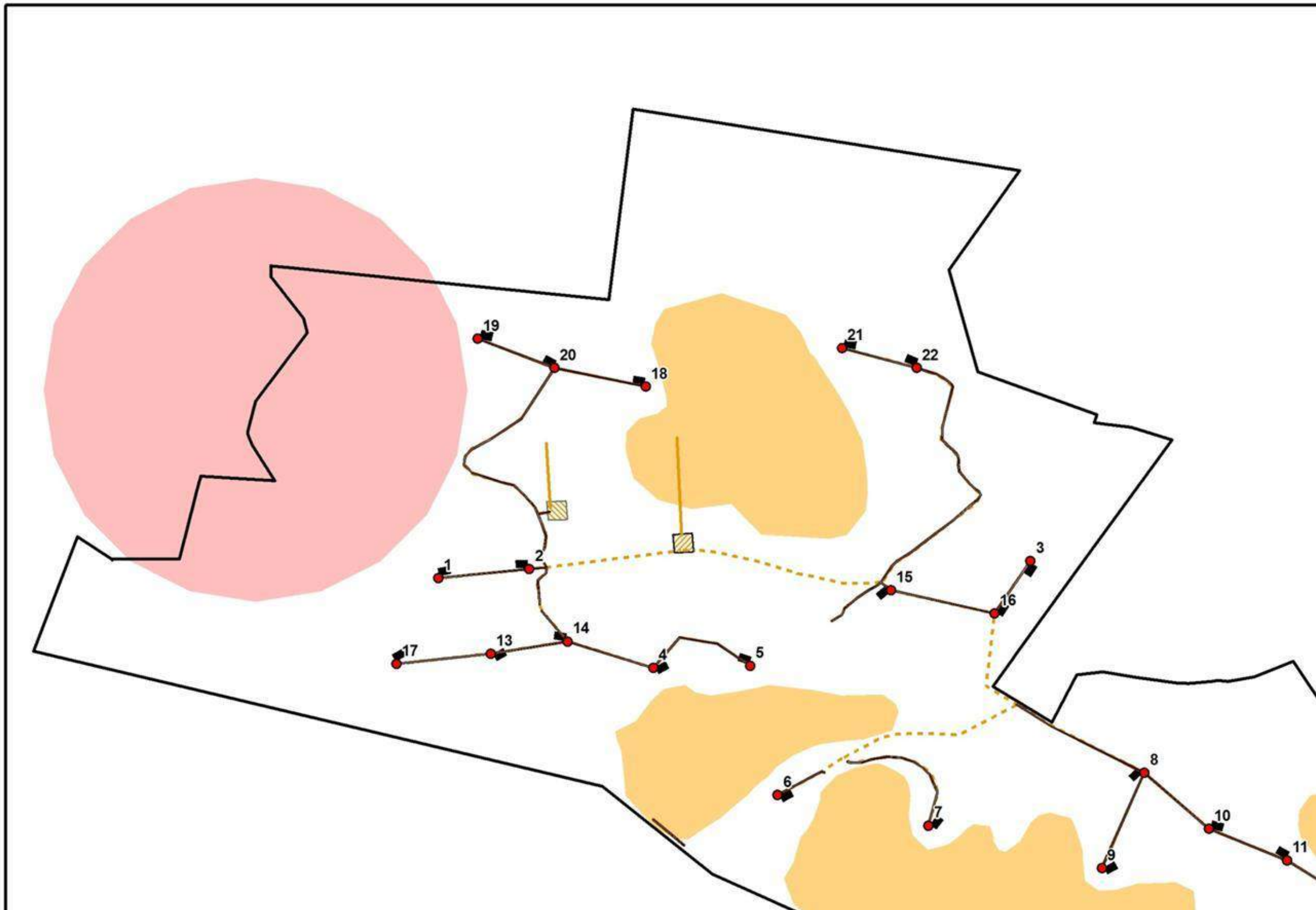
Up to 229 bird species could occur on site (Harrison et al, 1997), with 13 of these species being Red Listed by Barnes (2000). Of these species, the following have been selected as the ‘target species’ for this study, i.e. those species for which there is special concern related to the proposed WEF: African Crowned Eagle *Stephanoaetus coronatus*; African Fish-Eagle *Haliaeetus vocifer*; African Marsh-Harrier *Circus ranivorus*; Black Harrier *Circus maurus*; Black Sparrowhawk *Accipiter melanoleucus;* Black Stork *Ciconia nigra*; Black-shouldered Kite *Elanus caeruleus*; Black-winged Lapwing *Vanellus melanopterus*; Booted Eagle *Aquila pennatus*; Denham's Bustard *Neotis denhami*; Jackal Buzzard *Buteo rufofuscus*; Lanner Falcon *Falco biarmicus*; Marsh Owl *Asio capensis*; Martial Eagle *Polemaetus bellicosus*; Rufous-chested Sparrowhawk *Accipiter rufiventris*; Secretarybird *Sagittarius serpentarius*; Spotted Eagle Owl *Bubo africanus*; Steppe Buzzard *Buteo vulpinus;*Verreaux's Eagle *Aquila verreauxii*; Verreaux's Eagle-Owl *Bubo lacteus*; White Stork *Ciconiaciconia*; White-bellied Korhaan *Eupodotis senegalensis*; Yellow-billed Kite *Milvus migrans;* and African Harrier-Hawk *Polyboroides typus*. There is some doubt as to whether these species all occur on or near the proposed site. Their occurrence will need to be confirmed during the pre-construction monitoring programme.

The expected interactions between birds and the proposed WEF are: disturbance of birds and habitat destruction during construction and maintenance of the facility and associated infrastructure; displacement of birds from the area, or from flying over the area; collision of birds with turbine blades during operation; and collision and electrocution of birds on associated electrical infrastructure. With respect to the assessment of these potential impacts for the Grahamstown project, the following are key findings:

- The two impacts that are determined to be of medium or higher significance are collision of birds with turbine blades, and collision and electrocution on power lines. Since we have no data on bird abundance and movement on site, our confidence in the assessment of these impacts is relatively low. This could be rectified by obtaining primary data on site. It is therefore essential that a preconstruction bird monitoring program be initiated as soon as possible in order to begin the process of collecting relevant and accurate data on the

numbers of birds that could be affected by the project.

- The remaining impacts such as disturbance and habitat destruction have been judged to be of low significance due to the relatively small amount of habitat destruction that will take place (especially when related to the target species, which mostly have large territories).
- Micro-siting of turbines and other infrastructure within the proposed site remains the foremost means of mitigating impacts on birds. This study has mapped the avifaunal sensitivity of the study area, and classed it into medium and low sensitivity areas. The medium sensitivity areas are mostly the drainage lines, and steep ground immediately adjacent to them. Construction of infrastructure should take place only within the low sensitivity areas. The delineation of these sensitivity zones in this report should be interpreted as indicative. The exact edge of these zones cannot always be drawn as a line on a map, and is better determined on site in the EMP phase if there are any areas of conflict.
- Since the exact position of turbines and other infrastructure has not yet been finalized, a site specific avifaunal Environmental Management Plan is seen as essential.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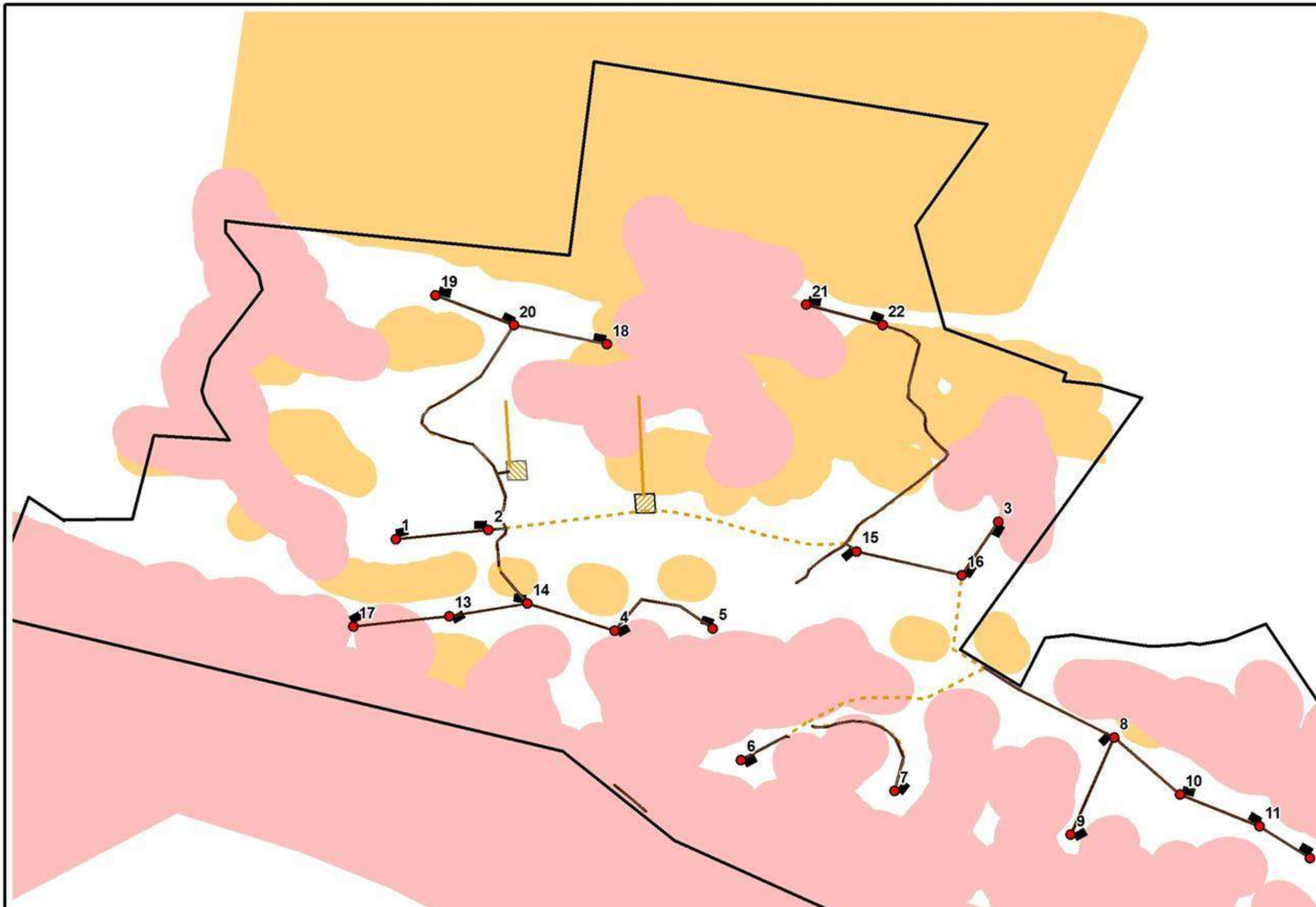
6.3 Bat (Chiroptera) Impact Assessment

Note: This is the opriginal summary assessment based on the short-term avifaunal mpact assessment undertaken in 2011, and has been left in place for completeness and comparison with an updated summary assessment, based on the results of the 12-month monitoring programme, which is included in new section 6.13.

The general bat activity in the project area is moderate and higher concentrations exist in lower elevation areas such as valleys and drainage lines. These areas can draw elevated numbers of insects and will therefore be utilised by bats. High flying species such as *Tadarida aegyptiaca* and *Miniopterus natalensis* are the most at risk by wind turbines. These species will readily pass through, and even forage to some degree, in high lying areas where winds are stronger and insects less, motivating further for the implementation of mitigation measures.

The small watercourses and sheltered valleys have been assigned a 150 m buffer. These buffer areas should be treated as sensitive and no turbines should be allowed to be placed in the buffers. The areas marked as having a Moderate Sensitivity are assigned as such due to topography and a higher amount of roosting space offered by the terrain in that area. Turbines located in the Moderate Sensitivity area should be prioritised during mitigation measures and must receive special attention during monitoring, although all turbines in the project area are subject to mitigation measures.

Since the possibility of the site being located in a migration path still exits, it is recommended that a long-term pre-construction monitoring study be undertaken to determine whether migrating cave bats may be at risk by the proposed wind farm. It is recommended that the curtailment mitigation measure be implemented on all turbines on the site, based on correlations found between wind speed and bat activities during the long-term study.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6.4 Heritage Impact Assessment

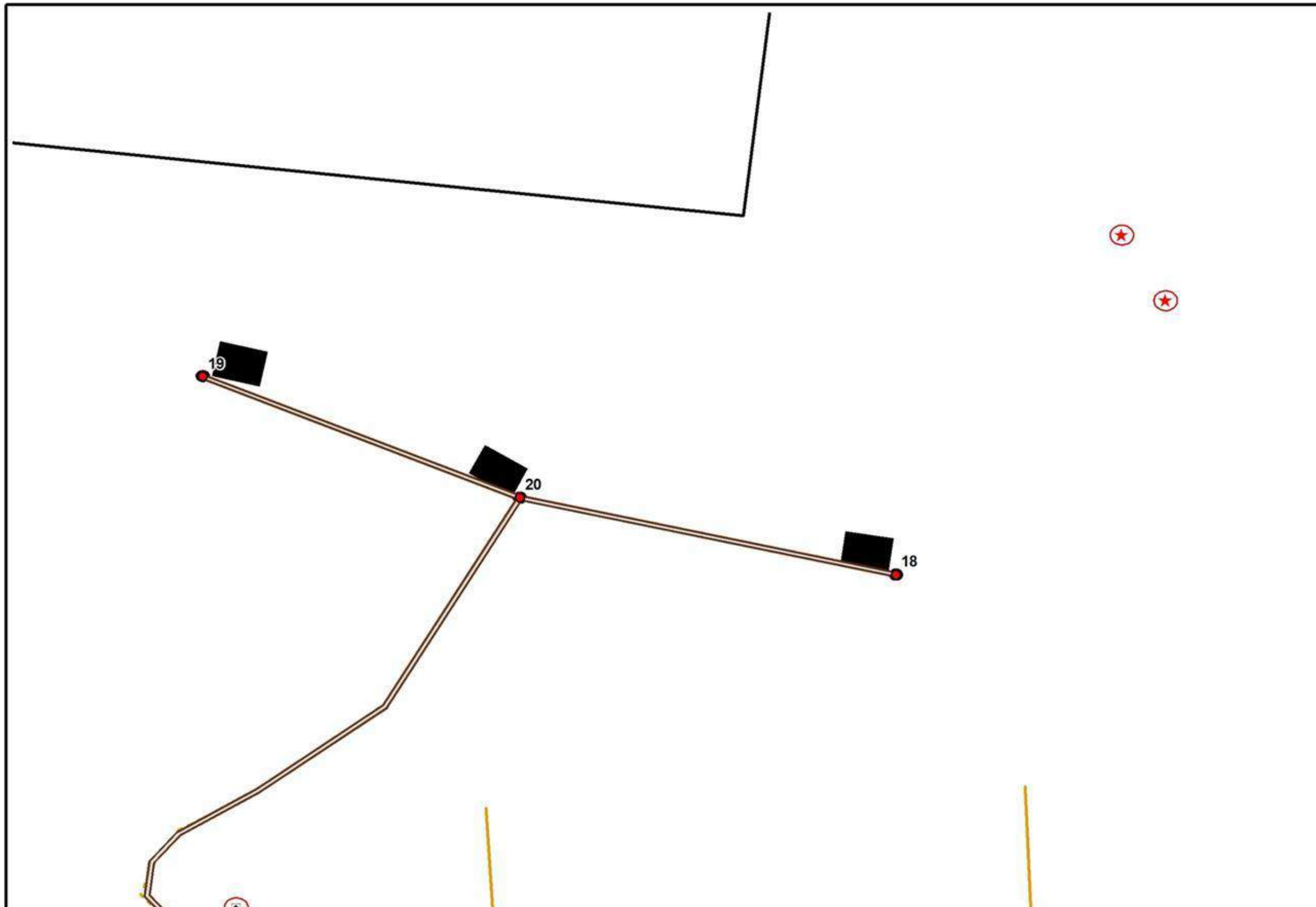
The cultural landscape qualities of the study area essentially consist of a rural area in which the human occupation is made up of a pre-colonial element (Stone Age) as well as a much later colonial (farmer) component. Apart from two unmarked graves and an old horse/oxen drawn plough, no material culture or structural remains of historical significance were observed in the studied area. Two isolated artefacts of Stone Age origin were recorded and a cave with rock paintings occurs in one of the gorges.

The survey indicated that, for the current turbine layout, none of the identified sensitive heritage sites would be impacted. A 15m buffer (Figure 8-4) is recommended around the two grave sites as well as perimeter fencing to exclude movement across the sites. Although the current access road layout falls within 50m of the grave sites, it will not impact the sites provided the recommendations for that site are observed.

From a heritage point of view it is recommended that the proposed development be allowed to continue, however this is subject to the following to conditions:

- Surveyed areas (walk tracks) – with the exception of waypoints 1 and 34-35 (see heritage Report) – are suitable for the proposed activities,
- Any areas outside the surveyed tracts might be archaeologically sensitive and therefore, placement of any activities outside the studied areas will require further archaeological investigation and assessment,
- Once the final layout and placement of wind turbines and associated facilities and services are determined, an Archaeological Impact Assessment focusing on the affected areas should be undertaken.

Should the archaeological sites or graves be exposed during construction work, it must immediately be reported to a heritage practitioner so that an investigation and evaluation of the finds can be made.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6.5 Palaeontological Impact Assessment

The area intended for development overlies strata of the upper portion of the Cape Supergroup and lowermost portion of the unconformably overlying Karoo Supergroup. In addition, portions of the Cape Supergroup rocks are capped by relict patches of Silcrete formed as a product of deep leaching during the Cretaceous. Cape Supergroup rocks represent sediments deposited in the Agulhas Sea, which had opened to the south of the current southern African landmass, in response to early rifting between Africa and South America during the Ordivician. The Witteberg Group is the uppermost of three subdivisions of the Cape supergroup and was laid down during the Late Devonian.

During the Cretaceous and early Tertiary Periods much of Africa was weathered down to a number of level horizons collectively known as the African Surface. The area in the vicinity of Grahamstown was reduced to a flat plain close to sea level, remnants of which are referred to as the Grahamstown Peneplane. During the Tertiary, mudstones, shales and diamictites were leached to considerable depth, transforming them into soft white kaolin clay. Silica, iron and magnesium from these rocks was carried in solution by groundwater and deposited near the ground surface due to steady evaporation of mineral rich waters. This lead to the formation of a hard mineralised capping layer, often consisting of silicified soil. Resultant silcretes are referred to as the Grahamstown Formation. Though occasional occurrences of root and stem impressions have been recorded from the Grahamstown Formation, it is generally considered unfossiliferous.

However, should substantial fossil remains be encountered or exposed during construction, the Environmental Control Officer (ECO) should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

6.6 Visual Impact Assessment

There are several sensitive visual receptors on surrounding farms which may be affected by the proposed wind farm development, but their current views are likely to contain elements which reduce the quality of these views. The agricultural activities in the region have affected the quality of the landscape and the quality of views, as have the high-voltage power lines and pylons. Although a wind farm will have a significant initial impact on views due mostly to the novelty of wind farms in South Africa, it is likely that in the long run viewers will experience them as positive rather than negative additions to the landscape when compared with the power stations and coal mines which exist in the broader landscape.

The following key findings were made from the Visual Impact Assessment which had the following limitations and assumptions:

6.6.1 Visibility

Cumulative viewsheds (Figure 6-5) indicate not only where a feature is visible from but also how much of the feature will be visible from that point or area. As expected, the visibility is high in terms of area due to the turbine heights and their location on relatively elevated land.

The map in Figure 6-5 shows the spatial extent of areas with views on the wind farm. In terms of the potential visibility the colour red indicates areas where views of the wind farm will contain most of the wind turbines (potentially all the turbines). Green lines on the map show positions of protected areas. The viewshed calculation does not take into account distance from the wind farm, which is discussed in the section on visual exposure, and is not a direct reflection of visual impact.

6.6.2 Sensitive Viewers and Viewpoints

Viewer sensitivity is the assessment of the receptivity of viewer groups to the visible landscape

elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions. The following sensitive viewers or viewpoints were identified:

1. Viewpoints in surrounding protected areas;
2. Tourists and visitors to protected areas;
3. Residents on surrounding farms;
4. Motorists using the N2 and other main roads in the region;
5. Residents of rural villages.

Residents of surrounding farms

Residents' views will be affected according to their visual exposure to the wind farm and the quality of their existing views and are therefore highly sensitive.

Scenic viewpoints and users of recreational trails

Viewpoints on farms in the surrounding landscape with scenic views can potentially be affected by the wind farm development. There are farms in the region with eco-trails which visitors can follow and viewpoints along these trails may include views of the wind farm.

Protected areas

There are a number of protected areas in the region which can potentially be affected by the proposed wind farm. These include a number of protected areas classified as Type 1 below, such as Great Fish River Complex, Double Drift Nature Reserve, Kap River Nature Reserve and Water's Meeting Nature Reserve.

Residents of rural villages

The rural villages north and east of the Great Fish River are likely to have views of the wind farm. They tend to be further than 10km from the proposed wind farm, but residents will potentially see most of the turbines in the wind farm.

Motorists

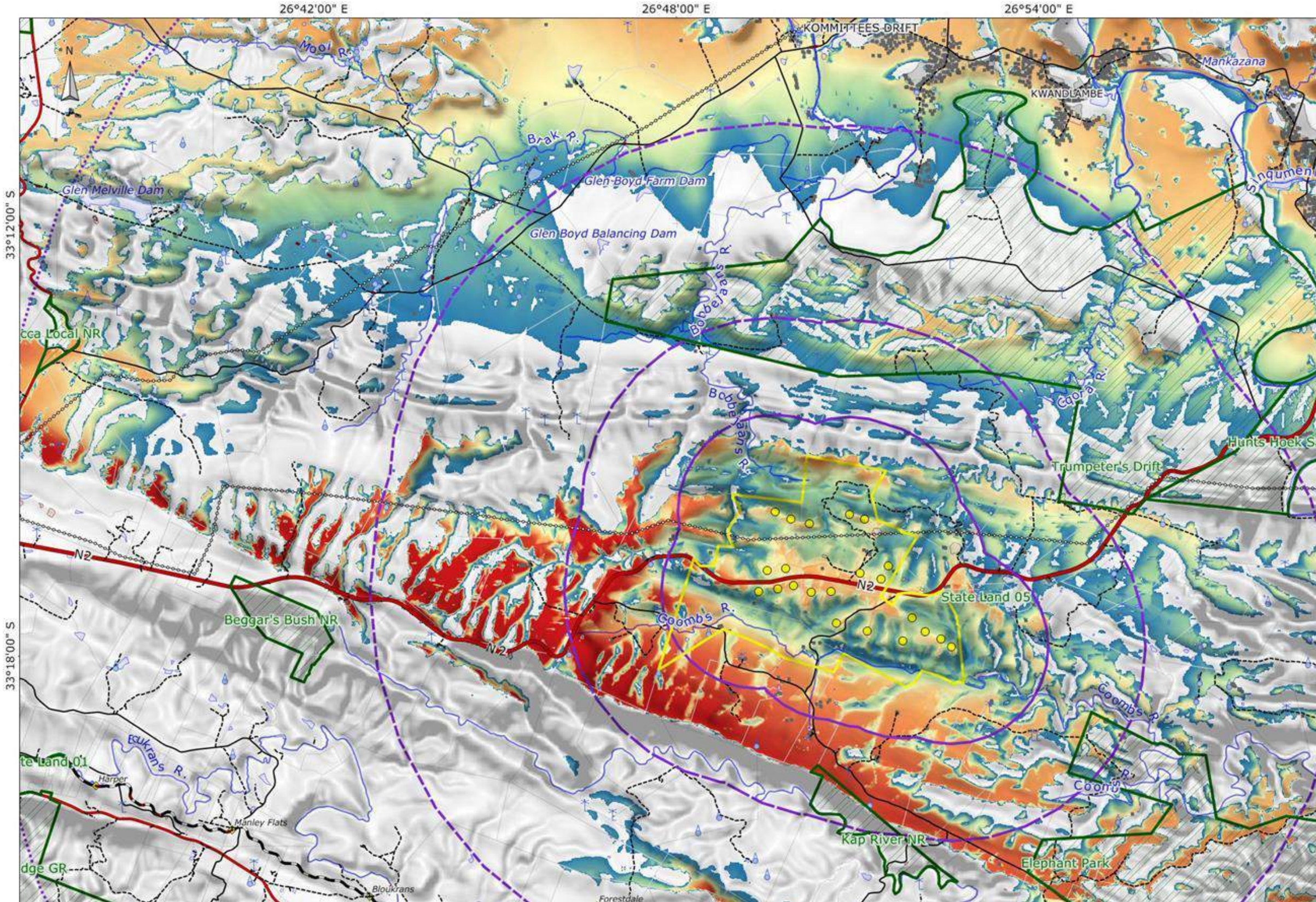
The N2 passes through the proposed site and is very likely to be affected. The R67 north of Grahamstown is more than 15km from the site and so is unlikely to be much affected. According to the visibility analysis the R67 east of Grahamstown will afford very few opportunities to see the wind farm if at all.

6.6.3 Visual Exposure

Visual exposure refers to the relative visibility of a project or feature in the landscape (Oberholzer, 2005). Exposure and visual impact tend to diminish exponentially with distance. The exposure is classified as follows:

- High exposure – dominant or clearly noticeable;
- Moderate exposure – recognisable to the viewer;
- Low exposure – not particularly noticeable to the viewer

Visual exposure for residents of surrounding farms and motorists on sections of the N2 will be high, moderate to high for some areas within Trumpeter's Drift, Elephant Park and Kap River nature reserve and low for residents of rural villages and surrounding urban areas more than 10km away.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Harper
Manley Flats
Bloukrans
Forestdale
Kap River NR
Elephant Park

The European Wind Energy Association (EWEA) also suggests zones of theoretical visibility (ZTV) as follows (EWEA, 2009):

- Zone I – Visually dominant: turbines are perceived as large scale and movement of blades is obvious. The immediate landscape is altered. Distance up to 2km.
- Zone II – Visually intrusive: the turbines are important elements on the landscape and are clearly perceived. Blade movement is clearly visible and can attract the eye. Turbines not necessarily dominant points in the view. Distance between 1 and 4.5km in good visibility conditions.
- Zone III – Noticeable: the turbines are clearly visible but not intrusive. The wind farm is noticeable as an element in the landscape. Movement of blades is visible in good visibility conditions but the turbines appear small in the overall view. Distance between 2 and 8km depending on weather conditions.
- Zone IV – Element within distant landscape: the apparent size of the turbines is very small. Turbines are like any other element in the landscape. Movement of blades is generally indiscernible. Distance of over 7km.

The zones overlap due to the fact that they attempt to incorporate atmospheric or weather conditions. The maps in this section do not show these zones but distance buffers are included to enable readers to apply the EWEA classification.

Visual exposure was calculated using visibility (i.e. how much of the wind farm will be visible) and distance from the nearest wind turbine.

Residents of surrounding urban areas

Urban centres and rural villages are all further than 10km from the proposed site and as such residents will experience **low** visual exposure to the development.

Protected Areas and Scenic Viewpoints

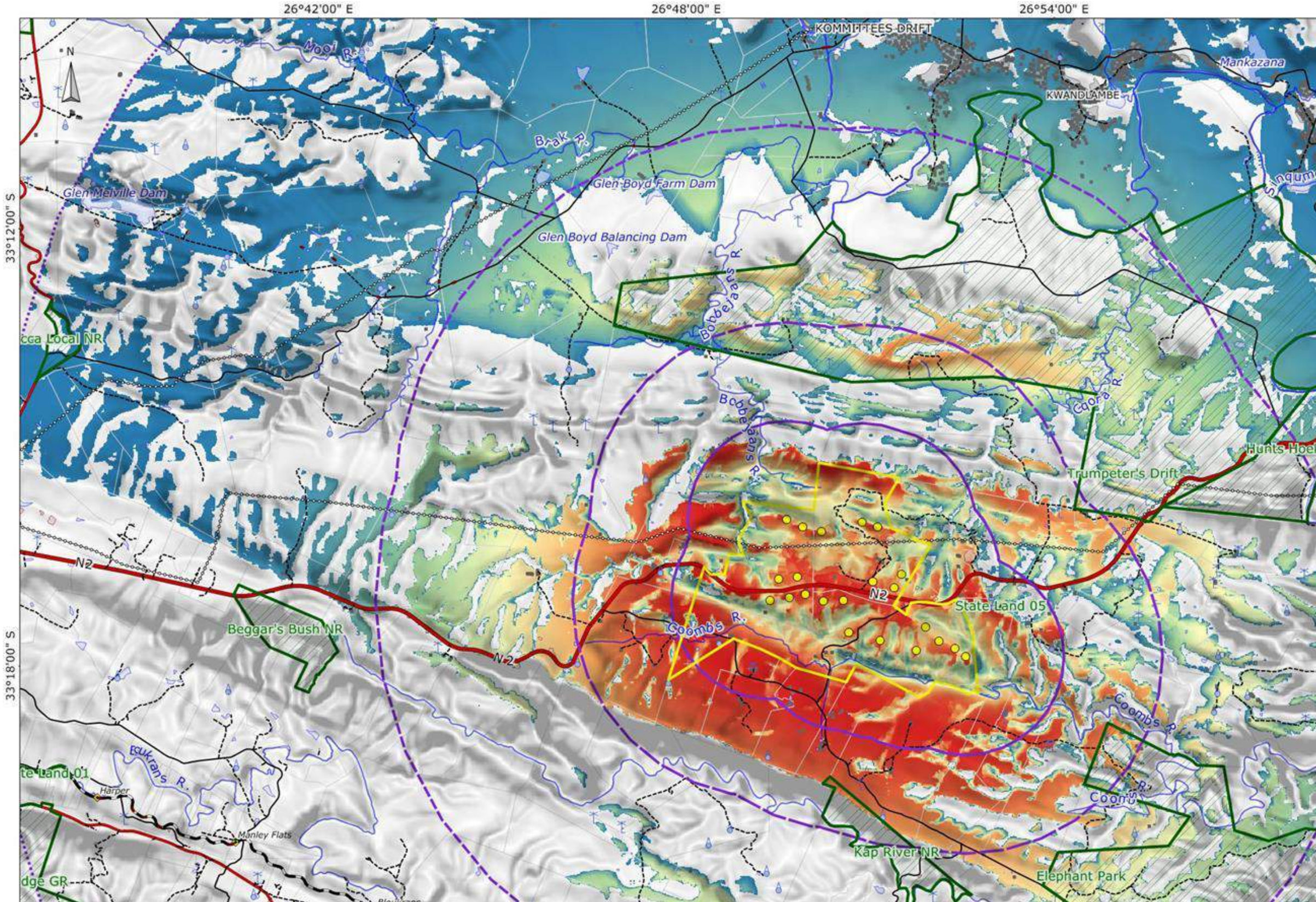
The protected natural areas that may be exposed to the visual impact of the project are presented in the Visual Impact Report. Most protected areas are rated on average to have **low** visual exposure to the development. There may however be areas within these where viewpoints will have medium or high visual exposure. This is particularly true of Elephant Park game farm where some regions in the west have **medium** to **high** visual exposure. Parts of Trumpeter's Drift game farm will experience **medium** visual exposure. The ridge north of Kap River nature reserve shows **high** visual exposure ratings and on the map a small part of this ridge is shown to fall within the reserve, hence the high visual exposure rating for the reserve. However, there do not appear to be tracks or roads in this section of the Kap River reserve and access will probably be limited.

Motorists

The N2 is the only major road in the Study Area which will have sections of high visual exposure where motorists will be in close proximity to the wind farm and will potentially have good views of turbines. It should be noted, however, that much of the section of N2 that passes through the wind farm site has tall trees next to the road which will limit views considerably.

Residents on farms

Table 6.1 lists buildings on farms surrounding the wind energy facility with high visual exposure ratings. There are a number of buildings with high visual exposure ratings and most of these are located on the ridge just south of the proposed site.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N
KOMMITTEES DRIFT
Mool R.
Mankazana
KWANDLAMBE
Brak R.
Glen Melville Dam
Glen Boyd Farm Dam
Glen Boyd Balancing Dam
Bobbejaans R.
Coora R.
Hunts Hoe
Trumpeter's Drift
N2
State Land 05
Coombs R.
Beggar's Bush NR
Eculrans R.
Harper
Manley Flats
Kap River NR
Elephant Park

6.6.4 Visual Intrusion

Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its sense of place. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer, 2005). It can be ranked as follows:

- High – results in a noticeable change or is discordant with the surroundings;
- Moderate – partially fits into the surroundings, but is clearly noticeable;
- Low – minimal change or blends in well with the surroundings.

Sense of place is defined by (Oberholzer, 2005) as: 'The unique quality or character of a place... relates to uniqueness, distinctiveness or strong identity.' It describes the distinct quality of an area that makes it memorable to the observer.

Residents of surrounding urban areas

The only urban areas that will potentially be affected by the wind farm are the rural villages north of the Fish River (e.g. Kwandlambe and Kommittee's Drift on the map). They are located beyond 10km from the proposed wind farm site, but residents will potentially have views of the wind farm on the distant, mountainous horizon towards the south. There are obviously no other structures of a similar size as the wind turbines in view from these villages and as such they may well be clearly noticeable.

The fact that these turbines will be exposed above the skyline and will have moving rotors will ensure that they will be noticed. However, their distance from the villages will reduce the intrusion effect and a **moderate** to **low** visual intrusion is expected.

Protected Areas and Scenic Viewpoints

There are several game farms in the region which will potentially be affected by the wind farm. Although there are communication towers on many hills, some power lines and pylons, and often large farm buildings and homesteads in views, there are no structures comparable to wind turbines in the landscape. There is potential for scenic views of the hills/mountains on which the turbines will be located, especially from viewpoints north of the proposed site (e.g. from viewpoints within Trumpeter's Drift). The level of intrusion will depend on the distance between the viewpoint and the turbines. Views from south of the proposed site tend to have less scenic potential due to the more noticeable effects of farming in this region, although viewpoints closer to the proposed site will also be more affected. It is debatable whether a wind farm is discordant with the landscape (since wind farms are an attempt to develop energy in an ecologically and environmentally sustainable way), but initially the landscape change will be highly noticeable. A **moderate** to **high** visual intrusion is expected for some game farms in the region

Residents on farms

Many, if not most, farms in the region have been converted to game farms or eco-tourism areas and as such most of the discussion in the previous paragraph applies. In general, though, wind farms are often located on agricultural land internationally and are therefore seen as congruent with the landscape. The visual intrusion rating will therefore depend on visual exposure to the wind farm and will range from **low** to **moderate** for residents and viewpoints from surrounding farms.

Motorists

The N2 passes through the proposed wind farm site and motorists will pass in close proximity to wind turbines. There are parts of this section of road where tall trees will obscure views of turbines.

Table 6-1: Summary of the visual impacts

Criteria	Impact
Viewer Sensitivity	Residents of urban areas and rural villages – **Highly sensitive** to changes in their views. Residents on surrounding farms – **Highly sensitive** Scenic viewpoints and protected areas – **Highly sensitive** – there are no recognised viewpoints protected for their scenic quality in the region. Motorists – **Low sensitivity** due to short exposure time and the fact that their focus on landscape is reduced.
Visibility of Development	**High** due to the tall structures and their position in the topography.
Visual Exposure	Residents of surrounding urban areas and rural villages – **Low** since these are more than 10km from the proposed site. Residents on surrounding farms – **high visual exposure** for a number of farm residences or buildings. Protected areas and scenic viewpoints – **moderate to high** for some areas within Elephant Park and Trumpeter's Drift game farms, and Kap River nature reserve. Motorists – **high** for sections of the N2.
Visual Intrusion	Residents of rural villages – **moderate to low** due to their distance from the wind farm site. Protected areas – **moderate to high** for some game farms in the region. Residents on surrounding farms – **moderate to low** since wind farms are seen as compatible with agricultural landscapes internationally. Motorists – **High** for a short time when in close proximity.

6.6.5 Shadow Flicker

Fifteen buildings were identified as potentially at risk of being affected by shadow flicker. These building localities were taken from a national database of buildings which Eskom derived from SPOT 5 satellite images using remote sensing techniques (de la Rey 2008; Mudau 2010). All fifteen sites were visited to verify that they are buildings and to determine whether existing surrounding vegetation will reduce the risk of shadow flicker affecting residents.

Shadow flicker modelling was conducted using these sites and the results are shown in Table 6-2 for sites shown in Figure 6-7.

Table 6-2: Buildings with potential risk of being affected by shadow flicker

FARM	LABEL	FEATURE	LONGITUDE	LATITUDE
PEYNES KRAAL (362/0)	E	HOUSE	26.8532	-33.2769
PEYNES KRAAL (362/0)	G	HOUSE	26.8532	-33.2765
GILEAD (361/1)	H	LODGE	26.8092	-33.2764
PEYNES KRAAL (362/0)	I	HOUSE	26.8523	-33.2762
COOMBS VALE (3/1)	J	HOUSE	26.8393	-33.2975
PEYNES KRAAL (362/0)	K	HOUSE	26.8515	-33.2759
COOMBS VALE (3/1)	L	HOUSE	26.8377	-33.2974
SPITZKOP (217/0)	O	HUT	26.8172	-33.2574
PEYNES KRAAL (362/0)	P	HOUSE	26.8546	-33.273

Parameters used for modelling purposes represent a 'worst case' scenario. In essence this means that it is assumed that the sun is shining for the whole day (no clouds or atmospheric variation), that the building under investigation has windows for walls (from 1m up to the roof) and that the wind turbine rotor is always perpendicular to the line from turbine to sun (i.e. largest shadow

effect).

These are standard international assumptions used when calculating the potential risk of shadow flicker from wind turbines (Parsons Brinckerhoff 2011) and actual shadow flicker hours will be much lower than model results. A Nordex N117 wind turbine with hub height of 91.5 m and rotor diameter of 117 m was used to model wind turbines.

According to international guidelines buildings that are affected by more than 30 hours/year, or 30 minutes on the worst affected day, of shadow flicker should be mitigated for (Parsons Brinckerhoff 2011). Results indicated that none of the buildings identified would be subject to more than 30 hours/year, or 30 minutes on the worst affected day.


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KOMSFOUNTAIN
COOMBS VALE
Coombs R.
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6.7 Noise Impact Assessment

6.7.1 Predicted Noise Levels for the Construction Phase

The construction noise at the various project sites will have a local impact. Typical noise emissions of various pieces of construction equipment are presented in the Table 6-3 below.

Table 6-3: Typical Construction Noise

Type of Equipment	LReq.T dB(A)
CAT 320D Excavator measured at approximately 50m.	67.9
Mobile crane measured at approximately 70m	69.6
Drilling rig measured at approximately 70m	72.6

The impact of the construction noise that can be expected at the proposed site can be extrapolated from Table 6-2. As an example, if a number of pieces of equipment are used simultaneously, the noise levels can be added logarithmically and then calculated at various distances from the site to determine the distance at which the ambient level will be reached.

Table 6-4: Combining Different Construction Noise Sources – High Impacts (Worst Case)

Description	Typical Sound Power Level (dB)
Overhead and mobile cranes	109
Front end loaders	100
Excavators	108
Bull Dozer	111
Piling machine (mobile)	115
Total*	117

*The total is a logarithmic total and not a sum of the values.

Table 6-5: Combining Different Construction Noise Sources – Low Impacts

Description	Typical Sound Power Level (dB)
Front end loaders	100
Excavators	108
Truck	95
Total	**111**

The information in the tables was used to calculate the attenuation by distance. Noise will also be attenuated by topography and atmospheric conditions such as temperature, humidity, wind speed and direction etc. but is ignored for this purpose. Therefore, the distance calculated below would be representative of maximum distances to reach ambient noise levels. The ambient day time and night time noise level measurements are presented in tables 6-6 and 6-7 below.

Table 6-6: Day time ambient noise level results

Location	Start Time	Duration (minutes)	Wind (m/s) *(At Microphone)	Temperature (^{o} Celsius) *(At Microphone)	$L_{Req.T}$ dB(A)	Comments
Peyneskraal Farmhouse	15:45	10	4.9m/s	13.6^{o} c	49.5	Birds & dogs barking; Traffic noise from N2
Jakkelsdraai Farmhouse (Main)	16:50	10	3.8m/s	13.1^{o} c	45.6	Traffic noise from N2

*Author measurements of wind speed and temperature at microphone height.

Table 6-7: Night time ambient noise level results taken on the 29th of June and 23rd July 2012.

Date	Location	Start Time	Duration (minutes)	$L_{Req.T}$ dB(A)	Comments
29th June 2012	Honeykop Farmhouse	22:26	10	43.2	• Distant traffic • Persons walking on gravel
29th June 2012	Peyneskraal Farmhouse	22:56	10	46.2	• Distant traffic
29th June 2012	Jakkelsdraai Farmhouse (Main)	23:26	10	47.7	• Distant traffic • Distant dog barking • Sheep and other farm animals
23rd July 2012	Honeykop Farmhouse	22:15	10	37.1	• Distant traffic • Farm animals • Diesel engine
23rd July 2012	Peyneskraal Farmhouse	22:45	10	31.2	• 3 cars in distance
23rd July 2012	Jakkelsdraai Farmhouse (Main)	23:05	10	41.4	• 3 cars in distance • Farm animals making a noise

The location of the points at which readings were taken, to establish the ambient noise levels, is displayed in the figure on the next page.

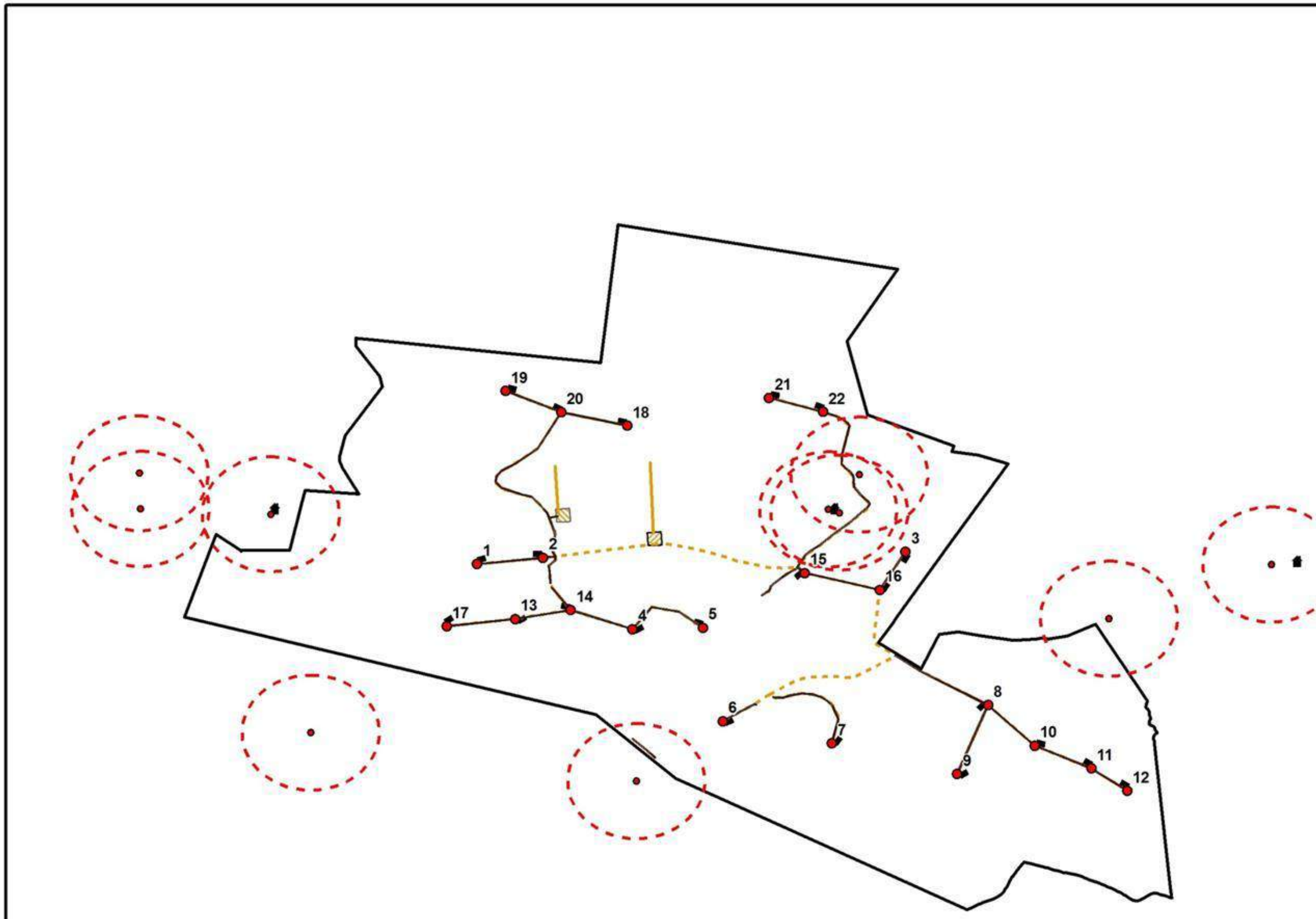
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Table 6-8 below gives an illustration of attenuation by distance for a noise of 117dB (sound power) at the source.

Table 6-8: Attenuation by distance for the construction phase (worst case)

Distance from noise source (metres)	Sound Pressure Level dB(A)
10	89
20	83
40	77
80	71
160	65
320	59
640	53
1280	47

It can be inferred from the above table that if the ambient noise level is at 45dB, the construction noise will be similar to the ambient level at approximately 1,280m from the noise source, if the noise characteristics are similar. Beyond this distance, the noise level will be below the ambient noise and will therefore have little impact. The above only applies to the construction noise and light wind conditions. In all likelihood the construction noise will have little impact on the surrounding community as it will most likely occur during the day when the ambient noise is louder and there are unstable atmospheric conditions.

6.7.2 Predicted noise levels for the Operational Phase

The effects of low frequency noise include sleep disturbance, nausea, vertigo etc. These effects are unlikely to impact on residents due to the distance between the facility and the nearest communities. Sources of low frequency noise also include wind and vehicular traffic, which are all sources that are closer to the residential areas and other Noise Sensitive Areas (NSAs). The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site. The ambient noise increases as the wind speed increases. In summary the noise rating limits used are 45dB for rural homesteads and 70dB for industrial sites. The recommended setback distances are 500 m for the rural homesteads and 100m for the industrial sites. The results (Table 6-9) indicate the following for the Nordex N117 turbine that will be utilised for the project.

Table 6-9: Summary of noise impacts on NSAs at various wind speeds (Nordex N117/3000)

NSA	4m/s	6m/s	8m/s	10m/s	12m/s	Turbine 500m setback distance criteria met
Jakkelsdraai Farm House	✓	✓	✓	✓	✓	Yes
Honeykop Lodge	✓	✓	✓	✓	✓	Yes
Honeykop Farmhouse	✓	✓	✓	✓	✓	Yes
Peynes Kraal Farm House	✓	✓	✓	✓	✓	Yes
Workers House - Peynes Kraal	✓	✓	✓	✓	✓	Yes

NSA	4m/s	6m/s	8m/s	10m/s	12m/s	Turbine 500m setback distance criteria met
Workers House - Honeykop	✓	✓	✓	✓	✓	Yes
Workers House - Peynes Kraal	✓	✓	✓	✓	✓	Yes
Fairview Farm House	✓	✓	✓	✓	✓	Yes
Coombs Vale House	✓	✓	✓	✓	✓	Yes
Jakkelsdraai Farmhouse (Main)	✓	✓	✓	✓	✓	Yes

✓ = Within Recommended Noise LimitX= Exceeds 45dB (A) day/night Recommended Limit

The results of the study indicate that the following conclusions can be drawn:

- There will be a short term increase in noise in the vicinity of the site during the construction phase as the ambient level will be exceeded. The impact during the construction phase will difficult to mitigate.
- The impact of low frequency noise and infra sound will be negligible and there is no evidence to suggest that adverse health effects will occur as the sound power levels generated in the low frequency range are not high enough to cause physiological effects.
- The area surrounding the construction site will be affected for short periods of time in all directions, should a number of main pieces of equipment be used simultaneously.
- The noise produced by the Nordex N117/3000 wind turbines will not exceed the 45dB(A) day/night limit at the identified noise sensitive areas

The following recommendations were made for the construction and operational phases respectively:

Construction:

- All construction operations should only occur during daylight hours if possible.
- No construction piling should occur at night. Piling should only occur during the day to take advantage of unstable atmospheric conditions.
- Construction staff should receive “noise sensitivity” training.
- An ambient noise survey should be conducted during the construction phase

Operation:

- The noise impact from the wind turbine generators should be measured during the operational phase to ensure that the impact is within the recommended rating limits.

6.8 Agricultural Assessment

In terms of grazing, the assessment could not determine whether livestock will be able to utilize the areas in between the turbines, as this will be a decision taken between the wind farm developers and the land owners. Subsequently, it may be a possibility that the farming economy may suffer if grazing is excluded due to the operation of the turbines and an application for change of use of agricultural land may have to be sought. It is likely though, that livestock grazing will be allowed to continue unabated. A land use re-zoning application is currently underway. Construction of access roads to the turbine sites may result in the loss of vegetation, particularly as the existing dirt roads may not be suitable for the transport of heavy machinery and equipment required for construction and maintenance of the turbines, particularly during episodic rainfall events.

Soils found within the proposed development site are generally shallow and have a high erosion index rating. Consequently, areas where clearing of vegetation is required may experience significant erosion. The medium potential soil identified at turbine 6 is localised. If this was moved 50m to the north this soil would be avoided.

Pollution of the water sources e.g. natural drainage zones (watercourses, streams and rivers), earth dams and boreholes may occur as a result of construction activities. Construction activities will lead to increased run-off and this will result in erosion. The soils are generally shallow with a high erosion index rating.

6.9 Geotechnical Assessment

The terrain consists of rolling hills with grass land type vegetation. The topsoil is relatively shallow with frequent rocky outcrops and does not have a high agricultural potential. Ground conditions are stable; there are no severe slope stability problems. The land, however, is considered sensitive to soil erosion and care must be taken during construction to mitigate soil erosion.

The hills where the wind turbines are to be situated are mostly of exposed surface or shallow underlying rock of generally fine to medium grained quartzite or sandstone of the Witpoort Formation. The higher hills have localised areas of silcrete. There are no major geological faults in the area. Much of the level area is covered with soils of varying depth. No artefacts where found during the visit to the Site.

In terms of foundation conditions this is a highly favourable site. If possible or practical the bases for the turbines should be excavated through the loose soils and founded on rock. In areas of deep soils mass concrete foundations will be required. Where the rock is on the surface or too shallow to allow for a mass foundation, consideration should be given for the use of rock anchors. This will negate the necessity for expensive mass concrete foundations and the need for blasting. Further research needs to be done to establish the cheaper option, namely blasting and excavating, or the use of rock anchors and a smaller radius foundation with less concrete. Due to the draining nature of the rock, which is highly jointed, the ground water table will be far below any concrete foundation base. This is also due the position of the wind turbines being on the higher ground in the area.

Ground water may have a high content of dissolved iron but is otherwise considered fairly good quality. Groundwater will not be affected by the construction or ground activity of the wind farm. This is due to the presence of surface rock over part of the area, it can be expected that there will be difficulty with excavating cable trenches in places. The farmer on Tower Hill, however, has successfully excavated irrigation pipes to a depth of 600mm using a ripper attached to a tractor or bull dozer. Alternatively, blasting in localized areas (estimated to about 20% of the total cable length) may be required. Alternatively, consideration should be given to surface conduits or pole mounted cables. The need for cathodic protection may be required for buried cables, due to the relatively high iron content in the rock, especially during rainy periods.

Temporary access roads can be constructed in similar manner to farm roads, with the provision for additional wearing-course gravel where required to make grade. Already, much of the wind turbine sites can be accessed on the existing farm roads although there are several places where the gradient exceeds the allowable 6% gradient and allowable turning radius. These geometric challenges can be overcome by re-design of the road. The borrow pit where material for the Coombs road that passes through the Tower Hill farm has a limited supply of sub base which can be used for access roads. The material was tested at GeoScience Laboratories and found to be of G5 grade, which is acceptable. Other borrow pits are found on the Peynes Kraal farm which was estimated to be of G5 grade or less. Relatively steep access roads may need to be concreted to prevent soil erosion.

In summary, ground conditions are stable; there are no slope stability problems. Care needs to be taken during construction to mitigate soil erosion as the top soil is thin. Geotechnical constraints

are minor and relate to the presence of surface or shallow hard rock over the areas where the turbines are to be installed. Ripping or blasting may be required for trenching and foundation excavation.

6.10 Socio-economic Assessment

Objectives

Objective of the Socio-economic Impact Study is to understand the current social and economic environment and use it as the baseline for assessing potential impacts. Potential impacts, both positive and negative, can then be evaluated and ranked according to how they will affect this baseline.

Methodology

Projection of the initial impacts and multiplier effects is done by employing a General Equilibrium Model (GEM). This model allows for the quantification of impacts in terms of a number of indicators, including: production, Gross Value Added (GVA), employment, and income. Secondary and cumulative effects can be identified through an expert opinion technique, consultations, development matrices and interviews. Such impacts are difficult to quantify. The SEIA made use of the economic models based on the Eastern Cape Social Accounting Matrix (SAM) developed in 2006 and adjusted to represent 2013 figures.

Impacts were evaluated in terms of extent, duration, magnitude, probability and significance. It is important to note that the evaluation of impacts is in many cases based on subjective criteria that are difficult to quantify, and are sometimes limited by the novelty of wind energy in the South African context.

Because the local economy is insufficiently diversified to supply all materials and services for development of the wind farm, economic impacts will extend beyond the municipal boundaries and affect the national economy. In this study, 3 study areas have been delineated: the Primary Study Area which is the Makana Local Municipality, the Secondary Study Area which is the Eastern Cape, and the Tertiary Study Area which is South Africa. The visually affected zone, as defined in the Visual Impact Study, was also defined as a study area.

Socio-economic Profile of the Area

Data for the Makana Local Municipality indicate out-migration, probably due to limited employment opportunities in the area, and high levels of poverty. Disposable average monthly income was 63.5 % lower than that of the Cacadu District Municipality and the number of households that earn no income is 42%.

Makana municipality has a small urban population with the majority of residents living in rural settings. Land is primarily used for livestock and game farming, conservation, and a very small area for crop farming. Livestock farming is dominated by sheep and goat farming, with cattle making a less significant contribution. The agricultural sector has experienced a significant decline in terms of its economic output and employment levels between 2005 and 2011. There has been a gradual movement away from traditional livestock farming towards game farming and eco-tourism.

Socio-economic Profile of the Immediately Affected Environment

The area surrounding the properties involved in the wind project are to a large extent used for game farming, hunting and eco-tourism. Some properties also undertake livestock and crop farming (lucerne and maize). There is some mixed use, with some properties being involved in both traditional farming and game farming and hunting activities. Within the game farming industry, some farms also provide accommodation to visiting tourists and some farms exclusively breed

game for sale to the hunting industry. From the data obtained from surveyed farmers it is estimated that (including hunting and tourism) in the directly affected area employ approximately 240 people. These farms generate an average annual revenue of R578,102 although the game/tourism farms tend to generate significantly higher earnings than crop or livestock farming. Hunting for biltong is undertaken by local tourists mainly, while hunting for trophy animals is undertaken by international tourists mainly. Local biltong hunters stay on average 2 - 3 days and hunt a few times per season (July to August). Trophy hunters tend to stay for periods of 5 – 7 days and visit once every 3 years. Some of the game farms earn income through the trading of live game.

Assumptions

The total investment for the establishment of the facility is valued at R1.3 billion of which 528 million will be spent within the South African economy. Of the South African spend, 83.66% will be spent on the procurement of goods and services and the rest on labour costs. Of the South African spend, 27.1% will be in the local area. The facility will operate for 20 years and will generate about R230 million a year in revenue. Operations and maintenance cost will be R16.1 million per year of which R5.6 million will be spent in the country. Greatest share of local spending will be labour costs associated with the employment of 10 permanent staff. Most of these staff will come from the local area. Approximately R11.5 million per year will be invested in social development and economic development projects in the surrounding communities. It is likely that the after the 20 year operation period, the farm will be refurbished to extend its lifetime.

The most significant negative impact of the wind farm is likely to be the visual impact, as the surrounding area is characterised primarily by tourism related to hunting and other activities. The revenue generated by livestock and crop farming is not going to be affected by visual disturbances in the area. The opposite however applies to the tourism and game farming industries. The following paragraphs describe the sensitivity of the tourism industry and game farms to visual disturbances and provide an estimation of the potential loss in revenue that could result from the establishment of the wind farm.

The majority of revenue generated by game farms in the immediately affected environment comes from international tourists. International tourists visiting the farm are almost exclusively trophy hunters. A small number of domestic tourists also visit the area for the purposes of relaxation, game viewing and hunting for biltong.

International tourists are expected to be fairly sensitive to a visual disturbance in the area. One of the reasons international tourists visit the area is to experience a “Wild Africa” and to hunt/view game. Any outside disturbance that would affect this “Wild Africa” experience is therefore likely to negatively impact the level of satisfaction that these tourists experience. It was however indicated that one of the critical factors that international hunters consider when visiting local game farms is the quality of the trophy. In many cases this is the chief concern of international hunters.

It was also noted that many of the international tourists visiting local game farms are repeat visitors and have been referred to the farms by friends and family. This means that any visual disturbance that would affect the experience of international visitors would impact on their decision to return to the respective game farm. It is also probable that these international visitors would likely spread the word about their experience to other potential tourists meaning that, in a case where the experience is unsatisfactory, international tourists may not make referrals to the game farms.

Domestic tourists are also expected to be sensitive to visual disturbance that affect their sense of places, as well as their experience of the game farms. Biltong hunters are however expected to be less sensitive than trophy hunters or even domestic visitors interested in eco-tourism. This is largely due to the fact that small groups of biltong hunters primarily hunt for meat and biltong and are generally not very demanding as far as their facilities and environment are concerned. The situation might differ if corporate groups are examined. Corporate tourists are likely to be more demanding with regard to facilities and thus more sensitive to the ambience created by the

surrounding environment. It is important to note that for both international and domestic tourists the visual experience of the area is but one factor that is considered when visiting a game farm. Other factors include inter alia:

- Location and quality of the facilities
- Variety and abundance of wildlife
- Quality of the trophy (for hunting tourists)
- Relationship with the farm owner

In order to determine the sensitivity of various groups towards the visual disturbances created by the proposed development, a telephonic perception survey was conducted with professional hunters operating in the area, as well as local game farms situated in the area. Based on the outcomes of this survey as well as other qualitative and quantitative assessments (as discussed and referenced throughout Chapter 5 of this document) the following assumptions were made:

- **International tourists**
  - A maximum of 50% of international tourists would definitely change their decision to visit the area if there was a high visual disturbance associated with the wind farm. A small visual impact created by the wind farm though was of a lesser concern.
  - Nevertheless it still might result in an estimated 15% of tourists choosing not to visit the respective farms. This means that as word spreads and usual repeat tourists visit the game farm that is within visual impact of the wind farm, the potential decline in the number of international tourists could range between 15% and 50% depending on the distance from the facility.

- **Domestic tourists**
  - Domestic tourists are also assumed to be sensitive towards the visual impact but to a slightly lesser degree than international tourists.
  - Based on the qualitative and quantitative assessments, between 10% and 40% of domestic visitors to game farms would change their decision to visit the farm depending on the extent of the visual impact.

Based on the findings of the Visual Specialist Study, assumptions with regards to the sensitivity of specific game farms towards the visual impact were made. The following factors were also taken into account when determining the rating of that impact from a socio-economic perspective:

- the location of accommodation facilities;
- the extent to which the visual impact would spread over the entire property;
- the existing visual disturbances (i.e. existing power lines) on the properties

It was calculated that potential losses to the local game farming, tourism and associated industries due to construction of the wind farm could range between R0.94 million and R6.13 million per annum.

Summary and conclusions

It is acknowledged that the area in proximity to the proposed wind farm has experienced a boom in recent years through tourism-related activity. This has resulted in the creation of employment in hunting, eco-tours, conservation of endangered species, taxidermy, employment, transportation, catering and several other sub industries. This has been matched by significant investments into land rehabilitation, economic infrastructure (e.g. roads and fences) property upgrades, animal holdings and training of employees in critical skills. This has made the region to the East of Grahamstown a growth-spot in terms of nature-based tourism. As a result of this, formerly stagnant or declining incomes from conventional farming were replaced by a revenue stream from both local and international tourists. This has also realised the profile of the area nationally. Such investments and activity have resulted in a robust local economy based on tourism. Based on survey responses

regarding visitor statistics potential production losses to the local tourism sector associated with visual exposure are estimated at between R0.94 million and R6.13 million per year. These are to be compared with the proposed wind farm's capital injection of R107.25 million into the Makana Local Economy. This is estimated as potentially creating a further R185.74 million for the local economy through indirect and induced production effects and a further R70.69 million through GDP-R impacts.

Benefits accruing to the region from investments and activity in the tourism sector are thus however outweighed by those that would arise from the construction and operation of a wind farm. The amount of money to be invested, together with its indirect and induced impacts is considerably more than that involved with the local tourism sector. It is also not anticipated that in future the local tourism sector would be able to raise investment capital equal or more than that related to the Grahamstown wind farm. As such, this report recommends that the Grahamstown wind farm be undertaken on the basis of its positive benefits outweighing negative outcomes accruing to the local tourism industry.

6.11 Community Needs Analysis

The recommended projects are as follows:

- Trentham Park vegetable production training and mentorship.
- Fingo Village bee-keeping and honey harvesting.
- Collingham Towers poultry training and mentorship.
- Eluxolweni childcare shelter support.
- Pershoek agri-business enterprise training.
- Establishment of Plan-8 Infinite Energy Scholarship.
- Wind farm learnership programme & visitor centre.

Within the community needs analysis report, the reader will find descriptions for each of these potential projects. Detailed information is supplied on what these projects seek to achieve, where they are located, how financial assistance will help them achieve their goals, the amount of assistance required and timeframes, and importantly: monitoring of the results of the financial stimulus. A summary of the projects recommended for support, and the financial assistance proposed, is presented in the table below.

Table 6-10: Summary of the Community Needs Analysis recommendations.

Capital expenditure	Average annual expenditure	Duration
Trentham Park vegetable production training & mentorship		
Not applicable	R720 000	36 months
Fingo village bee-keeping and honey harvesting		
R510 000	Not applicable	12 months
Collingham towers poultry training and mentorship		
R500 000	R680 000	18 months
Pershoek agri-business enterprise training		
R150 000	R409 992	36 months
Eluxolweni (Grahamstown) childcare shelter support		
Not applicable	R 1400 000	240 months
Establishment of Infinite Plan-8 Scholarships		
Not applicable	R 1 010 000	240 months
Wind farm learnership programme and visitor centre		
R2 000 000	R670 000	240 months

6.12 12 Month Bird Monitoring Report

A total of 102 small bird species were recorded on site by Walked Transects, with a peak in species richness in spring and summer. A number of southern African endemics were included in this set of species, but no Red Listed species were recorded. No particularly sensitive avifaunal aspects are evident from this data set. Eight large bird species were recorded on and near the site by Vehicle Transects, with a peak in spring once again. Martial Eagle (Endangered) was the only Red Listed species recorded by this method.

An African Crowned Eagle nest site was found in a small gorge immediately to the west of the site. This nest is approximately 820 metres from the nearest turbine position (T19). As of late January 2015, a large chick was on the nest, not yet fledged. This is the most sensitive avifaunal aspect of this project and requires careful management, as recommended below. Verreaux's Eagle was not recorded on or near site during the duration of this programme. No evidence of either current or historic nests was found in the gorges that were surveyed. Martial Eagle was recorded on site several times in spring, but no breeding sites for this species were found in the gorges.

Fifteen target bird species were recorded flying on site during Vantage Point observations, five of which are Red Listed: the Martial Eagle (Endangered); Lanner Falcon (Vulnerable); Black Harrier (Endangered); African Crowned Eagle (Vulnerable) and African Marsh-Harrier (Endangered). The most frequently recorded species was Jackal Buzzard, followed by Rock Kestrel and Booted Eagle. Based on the species' mean flight height above ground, and percentage of flight time spent at rotor height (approximately 30 – 150m), the species likely to be most at risk of collision with turbines appear to be Jackal Buzzard and Rock Kestrel. A spatial 'collision risk index' was created for the site, and indicates two key areas of higher collision risk, close to Turbines 19 and 20 and Turbine 08. Since the flight records responsible for these scores are mostly long flights of Booted Eagle, Rock Kestrel and Jackal Buzzard (none of which are Red Listed), no mitigation action in these areas is required.

6.13 12 Month Bat Monitoring Report

The 12 Month Bat Monitoring Report recorded average bat passes detected per bat detector night (nights on which detectors recorded correctly) and total number of bat passes detected over the monitoring period by all systems. Seven bat species were detected namely *Cistugo lesueuri, Chaerephon pumilus, Tadarida aegyptiaca, Scotophilus dinganii, Neoromicia capensis, Miniopterus natalensis* and an unknown bat species from the Molossid family. The Molossid could not be identified down to species level and thus was classified at family level.

Lower bat activity levels were detected at the 50m microphone height, in comparison to 10m microphone height, by the met mast monitoring system. Short mast 4 recorded the most bat calls compared to the other four systems with *Neoromicia capensis* being the most abundant bat species recorded by all systems. Short mast 4 and the met mast was the only systems that recorded *Cistugo lesueuri* calls.

The month of January 2015 had the highest average bat call per night recorded during the monitoring period this far. All monitoring systems detected a decline in activity over the colder winter months. This excludes April which is based on a small sample size resulting in less accurate averages, April will be completed at the end of the 12 months monitoring.

Common and abundant species, such as *Neoromicia capensis, Tadarida aegyptiaca* and *Miniopterus natalensis*, are of a larger value to the local ecosystems as they provide a greater contribution to most ecological services than the more rare species due to their higher numbers.
The migratory species, *Miniopterus natalensis*, was detected by all monitoring systems and is rather prevalent on site. The temporal distribution of this species will be monitored over the course of the 12 month study for migratory events. In the case of a migratory event, a mitigation schedule

will be drawn up specifically for the event.

7 IMPACT ASSESSMENT

In terms of section 31 (2) of the EIA regulations (2010), a*n environmental impact assessment report must include:*

(k) 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;

(l) 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.***

(m) A description of any assumptions, uncertainties and gaps in knowledge

Please note when reviewing these impacts that some of the assumptions, uncertainties and gaps in knowledge have been described in Chapter 1.

7.1 Construction Phase Impacts

7.1.1 Flora and Vegetation

Issue 1: Loss of vegetation communities

Construction of the wind farm will result in loss of a small amount of vegetation on the site. This loss will occur as a result of trampling of the vegetation as well as extra clearing needed for construction. Mitigation measures can be used in order to reduce the trampling and rehabilitate the vegetation respectively. If nothing were built on the site the overall significance would be negative. This would be due to the continuation of the current land use, grazing, which is already having a negative impact on the vegetation of the site.

Impact 1: Loss of Degraded Thicket

Cause and Comment
Three turbines are sited in this vegetation type, with two bordering very closely on this vegetation type. It is considered a low sensitivity area due to its degraded nature and, as turbine footprints are small; impacts are low. If nothing were built on the site, the overall significance would be negative. This would be due to the continuation of the current land use, grazing, which is already having a negative impact on the vegetation of the site.

Mitigation and management
Mitigation measures include the following: Keep removal of vegetation to a minimum. Micro-sting of the final access roads and lay down areas must be done by a specialist in order to ensure that the least sensitive areas are disturbed.

Without mitigation: In the construction phase of this development, the impact will be permanent, localised, may occur and will be a slight severity. The overall significance of the impact will thus be a low negative. This impact was assessed with a high level of confidence.

With mitigation: With mitigation, in the construction phase of the development, the impact is reduced to moderate and probable and has an overall significance of low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Localised	Slight	May occur	**LOW -**
With mitigation	Permanent	Localised	Slight	Slight	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 2: Loss of Fynbos

Cause and Comment
Two turbines are sited in this vegetation type, with one bordering very closely on this vegetation type. It is considered a medium sensitivity area due to the presence of species of special concern, as turbine footprints are small; impacts are relatively low.

Mitigation and management
It is recommended that areas containing species of special concern be noted and every effort made to reduce the impacts of construction on these sections of vegetation. SSC in any area to be cleared should be identified and rescued. Some SSC will not transplant. These individuals should, as far as possible, be left untouched.

Without mitigation: In the construction phase of this development, the impact will be permanent, localised, may occur and will be a slight severity. The overall Significance of the impact will thus be a low negative. This impact was assessed with a high level of confidence.

With mitigation: With mitigation, in the construction phase of the development, the impact remains an overall significance of low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Localised	Slight	May occur	**LOW -**
With mitigation	Permanent	Localised	Slight	Slight	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 3: Loss of Fynbos, thicket, karoo mosaic

Cause and Comment
Seventeen turbines are sited in this vegetation type, with two bordering very closely on this vegetation type. It is considered a low sensitivity area due to the level of degradation due primarily to overgrazing, but also, to a lesser extent, to the invasion by alien species. As turbine footprints are small; impacts are relatively low.

Mitigation and management
Mitigation measures to reduce the impact of the introduction of alien invaders, as well as mitigation against alien invaders that have already been recorded on the site should be actively maintained throughout both the construction and operation phases. Removal of existing alien species should

be consistently done. Also, rehabilitation of disturbed areas after the construction of the wind energy facility should be done as soon as possible after construction is completed. Invasive plant species are most likely to enter the site carried in the form of seeds by construction vehicles and staff; these should be cleaned before entering the site to prevent alien infestation.

Without mitigation: In the construction phase of this development, the impact will be permanent, localised, may occur and will be a slight severity. The overall Significance of the impact will thus be a low negative. This impact was assessed with a high level of confidence.

With mitigation: With mitigation, in the construction phase of the development, the impact is remains an overall significance of low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Localised	Slight	May occur	**LOW -**
With mitigation	Permanent	Localised	Slight	Slight	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Loss of Rocky Fynbos

No turbines are sited in this vegetation type; this impact is thus not applicable.

Loss of Thicket

No turbines are sited in this vegetation type; this impact is thus not applicable.

Impact 4: Loss of Thicket Mosaic

No turbines are sited in this vegetation type. It is considered a high sensitivity area due to the numbers of species of special concern occurring here, but generally impacts are low.

Without mitigation: In the construction phase of this development, the impact will be permanent, localised, may occur and will be a slight severity. The overall Significance of the impact will thus be a low negative. This impact was assessed with a high level of confidence.

With mitigation: With mitigation, in the construction phase of the development, the impact remains an overall significance of low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Localised	Slight	May occur	**LOW -**
With mitigation	Permanent	Localised	Slight	Slight	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Issue 2: Loss of species of special concern and biodiversity (general)

Impact 5: Loss of plant species of special concern

Cause and Comment
There are, on the study site, thirteen species of special concern. There may be many additional species of special concern that will be found on site during construction that were not found during this study. These should be relocated if they need to be removed, and the required permits obtained in order to do so. Immediately prior to construction, when the final infrastructure layout is available, a botanical search and rescue operation will need to be conducted to transplant these species from the development footprint. If nothing was built on the site the overall impact would be negative. This would be due to the continuation of the current land use, grazing.

Mitigation and management
It is recommended that areas containing species of special concern be noted and every effort made to reduce the impacts of construction on these sections of vegetation. SSC in any area to be cleared should be identified and rescued. Some SSC will not transplant. These individuals should, as far as possible, be left untouched.

Without mitigation: Without mitigation in the construction phase of the project the impact will be restricted to the study area, long term and definite with a moderate impact, resulting in an overall significance of high negative. This impact was assessed with a high level of confidence.

With mitigation: With mitigation the severity of the impact is decreased from moderate to slight and the risk from definite to probable, reducing the overall significance of the impact to low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Study area	Moderate	Definite	**HIGH -**
With mitigation	Long term	Study area	Slight	Probable	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 6: Loss of animal species of special concern

Cause and Comment
There are a number of species of special concern that occur within the study site. This development is unlikely to affect any of these as few are restricted to the site specifically. For the No-Go option, the impact will be negative. This would be due to the continuation of the current land use.

Mitigation and management
If any fencing is to be done the fences should have enough space between wires for small animals to move across them uninhibited. Workers should also be educated on conservation and should not be allowed to trap animals on site.

Without mitigation: Without mitigation in the construction phase of the development, the impact will be long term, restricted to the study area and may occur with a slight severity and an overall significance of low negative. This impact was assessed with a high level of confidence.

With mitigation: Mitigation measures reduce the risk to unlikely, but the overall significance remains a low negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Study area	Slight	May occur	**LOW -**
With mitigation	Long term	Study area	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 7: Loss of biodiversity

Cause and Comment

This will occur as a result of the loss of some of the vegetation on site. Species other than just species of special concern will be affected; both floral and faunal. For the No-Go option, the impact will be negative due to the continuation of the current land use.

Mitigation and management

An area within the site that can be set aside for conservation and actively managed as a corridor area would be ideal to mitigate loss of biodiversity. It is recommended that as much as possible of the high sensitivity areas be set aside as conservation areas and be managed as such by the land owners and wind farm developers.

Without mitigation: Without mitigation in the construction phase of the development, the impact will be permanent, restricted to the study area and may occur with a moderate severity and an overall significance of moderate negative. This impact was assessed with a high level of confidence.

With mitigation: Mitigation measures reduce the risk to unlikely and the severity to slight, reducing the overall significance to negative.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Study area	Moderate	May occur	**MODERATE -**
With mitigation	Permanent	Study area	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Issue 3: Disruption of ecosystem function and process

Cause and comment

The habitats that exist in the project area, together with those of the surrounding area that are linked, form part of a functional ecosystem. An ecosystem provides more than simply a 'home' for a set of organisms, and can be viewed as an arena where biological and biophysical processes such as nutrient cycling, soil formation, reproduction, migration, competition, predation, succession, evolution and migration take place.

Destruction or modification of habitats causes disruption of ecosystem function, and threatens the interplay of processes that ensure environmental health and the survival of individual species. This issue deals with a collection of complex ecological impacts that are almost impossible to predict with certainty, but which are nonetheless important.

Fragmentation is one of the most important impacts on vegetation, especially when this creates breaks in previously continuous vegetation, causing a reduction in the gene pool and a decrease in species richness and diversity. In terms of current land use, this impact occurs when large areas are cleared for agriculture or large areas of vegetation are overgrazed.

The removal of existing vegetation creates 'open' habitats that will inevitably be colonised by pioneer plant and animal species. While this is part of a natural process of regeneration, which would ultimately lead to the re-establishment of a secondary vegetation cover, it also favours the establishment of undesirable species in the area.

These species are introduced along transport lines, by the transportation into the area of goods and equipment, and by human and animal movements in the area. Once established, these species are typically very difficult to eradicate and may then pose a threat to the neighbouring ecosystem. This impact is likely to be exacerbated by careless management of the site and its facilities, e.g. organic waste disposal and inadequate monitoring. Many such species are, however, remarkably tenacious once they have become established.

Impact 8: Fragmentation of vegetation and edge effects

Cause and Comment
This impact is unlikely to occur if the development is managed effectively. Considering the nature of wind turbines, it is unlikely that fragmentation will occur if the natural vegetation is left beneath them and the building of roads kept to a minimum.

Mitigation and management
As mentioned above, fragmentation is unlikely to occur due to the nature of the development. However, it is important to make sure all fences have wide enough mesh to let small animals through, and that large areas of vegetation are not cleared, especially for roads.

For the No-Go option, the impact will be negative. This would be due to the continuation of the current land use.

Without mitigation: Without mitigation the impact will be unlikely, in the long term and restricted to the study area and slight. Overall significance will be a low negative.

With mitigation: With mitigation the temporal scale would be reduced from long term to short term, thus the overall significance remains a low negative. This impact was assessed with a high level of confidence.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Study area	Slight	Unlikely	**LOW -**
With mitigation	Short term	Study area	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Long term	Study area	Slight	Unlikely	**LOW -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 9: Invasion of alien species

Cause and Comment
As with all building operations, the introduction of alien and invader species is inevitable; with disturbance comes the influx of aliens. Alien invader species need to be consistently managed over the entire operation phase of the project.

Mitigation and management
Mitigation measures to reduce the impact of the introduction of alien invaders, as well as mitigation against alien invaders that have already been recorded on the site should be actively maintained throughout both the construction and operation phases. Removal of existing alien species should be consistently done. Also, rehabilitation of disturbed areas after the construction of the wind energy facility should be done as soon as possible after construction is completed. Invasive plant species are most likely to enter the site carried in the form of seeds by construction vehicles and staff; these should be cleaned before entering the site to prevent alien infestation.

Without mitigation: In the construction phase of the development, the impact will be short-term, restricted to the study area and definite, with a severe severity. The impact will have an overall significance of moderate negative. In the operation phase of the project, the impact will be permanent, restricted to the study area, definite and with a severe severity. Overall significance would be a high negative. Should the proposed development not go ahead (the No-Go option), the impact would be permanent, definite and restricted to the study area with a severity of moderate and an overall significance of high negative. This impact was assessed with a high level of confidence.

With mitigation: In the construction phase of development mitigation measures will result in an overall positive impact. For the operation phase of development; mitigation measures will result in an overall positive impact.

Significance statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short term	Study area	Severe	Definite	**MODERATE -**
With mitigation	Short term	Study area	Moderately beneficial	Definite	**MODERATE +**
No-Go					
Without mitigation	Permanent	Study area	Moderate	Definite	**HIGH -**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.1.2 Avifauna

Impact 10: Avifauna Habitat Destruction

Cause and Comment
During construction a relatively large amount of habitat destruction will take place. This will be from the actual footprint of each turbine (+-20m x 20m) as well as associated infrastructure such as roads, batching plants, labour camps, power lines, substations and machinery and equipment storage.

From an avifaunal perspective this habitat destruction will result in a loss of habitat for many bird species. It must be noted however, that the target species that occur in the study area have large territories and therefore the habitat destruction and disturbance was assigned a low significance.

Mitigation and Management
The preferred mitigation for this impact would be to select a site that is already disturbed or transformed, for example a mine spoil site or a maize land. With no alternative sites under consideration, and with a project of this scale, the possibility for mitigating the impact of habitat destruction is very low.

The scale of the project means that it is inevitable that certain amounts of habitat destruction will take place.

The mitigation for this impact will be to only affect the minimum amount of habitat possible and to avoid any natural habitats as far as possible. This means that where possible existing roads must be used and batching plants, labour camps, equipment storage, etc. should be situated in areas that are already disturbed.

A full EMPr must also be prepared to specify all of the impacts and mitigation measures to follow for the ECO on site. Specialist avifaunal input must be included into the EMPr and this will focus on breeding sensitive species and their locations and the mitigation for this impact.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Localised	Slight	Definite	**LOW- TO MODERATE -**
With mitigation	Permanent	Localised	Slight	Definite	**LOW -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Habitat destruction is rated as a moderate negative before mitigation. With the no-go alternative, no habitat destruction is anticipated under the current land use (grazing) and hence the impact is not applicable.

Impact 11: Disturbance of birds

Cause and Comment
During construction, disturbance of avifauna during all of the construction activities has the ability to negatively affect avifauna. This is especially true during breeding of sensitive species. The impact can cause sensitive species to abandon their nest or chicks and as such these species can lose this important recruitment to the population.

The 12 month Bird Monitoring Report (2015) prepared by Wild Skies Ecological Services, identified a Crowned Eagle nest site that was found in a small gorge immediately to the west of the site. This nest is approximately 820m from the nearest turbine (WTG19). This is the most sensitive avifaunal aspect of this project.

Mitigation and Management
Mitigation for disturbance is much the same as for habitat destruction. In general terms all construction activities should result in the minimum amount of disturbance possible. This will be detailed in the site specific EMPr and will be enforced and overseen by the ECO for the project.

During the EMPr the avifaunal specialist must identify any breeding sensitive bird species in close

proximity to specified turbine locations, as well as associated infrastructure positions. Specific recommendations must be provided for each case and these must be strictly enforced and followed.

In addition, the 12-month Bird Monitoring Report (2015) prepared by Wild Skies Ecological Services, recommends that a final avifaunal walk through must be conducted prior to construction. This is to ensure that all the avifaunal aspects have been adequately addressed and managed, and ground truth the final layout of all infrastructure and be included in the site specific Environmental Management Programme (EMPr).

The turbine WTG19 has since been moved 460m in a direction 10 degrees south of east away from the African Crowned Eagle nesting site to mitigate the potential for collision impacts. The new position of WTG 19 is shown on, among others, Figure 2.4. In addition, a specialist should monitor the effect of construction activities on the African Crowned Eagle during the breeding season to measure the effectiveness of the above mitigation measure.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short term	Localised	Moderate	Probable	**MODERATE -**
With mitigation	Short term	Localised	Slight	Probable	**LOW -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Disturbance is rated as low negative before mitigation, however mitigation must still be implemented to keep it this way and make sure that sensitive bird species are not affected.

With the no-go alternative, no additional disturbance to avifauna is anticipated under the current land use practises (grazing) and hence the impact is not applicable.

7.1.3 Bats (Chiroptera)

Impact 12: Destruction of bat foraging habitat

Cause and Comment

Bat foraging habitat will possibly be destroyed during the construction phase and this impact will be present to a lesser extent during the lifetime of the wind farm, when turbines are constructed in areas designated as sensitive for bat foraging habitat. Such areas are higher in moisture and will therefore support more insects, which in turn will attract more insectivorous bats.

Important note: These assessments were made on the preliminary turbine layout, and the layout has been revised in response to the specialist assessments. In can thus be said, with regards to this impact specifically, that the mitigation measure suggested has been implemented.

Mitigation and Management

Correct turbine placement is crucial to avoid destruction of bat foraging habitat. The areal footprint of the wind farm should be kept to a minimum, and areas designated as sensitive should be avoided.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Study Area	Slight	Unlikely	**MODERATE -**
With mitigation	Long Term	Study Area	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Permanent	Study Area	Beneficial	Probable	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 13: Destruction of bat roosts

Cause and Comment

Bat roosting habitat will indefinitely be destroyed during the construction phase and this impact will be present to a lesser extent during the lifetime of the wind farm. When turbines are constructed in areas designated as sensitive for bat roosting habitat, larger trees and riparian/dense valley vegetation will be destroyed. Such areas can provide many roosting spaces under tree bark and any other hollows/crevices.

Important note: These assessments were made on the preliminary turbine layout, and the layout has been revised in response to the specialist assessments. In can thus be said, with regards to this impact specifically, that the mitigation measure suggested has been implemented.

Mitigation and Management

Correct turbine placement is empirical to avoid destruction of bat roosting habitat. The areal footprint of the wind farm should be kept to a minimum, and areas designated as sensitive should be avoided.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Study area	Moderate	Probable	**MODERATE -**
With mitigation	Long Term	Study area	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Permanent	Study Area	Beneficial	May Occur	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.1.4 Archaeology

Impact 14: Impact on heritage resources

Cause and Comment

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal. The objective should be to limit such impacts to the primary activities associated with the

development and hence to limit secondary impacts during the medium and longer term working life of the facility.

Mitigation and Management

Known sites should be located and isolated, e.g. by fencing them off. Those resources that cannot be avoided and that are directly impacted by the development can be excavated/recorded and a management plan can be developed for future action. Those sites that are not impacted on can be written into the management plan, whence they can be avoided or cared for in the future. In only one case would a turbine and access road be constructed near to a sensitive site, namely the unmarked graves. A buffer zone of 15m around the graves should be enforced and demarcated by a perimeter fence. All workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer:

- Provision for on-going heritage monitoring which provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of development or operation.
- Inclusion of further heritage impact consideration in any future extension of infrastructural elements.
- Immediate reporting to relevant heritage authorities of any heritage feature discovered.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Localised	Slight	May Occur	**LOW -**
With mitigation	Medium term	Localised	Slight	May Occur	**LOW -**
No-Go					
Without mitigation	Permanent	Localised	Beneficial	May Occur	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.1.5 Noise

Impact 15: Potential Construction Noise Sources (General Equipment and Vehicles)

Noise pollution will be generated during the construction phase as well as the operational phase. The construction phase could generate noise during different activities such as:

- Site preparation and earthworks to gain access using bulldozers, trucks etc.
- Foundation construction using mobile equipment, cranes, concrete mixing and pile driving equipment (if needed).
- Heavy vehicle use to deliver construction material and the turbines.

The number and frequency of use of the various types of vehicles has not been determined but an indication of the type and level of noise generated is presented below.

Table 7-1: Typical types of vehicles and equipment to be used on site (Construction Phase)

Type	Description	Typical Sound Power Level (dB)
Passenger Vehicle	Passenger vehicle or light delivery vehicle such as bakkies	85
Trucks	10 ton capacity	95
Cranes	Overhead and mobile	109
Mobile Construction Vehicles	Front end loaders	100
Mobile Construction Vehicles	Excavators	108
Mobile Construction Vehicles	Bull Dozer	111
Mobile Construction Vehicles	Dump Truck	107
Mobile Construction Vehicles	Grader	98
Mobile Construction Vehicles	Water Tanker	95
Stationary Construction Equipment	Concrete mixers	110
Compressor	Air compressor	100
Compactor	Vibratory compactor	110
Pile Driver	Piling machine (mobile)	115

Predicted Noise Levels for the Construction Phase

The construction noise at the various sites will have a local impact. Safetech has conducted noise tests at various construction sites in South Africa and have recorded the noise emissions of various pieces of construction equipment. The results are presented in the Tables below.

Table 7-2: Typical Construction Noise

Type of Equipment	$L_{Req.T}$ dB(A)
CAT 320D Excavator measured at approximately 50 m.	67.9
Mobile crane measured at approximately 70 m	69.6
Drilling rig measured at approximately 70 m	72.6

The impact of the construction noise that can be expected at the proposed site can be extrapolated from Tables 7.1 and 7.2.

As an example, if a number of pieces of equipment are used simultaneously, the noise levels can be added logarithmically and then calculated at various distances from the site to determine the distance at which the ambient level will be reached. The upper end and lower end of the noise spectrum are provided in Tables 7-3 and 7-4 respectively.

Table 7-3: Combining Different Construction Noise Sources – High Impacts (Worst Case)

Description	Typical Sound Power Level (dB)
Overhead and mobile cranes	109
Front end loaders	100
Excavators	108

Description	Typical Sound Power Level (dB)
Bull Dozer	111
Piling machine (mobile)	115
Total*	117

*The total is a logarithmic total and not a sum of the values.

Table 7-4: Combining Different Construction Noise Sources – Low Impacts

Description	Typical Sound Power Level (dB)
Front end loaders	100
Excavators	108
Truck	95
Total	111

The information in the tables above can now be used to calculate the attenuation by distance. Noise will also be attenuated by topography and atmospheric conditions such as temperature, humidity, wind speed and direction etc. but this is ignored for this purpose.

Therefore, the distance calculated below would be representative of maximum distances to reach ambient noise levels. The table below gives an illustration of attenuation by distance from a noise of 117dB measured from the source.

Table 7-5: Attenuation by distance for the construction phase (worst case)

Distance from noise source (metres)	Sound Pressure Level dB(A)
10	89
20	83
40	77
80	71
160	65
320	59
640	53
1280	47

What can be inferred from the above table is that if the ambient noise level is at 45dB(A), the construction noise will be similar to the ambient level at approximately 1280 m from the noise source, if the noise characteristics are similar. Beyond this distance, the noise level will be below the ambient noise and will therefore have little impact. The above only applies to the construction noise and light wind conditions. In all likelihood, the construction noise will have little impact on the surrounding community as it will most likely occur during the day when the ambient noise is louder and there are unstable atmospheric conditions. The ambient noise levels recorded on the site are presented in tables 6-6 and 6-7.

Significance Statement – Construction Activities

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short term	Localised	Slight	May Occur	**LOW -**
With mitigation	Short term	Localised	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Permanent	Localised	Beneficial	May Occur	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.1.6 Visual

Impact 16: Intrusion on views of sensitive visual receptors of construction phase

Cause and Comment

The height of the features being built and the siting on the flat landscape is likely to expose construction activities against the skyline. Large, abnormal freight vehicles and equipment will be visible. Traffic may be disrupted while large turbine components are moved along public roads. Activity at night is also probable since transport of large turbine components may occur after work hours to minimise disruption of traffic on main roads.

Mitigation Measures

The most obvious causes of impact cannot be mitigated for since the turbines are so tall and they are to be installed on the top of ridges. The duration of the impact is relatively short, though, and there are a number of mitigation measures that will curtail the intensity to some extent:

- Dust suppression is important as dust will raise the visibility of the development.
- New road construction should be minimised and existing roads should be used where possible.
- The contractor should maintain good housekeeping on site to avoid litter and minimise waste.
- Clearance of indigenous vegetation should be minimised and rehabilitation of cleared areas should start as soon as possible.
- Erosion risks should be assessed and minimised as erosion scarring can create areas of strong visual contrast with the surrounding vegetation, which can often be seen from long distances since they will be exposed against the hillslopes.
- Laydown areas and stockyards should be located in low visibility areas (e.g. valleys between ridges) and existing vegetation should be used to screen them from views where possible.
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency. See section on lighting for more specific measures.
- Fires and fire hazards need to be managed appropriately especially in winter when fires are a constant threat.
- If practical, notify locals when turbines are being assembled, and invite them to a viewing of the construction process (although the novelty may wear off after a while).

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short Term	Regional	High	Definite	**HIGH -**
With mitigation	Short Term	Regional	High	Definite	**HIGH -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/Ar	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

The duration of the impact is short – construction of the highly visible components of the wind farm is unlikely to last longer than one year. The extent is regional due to the nature of the development (height of towers and siting on ridges and higher ground) and construction activities will be visible over long distances). The severity of the visual impact will be high since construction activity will often be exposed against the skyline. The likelihood of the impact occurring is definite (since construction of the turbines will be outlined against the skyline for many of the viewers, and is likely to be viewed with some curiosity. The construction engineering feat of lifting and attaching components weighing more than 60 tons a piece in a highly visible area is bound to be spectacular (see for example (filmsfromyes2wind 2010) or (Gipe 1995; Stanton 1996; Vissering 2005)).

Impact 17: Intrusion of large, highly visible wind turbines on the existing views of sensitive visual receptors

Cause and Comment

A number of highly sensitive visual receptors will potentially be affected by the proposed wind farm. These include residents of, and viewpoints in, game farms and eco-tourism operations in the region. There are not many urban areas within 20-25km of the development site, but a few rural villages north of the Fish River are about 10km away and residents here often have scenic views of the hills on which the turbines will be built.

Mitigation Measures

There are no mitigation measures that can reduce the perception of a negative impact significantly unless the site is avoided. But there are a number of measures that can enhance the positive aspects of the impact. It has been shown that uncluttered sites are preferred for wind farms (Gipe, 1995; Stanton, 1996; Vissering, 2005). In view of this the following mitigation measures and suggestions may <u>enhance</u> the positive visual aspects of the development:

- Ensure that there are no wind turbines closer than 500m to a residence or farm building.
- Maintenance of the turbines are important. A spinning rotor is perceived as being useful. If a rotor is stationary when the wind is blowing it is seen as not fulfilling its purpose and a negative impression is created (Gipe, 1995).
- Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided.
- According to the Aviation Act, 1962, Thirteenth Amendment of the Civil Aviation Regulations, 1997: “Wind turbines shall be painted bright white to provide maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required.”
- Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations.

- An information kiosk (provided that the kiosk and parking area is located in a low visibility area) and trails along the wind farm can enhance the project by educating the public about the need and benefits of wind power. 'Engaging school groups can also assist the wind farm proponent, as energy education is paramount in developing good public relations over the long term. Instilling the concept of sustainability, and creating awareness of the need for wind farm developments, is an important process that can engage the entire community' (Johnston, 2001).

Significance Statement

.Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long Term	Regional	High	Definite	**HIGH -**
With mitigation	Long Term	Regional	High	Definite	**HIGH -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/Ar	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

The temporal scale for the impact is long term since the life span of a wind turbine can be up to 40 years after which it can be dismantled, or upgraded. Although the duration of the impact can be permanent (more than 40 years) since the lifetime of a wind farm can be extended indefinitely, it is possible to remove the turbines completely in a relatively short time and as such the impact is seen as long term rather than permanent. The spatial scale of the impact is regional since the turbines will be visible from more than 20km away on clear days. There are a number of highly sensitive visual receptors with high visual intrusion ratings the severity of the impact is deemed severe.

Impact 18: Impact of night lights of a wind farm on existing nightscape

Cause and Comment

Wind farms are required by law to be lit at night as they represent hazards to aircraft due to the height of the turbines. Marking of turbines depends on wind farm layout and not all turbines need to be lit. Marking consists of a red flashing light of medium intensity (2000 candela). The conceptual layout of the wind farm is a 'cluster' in terms of the lighting specification (Minister of Transport, 1997).

According to the Civil Aviation directive most of the turbines will have to be marked.

Mitigation Measures

The aviation standards have to be followed and no mitigation measures are applicable in terms of marking the turbines. Lighting of ancillary buildings and structures should be designed to minimise light pollution without compromising safety. Motion sensitive lighting can be used for security purposes.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long Term	Localised	Moderate to Slight	Unlikely or probable	**LOW TO MODERATE**
With mitigation	Long Term	Localised	Moderate to Slight	Unlikely or	**LOW TO**

				probable	**MODERATE**
No-Go					
Without mitigation	N/A	N/A	N/A	N/Ar	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

The sources of light pollution in the region are mostly related to farmsteads, communication towers and the background glow caused by towns such as Grahamstown, Peddie and the rural villages spread out along the opposite bank of the Fish River. Vehicles on the N2 also contribute to night lighting.

7.1.7 Agriculture

Impact 19: Loss of vegetation

Cause and Comment
The erection and maintenance of the turbines will most certainly require the construction of access roads. Farm type access roads probably exist but these will not be suitable for this type of construction and routine maintenance which may have to take place during and after rains. The construction of access roads linking the turbine sites will result in the loss of vegetation.

Mitigation and Management
The conservation status of the three vegetation biomes is least threatened. There may however be listed vegetation species in these vegetation biomes and such plants should be identified and protection measures included in the construction regime. Permits may be required for the removal and transplanting of such species, if this becomes necessary.

It is recommended that the positioning of the turbines be discussed with staff of the Department of Agriculture to align the project with the Conservation of Agricultural Resources Act.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Study area	Very severe	Definite	**VERY HIGH -**
With mitigation	Permanent	Study area	Severe	Definite	**HIGH -**
No-Go					
Without mitigation	Permanent	Study Area	Beneficial	Probable	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 20: Pollution of water sources

Cause and Comment
Pollution of the water sources e.g. natural drainage zones (watercourses, streams and rivers), earth dams and boreholes may occur as a result of construction activities. Construction activities will lead to increased run-off and this will result in erosion. The soils are generally shallow with a high erosion index rating.

Mitigation and Management
It is recommended that the positioning of the turbines be discussed with staff of the Department of Agriculture to align the project with the Conservation of Agricultural Resources Act. Construction activities adjacent to watercourses should not be closer than 100 m from the 1-in-100 year flood

levels. Should construction take place in close proximity to any drainage area silt fences should be erected to prevent sedimentation. Turbines should be sited at least 100 m away from earth dams and boreholes. Access roads must be provided with adequate drainage structures to control run-off water. A routine maintenance regime is to be implemented as part of the operational plan for the lifespan of the project.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Study area	Severe	Definite	**HIGH -**
With mitigation	Medium term	Study area	Moderate	May occur	**MODERATE -**
No-Go					
Without mitigation	Permanent	Study Area	Beneficial	Probable	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 21: Erosion and construction on land with a gradient

Cause and Comment

Degradation of the vegetative cover will increase potential for erosion to occur as the soils generally have a high erosion index rating.

Mitigation and Management

It is recommended that the positioning of the turbines be discussed with staff of the Department of Agriculture to align the project with the Conservation of Agricultural Resources Act. A construction regime to be specified by the design engineer to limit and control loss of vegetation and resultant increased run-off of storm water. A routine maintenance regime is to be implemented as part of the operational plan for the lifespan of the project. The clearance of vegetation should be kept to a minimum to reduce the area of soil exposed at any one time.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Permanent	Study area	Very severe	Definite	**VERY HIGH -**
With mitigation	Medium term	Study area	Moderate	May occur	**MODERATE -**
No-Go					
Without mitigation	Permanent	Study Area	Beneficial	Probable	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

The No-Go scenario will result in the current land use remaining the status quo on the ±2 550 ha i.e. cultivation of arable land in the low-lying areas in the Coombs River valley and utilisation of the natural grazing by livestock and game animals. There will therefore be no new impact in terms of current agricultural production and the "farming economy" of the area. The impact of the operation of the turbines on livestock or game is unknown to the author and it may well be feasible to operate the wind turbine farm and continue with farming operations. Thus, to retain the status quo will provide an income to the land users from farming operations only, whereas should farming practices be able to continue together with the implementation of the wind farm this will allow for a potential increase in income from the resources beneficial to the developer, the local community

and the country.

7.1.8 Socio-economic

Impact 22: Temporary stimulation of the national and local economy

Cause and Comment
The proposed Grahamstown Wind farm will cost R 1,320 billion (2013 prices) to establish. Of the above mentioned expenditure R 528.03 million will be spent in the country. R107.25 million will be spent within the Makana Local economy, R25.08 million being allocated to local labour costs. This equates to approximately 20% of all national expenditure by the developers. An additional R140.36 million will be spent within the Eastern Cape Province. Aspects such as aggregate, civil works for the substation and electrical infrastructure and fuel will be procured exclusively from Makana suppliers. Equipment and plant which is not available in Grahamstown and other towns within the Makana region will be procured from suppliers within the province. The localised expenditure on the project will stimulate the local and national economies. The availability of materials within South Africa will dictate where inputs are sourced from and which company will be awarded the tender, with closely proximity to site and BBBEE status given as preference.

Mitigation and Management
The developer should be encouraged by the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies.

The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Medium term	National	High	Highly probable	**HIGH +**
With mitigation	Medium term	National	High	Highly probable	**HIGH +**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 23: Temporary increase in employment in the national and local economies

Cause and Comment
The proposed facility will create 142 Full Time Equivalent (FTE) employment positions during construction. About 85% of the employment positions involve skilled and semi-skilled construction workers, with the remaining being managers, professional engineers and supervisors. It is anticipated that 60% of these employment will be filled by people from local communities. Given the size of the local construction sector it is anticipated that there will be sufficient local labour to satisfy the demand for unskilled workers. Beyond the direct employment opportunities that will be created by the project during the construction phase the development will also have a positive spin-off effect on the employment situation in other sectors of the national and local economies. Most of these positions will be in sectors such as construction, business services and trade. Given that a significant portion of the multiplier effects will be generated through backward linkages, more than half of these FTE employment positions will be created along the supply chain and amongst industries providing inputs to the businesses in the supply chain. Based on these figures the total contribution of the project towards employment creation in South Africa is estimated at 1 410 FTE

employment positions. Throughout the construction phase it is recommended that the developer encourage the EPC contractor to fill as many local positions as possible.

Mitigation and Management

- Organise local community meetings to advise the local labour force about the project that is planned to be established and the employment that can potentially applied for
- Establish a local skills desk (in Grahamstown) to determine the potential skills that could be sourced in the area
- Recruit local labour as far as feasible
- Employ labour-intensive methods in construction where feasible
- Sub-contract to local construction companies particularly SMME's and BBBEE compliant enterprises where possible
- Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering and other services to the construction crews.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short term	National	High	Highly probable	**Medium +**
With mitigation	Short term	National	High	Highly probable	**Medium +**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 24: Contribution to skills development in the country and local economy

Cause and Comment

The construction of the proposed Grahamstown Wind farm is likely to have a positive impact on the skills development in South Africa particularly given the limited number of such facilities currently operating in the country. Since there are a limited number of operational wind energy facilities in South Africa, the local expertise in the construction of such facilities is very limited.

During the turbine component assembly and tower manufacturing period which is included as part of the construction phase and is planned to be conducted in the Eastern Cape, it is likely that foreign technical experts will be involved. This will present an opportunity for skills and knowledge transfer between these technical experts and local manufactures. It is also expected that the construction crew involved in the project will gain knowledge and experience in respect of the development of wind energy facilities.

This will be highly beneficial given South Africa's target of generating 9 200 MW from wind energy by 2030 (Department Energy, 2011). In addition to the direct effects of the project on skills development in the country and the local economy, the project could contribute to the development of the local R&D and manufacturing industries associated with wind technology. This could be achieved through partnerships with Rhodes University (situated in the Makana Local Municipality) or the Nelson Mandela Metropolitan University (NMMU) in Port Elizabeth. Partnerships of this nature could further enhance the development of new skills and expertise.

Mitigation and Management

- Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases.
- Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Medium	National	Moderate	Probable	**Medium +**
With mitigation	Medium	National	Moderate	Highly probable	**Medium +**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 25: Temporary increase in household earnings

Cause and Comment

The proposed wind farm will create a total of 1 410 FTE employment positions during construction generating R 140.35 million of revenue for the affected households in the country through direct, indirect and induced effects. Of this figure R 55.83 million will be paid out in the form of salaries and wages to those individuals directly employed during the construction phase.

The remaining R 84.52 million in households' earnings will be generated through indirect and induced effects resulting from project expenditure. Given the average household size in the average household size in the Makana Local Municipality and South Africa was 3.7 and 3.6 respectively, a total of 5 146 people nationally are likely to benefit from the employment positions created and the income derived through these 1 410 FTE employment positions.

Although temporary, this increase in household earnings will have a positive effect on the standard of living these households. This is especially applicable to the households benefiting from the project that reside in the Makana Local Municipality.

The average annual salary that will be paid to people employed in the construction of the facility will be R 12,152 per month, with this figure varying significantly based on the respective skill levels and employment specifications of the employee.

Mitigation and Management

- Recruit local labour as far as feasible to increase the benefits to the local households
- Employ labour intensive methods in construction where feasible
- Sub-contract to local construction companies where possible
- Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	National	Moderate	Probable	**Medium +**
With mitigation	Short	National	Moderate	Probable	**Medium +**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 26: Temporary increase in government revenue

Cause and Comment
The investment in the Grahamstown Wind farm will generate revenue for the government during the construction period through a combination of personal income tax, VAT, companies tax etc. Government earnings will be distributed by national government to cover public spending which includes amongst others the provision and maintenance of transport infrastructure, health and education services as well as other public goods.

Mitigation and Management

None.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	National	Low	Highly probable	**Medium +**
With mitigation	Short	National	Low	Highly probable	**Medium +**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 27: Negative changes to the sense of place

Cause and Comment
A community's sense of place is developed over time as it embraces the surrounding environment, becomes familiar with its physical properties and creates its own history. The sense of place is created through the interaction of a number of different factors such as the areas visual resources, its aesthetics, climate, culture and heritage as well as the lifestyle of individuals that live in and visit the area. Most importantly, it is a highly subjective matter and dependent on the demographics of the population that resides in the area and their perceptions regarding trade-offs. For example, a community living in poverty is generally more likely to be accepting of industrial development that promises employment opportunities while a more affluent residential area is more likely to oppose such a development on the grounds that the development is not likely to generate gains for the community.

The area proposed for the development as well as its surrounds does not currently have any large scale industries or high rise buildings. Noise and light intrusion during the night in the area is also very low. Given the above characteristics the area can be defined as being largely rural. Any rapid changes that alter the characteristics that define the areas sense of place could potentially have a negative impact.

It is important to note that noise in this discussion refers to the construction period of the project, and does not refer to the operation phase of the wind farm. During the construction of the proposed wind farm there are likely to be noise impacts caused by the movement of vehicles as well as construction activities on site. These impacts are anticipated to occur primarily during the day with illumination from the site being experienced during the night. The presence of this noise is likely to alter the way the surrounding environment is experienced by households in the area. 61% of respondents to the survey indicated that they had concerns about how the construction of the wind farm would affect the local tourism sector based on the visual disturbance it would impose on the

area's sense of place. It is worth noting however that as the site is located adjacent to the N2 road which is characterised by relatively high levels of traffic compared to other national roads which therefore in itself generates notable levels of noise pollution as it stands.

This means that the noise generated by construction activities may possibly exacerbate the current situation or not be noticed at all as a result of high levels of ambient noise. Visual impacts associated with the sense of place will initially be very limited as the site will only be visible to a few individuals in the early stages of construction. In the early stages of construction the equipment, machinery and changes to the site will not be visible from a distance as road building and digging of foundations will take place at this stage. As construction activities progress and the footprint of the facility grows, the visual impact will also become more apparent and the sense of place experienced by households residing within the visually affected area will be altered further. This will happen when the towers, nacelles and blades are being erected.

While it is recognised that much of the local natural environment has been transformed by agricultural activities in the past, some farms that are involved in tourism related activities have undertaken activities to rehabilitate the land. As such, the sense of place in some properties will be a notable factor while this will be less of a concern on other properties. It is anticipated that households residing on the farms on which wind turbines are proposed to be established will experience the greatest disruption in their sense of place during the construction period. Individuals living on the properties, as well as tourists to the area staying in hospitality facilities will over the course of the construction phase of the project, be subjected to either visual or noise disruptions that are currently not present in the area.

The sense of place at the farms located adjacent to or beyond the site of the proposed wind farm will also be affected to some extent. The visual exposure on all these farms during the construction phase will not be continuous given the proximity of some of the farms from the proposed wind farm.
Nevertheless, the knowledge of the facility near the farm and the fact that it could be seen from some parts will still have a negative connotation and will alter the sense of place experienced by the households residing on these farms.

It is important to provide a caveat that some households in the affected area may consider the changes to the area's sense of place during construction as positive. Such sentiments may emanate from perceptions about the construction project facilitating a shift towards a greener or more sustainable future (through increased use of renewable energy production).

Mitigation and Management

- The mitigation measures proposed by the visual and noise specialists should be adhered to
- Natural areas that are not affected by the footprint should remain as such. Efforts should also be made to avoid disturbing such sites during construction

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	Surrounding area	High	Highly probable	**Medium -**
With mitigation	Short	Affected site	High	Highly probable	**Medium -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 28: Negative impact on the local tourism, game industry and associated industries

Cause and Comment

As indicated earlier the increased noise as well as the visual disturbance generated by the construction phase of the development will affect resident's sense of place. This however will not only affect the people that live in the area but also alter the experience of any international and domestic tourists that visit the area.

Changes in the perceptions of the aesthetics of the surrounding environment by tourists visiting the potentially affected game farms are likely to increase as construction progresses.

The construction activity is however likely to impact their experience and perceptions of the destination which could have an impact on both their decision to revisit the area in future as well as their recommendations that they provide to other potential tourists.

Thus the majority of the negative effect of the facility on the tourism industry is likely to be captured during the operation phase of the project.

Mitigation and Management

- Mitigation proposed by the visual specialists should be implemented during the beginning of the construction period to screen off visual disturbances as soon into the development phase as feasible
- Heavy vehicles travelling on secondary roads should adhere to low speed limits to minimise noise and dust pollution
- If feasible, no construction activities should be carried out during weekends and outside day time working hours

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	Local economy	High	Highly probable	**Medium -**
With mitigation	Short	Surrounding area	Moderate	Probable	**Low -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 29: Temporary increase in social conflicts associated with the influx of people

Cause and Comment

The Makana Local Municipality is not sufficiently diversified to supply the entire workforce for the construction of the proposed wind farm, particularly in terms of skilled positions. A significant number of the unskilled and semi-skilled workers required during the construction phase will however be sourced locally. It is estimated that up to 60% of employment that will be created during the construction phase could be filled by labour coming from the local municipality. Migrant workers will therefore comprise just over a third of the total work force equating to approximately 56 highly skilled, skilled and semi-skilled workers.

The migration of people to the area is not likely to result in social conflicts between the local population and the migrant work force from the local population perceiving the migrant workers as

"stealing" their employment opportunities. Given the low reliance on labour sourced externally, the potential of an the influx of people into the area leading to a temporary increase in level of crime, illicit activity and possibly a deterioration of the health of the local community through the spread of infectious diseases is low.

Semi-skilled and unskilled construction workers are unlikely to choose to remain in the area following the completion of the construction phase given the rural nature of the project site (with limited human settlements in the surrounding area). The risk of such individuals exacerbating the level of poverty within the Makana Local Municipality from living in the area without a source of income is thus low.

The influx of employment seekers and the potential social conflicts that can arise with in-migration of temporary workers to an area is difficult to mitigate. Plan-8 Infinite Energy has indicated that appropriate awareness campaigns and strict adherence to recruiting practices will be employed to reduce the possibility of adverse effects such as stock theft, incidents of trespassing and littering.

During the construction phase none of the workforce (excluding security personnel) will live on site as they will be transported on a daily basis from Grahamstown. Access control will restrict access to the construction site. Furthermore a community liaison officer (approved by the Makana Local Municipality) will be appointed prior to the commencement of the construction.

Addressing the challenges related to potential social impacts is best done in partnership with all stakeholders in the area, specifically the affected and adjacent property owners, local communities, ward communities and municipalities. This would promote transparency, information sharing and help build good relationships between all affected parties. In addition, all opportunities that would include the community in the project should be explored and where possible implemented. Employment opportunities, including the provision of ancillary services, are particularly relevant in this incidence as the creation of employment opportunities for locals could eliminate the potential alienation between the community and the project as well as migrant workers.

Mitigation and Management

- Adhere to strict labour recruitment practices that would reduce the desire of potential employment seekers to loiter around the properties in the hope of finding temporary employment
- Control the movement of workers between the site and areas of residence to minimise loitering around the facility. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence
- Employ locals as far as feasible through the creation of a local skills database
- Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of employment seekers to the area
- Ensure that any damages or losses to nearby affected farms that can be linked to the conduct of construction workers are adequately reimbursed
- Assign a dedicated person to deal with complaints and concerns of affected parties

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	Surrounding area	Low	Probable	**Medium -**
With mitigation	Very short	Affected site	Small	Very improbable	**Low -**
No-Go					
Without	N/A	N/A	N/A	N/A	**N/A**

mitigation					
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 30: Impact on economic and social infrastructure

Cause and Comment

Given that migrant workers will require accommodation and other services there is likely to be an increase in the demand for rental accommodation, social services and access to water and electricity. Local workers may also be required to be accommodated overnight on the site in temporary accommodation during the construction phase of the project.

According to the Makana Local Municipality's SDF (2008) the municipality has a number of clinics and hospitals situated throughout its municipal area.

The effects of the project on road infrastructure should also be considered as it is highly likely that the development will lead to an increase in traffic volumes in surrounding areas. This could lead to a deterioration of local road conditions which could place additional financial burden on the Makana Local municipality through additional maintenance costs. This may add additional operating costs to farmers in the area due to delays in deliveries and damage to vehicles.

Based on the above discussion is expected that the housing and accommodation situation, basic service provision, health facilities and road infrastructure will be under additional strain during the construction period. Given that the project is anticipated to attract additional people to the area the significance of the impact is considered to be medium. These impacts can however be mitigated if the developer engages with the local municipalities and plans accordingly.

Mitigation and Management

- Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional demands on social and basic services created by the in-migration of workers
- Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Short	Surrounding area	Moderate	Probable	**Medium -**
With mitigation	Short	Surrounding area	Minor	Probable	**Low -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 31: Impact on real estate dynamics and business activity in the immediately affected area

Cause and Comment

During the scoping phase of the project the local community exhibited concern that the visual impact and the proximity of the farms to the proposed sites could negatively impact land values in the area. This report does not attempt to quantify potential positive and negative impacts on

property values resulting from the proposed investment. This report rather makes reference to previous studies of a similar nature in order to provide perspective on factors to consider.

In general, any development associated with some negative environmental effects can influence property values in two primary ways:

- Firstly, it can reduce the value of the land if the proposed development has a negative image associated with it. This could be related to the real or perceived adverse effects that the proposed development could have on ability to conduct business, air quality, noise levels, aesthetics, traffic congestion, health, and crime levels in the area.
- Secondly, the development could increase the demand for surrounding properties and lead to a rise in the area's property values. This could occur in situations where nearby properties are found to carry valuable marketable natural resources.

Impact on real estate dynamics

The value of a commercial agricultural property can be determined using a "going concern value" method which refers to a real estate value, personal property value and a business enterprise value. The former two refer to physical assets or property values, whilst the latter refers to the value of the income derived from a business and its goodwill or other intangible assets. An investigation into the potential effects of these parameters could shed some light onto the potential effects of the proposed project on the property value of the land in the area.

There are currently only three operational wind farms in South Africa (Klipheuwel, Darling, Coega) of which one, the Coega wind farm comprises of only one wind turbine and is located in a yet undeveloped Industrial Development Zone. In contrast the Klipheuwel development is a small scale prototype wind farm comprising three wind turbines with hub heights of between 40 and 60 metres.

Given the small number of operational facilities, assessing the impact of wind farms on property values using empirical evidence is exceptionally difficult. There are also no known domestic studies that investigate the impact of wind farms on property prices. Several international studies however have been conducted but many of these studies reveal conflicting results.

For example, a study undertaken by British Wind Energy Association (BEWA) (now known as RenewableUK) in Cornwall in the United Kingdom, displays that most estate agents (60% of 405 respondents) agreed that there was a detrimental effect on property value in close proximity to or within visibility of a wind farm (Dent and Sims, 2007). This study however also suggested that since most negative responses were acquired during the planning stages, these concerns are most likely the result of uncertainty or fear of a wind warm being constructed nearby and that concerns would lessen with time (Dent and Sims, 2007).

On the contrary, other studies have demonstrated that the establishment of wind farms have no impacts on property and house values. This was evident in an American study which examined 24 300 property transactions at ten locations over a six year period found no evidence that wind turbines within an eight kilometre radius had a negative impact on property values (Sterzinger, Beck & Kostiuk, 2003). Alternatively some of the property values rose above the regional average, suggesting that perhaps close proximity to wind turbines (within 10 miles or 16 kilometres) can actually increase residential property values.

Another study conducted by the New South Wales Valuer General (Duponts, 2009) also sought to determine the impact that wind farms have on the surrounding land value in Australia. The main finding of the study was that wind farms, in most cases, did not appear to have negatively affected property values in the analysed areas. Of the 45 sales investigated, 40 did not show any reduction in value, while only five properties were found to have lower than expected sale prices (Duponts, 2009).

The results from rural residential properties (known as 'lifestyle properties') were more mixed. A relatively small number of these properties located very close (less than 500 metres) to wind farms were found to have lower than expected sales prices (based on statistical analysis), and it is possible that audio and visual aspects of wind farms contributed to this phenomenon (Duponts, 2009). Property values alongside these locations however also appeared not to have been affected.

Furthermore, landowners can also potentially benefit from the presence of wind farms on their land. Wind energy companies provide an annual fee for the use of the land (CanWEA, 2006; Wasatch Wind, 2011) and since only a small percentage of the land is used for wind turbines existing land use (such as farming, recreation, ranching) can continue. This thereby increases the landowners' revenue without materially impacting the existing land use. This however only applies for the owners of the land on which the turbines will be located and owners of land adjacent to the turbines will not experience this benefit.

Impact on business enterprise activity

Business enterprise value is determined by goodwill and income derived by the business at the time of the transaction. Goodwill, as an intangible asset, is extremely difficult to quantify as it refers to factors such as management style, customer loyalty, brand recognition, etc. Income on the other hand is easier to assess as it includes all revenue derived by the activity using the combination of the capital and labour resources.

Among the major types of businesses that exist within the visually affected environment of the proposed Plan-8 Infinite energy Grahamstown Wind Farm are conventional farming (crops and livestock), game farming and eco-tourism.

It is anticipated that, in respect of existing conventional farming operations, that the proposed project will not affect the goodwill or the productivity of the land and thus the revenue derived from farming. The effects of the proposed project on the business value of conventional farming are therefore expected to be marginal if not non-existent. The situation with game farms and eco-tourism through is expected to be different.

As mentioned earlier in this report the change in the aesthetics and visual resource of the environment as a result of the wind farm development are expected to have a negative impact on the number of international and domestic tourists of the nearby game farms and eco-tourism establishments, albeit to a different extent. Many of these tourists are repeat visitors meaning that the proposed activity could potentially diminish the client lists' of both the game farms and eco-tourism establishments, thereby diminishing their goodwill component. Furthermore, it will have an impact on the revenue derived by game farming and eco-tourism businesses.

A key determinant of business value is the ability of its assets (both fixed and current) to generate revenue in the future. As such, any factors that impair this ability may negatively affect business valuation. In this case, the possibility of a reduced capability to generate revenue from hunting and related activities exists. The business enterprise values of nearby game farmers and eco-tourism establishments could thus be reduced because of the proposed project.

It is also worth noting that the extent of such a reduction in business values would be for the entire local municipality rather than just for the site around the affected area. This is because of the value chains which exist in the local hunting-based tourism sector in the Makana region. As such, hunting activities are thus interrelated with business values of taxidermists, freight forwarders, transporters, booking agencies.

This implies that small changes in tourist visitor numbers to the region would have far-reaching effects on the local economy of Grahamstown. Given the visual exposure of the proposed wind farm from different game farms and eco-tourism establishments in the area and estimated losses

in revenue derived from international and domestic tourist by these facilities, the following can be suggested:

- Game farms that cater to mostly international tourists and are in the immediate vicinity of the development could potentially experience the largest decrease in existing business enterprise value relative to their current values. These farms could potentially lose up to 60% of their revenue.
- Game farms that cater to mostly domestic tourist could potentially lose up to 50% of their revenue.

It is critical to note, as indicated earlier, that revenue from game farms and eco-tourism establishments has been estimated based on total tourist numbers visiting the respective farms as well as the reported average spend by tourists as quoted by survey respondents. Total revenue, as utilised in this calculation, is therefore a function of tourist numbers and does not fully incorporate other sources of income. The decline in tourism numbers therefore has a disproportionally high impact on the revenue changes indicated above than would be the case if other sources of income were considered.

Given the combination of the possible effects of the proposed project on property prices and the income of businesses the following can be envisaged:

- The value of crop and stock farms located in the area could be negatively affected by the proposed activity. In the likelihood of this happening the impact would most likely be small and short-lived.

It is important to note that this assessment is based on a combination of two factors: real estate value and business enterprise value. The literature discussed in this section refers more to real estate values than business enterprise values (which are based on survey feedback and engagements with various stakeholders. This is thus reflected in the assessment presented in this section.

Mitigation and Management

- The developer should offer some form of an agreement, incentive, or property value guarantee to the nearby farms to offset potential losses in property values provided they are proven to result from the establishment of the facility in the area. The nature and conditions of such agreements should be negotiated with the affected landowners and should be acceptable by both parties.
- Mitigation measures to reduce the impact on the sense of place should also be implemented.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Construction phase					
Without mitigation	Long term	Local economies	High	Highly probable	**High -**
With mitigation	Long term	Local economies	Moderate	Probable	**Medium -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2 Operational Phase Impacts

7.2.1 Flora and Vegetation

Issue 1: Alien Vegetation

Impact 1: Introduction of alien plant species

Cause and Comment
As with all building operations, the introduction of alien and invader species is inevitable; with disturbance comes the influx of aliens. Alien invader species need to be consistently managed over the entire operation phase of the project.

Mitigation and management
Mitigation measures to reduce the impact of the introduction of alien invaders, as well as mitigation against alien invaders that have already been recorded on the site should be actively maintained throughout the operation phase. Removal of existing alien species should be consistently done.

Without mitigation: In the operation phase of the project, the impact will be permanent, restricted to the study area, definite and with a severe severity. Overall significance would be a high negative. Should the proposed development not go ahead (the No-Go option), the impact would be permanent, definite and restricted to the study area with a severity of moderate and an overall significance of high negative. This impact was assessed with a high level of confidence.

With mitigation: For the operation phase of development; temporal scale is reduced to medium-term, severity of impact to slightly beneficial and likelihood to may occur, thus reducing the overall significance from high negative to low positive. Alien invasion is just as likely to occur if no development takes place and mitigation measures for the No-Go option will reduce temporal scale, severity and likelihood as well, giving an overall significance of low positive. To ensure the impact is positive, continual alien vegetation clearing should be done during the operation phase.

Significance statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	Study area	Severe	Definite	**HIGH -**
With mitigation	Medium-term	Study area	Slight	May Occur	**LOW +**
No-Go					
Without mitigation	Permanent	Study area	Moderate	Definite	**HIGH -**
With mitigation	Medium-term	Study area	Slight	May Occur	**LOW +**

7.2.2 Avifauna

Impact 2: Bird collision & electrocution on overhead power lines, Impact on Red Listed and other species

Cause and Comment:
Collisions are one of the biggest single threats posed by overhead power lines to birds in southern Africa (van Rooyen 2004a). Most heavily impacted 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.

Depending on the routes and amount of overhead power lines in this project, this could have a serious impact on avifauna, as several of these key species are common in the study area. At the time of the site visit, an existing 132KV overhead power line traverses the site and a second line was under construction.

Electrocution of the larger bird species whilst perched or roosting on power lines is also a significant impact in South Africa. It is understood that the developer intends to bury all power line underground, so these cumulative impacts may not occur. If there are any changes to these plans, the Avifaunal Specialist should be notified so that these impacts can be reassessed.

Mitigation:
Bury all 'on site' power line underground. On power lines to grid, mark certain sections of the line with anti-collision marking devices on the earth wire to increase the visibility of the line and reduce likelihood of collisions. High risk sections of line can only be identified once the route of the power lines is available. Bird friendly pole/pylon designs should be used to prevent electrocutions. Systematic patrols of this power line should be conducted during post-construction bird monitoring for the wind energy facility, in order to monitor the impacts

Significance Statement:

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	National	Mod Severe	Probable	**MODERATE -**
With mitigation					**LOW -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	N/A
With mitigation	N/A	N/A	N/A	N/A	N/A

Impact 3: Bird disturbance and displacement from area as result of wind turbines and other infrastructure

Cause and Comment:
During operation the disturbance caused by the noise and movement of the wind turbines will disturb avifauna.

Mitigation:
It is very difficult to mitigate for this. Disturbance can be reduced to some extent by following general environmental best practice in terms of managing people, machines and equipment during operations and maintenance. Pre-construction monitoring will establish baseline data against which this impact can be evaluated.

Significance Statement:

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	National	Mod Severe	Possible	**LOW -**
With mitigation					**LOW -**
No-Go					

Without mitigation	N/A	N/A	N/A	N/A	N/A
With mitigation	N/A	N/A	N/A	N/A	N/A

Impact 4: Bird collision with turbine blades

Cause and Comment:
In general, the main cause will be the positioning of the turbines in or close to important bird flight paths. This impact of collisions is seen as the largest potential impact on avifauna for this project and as such the one that requires the most mitigation.

Mitigation:
This is extremely difficult to mitigate for post construction. Sensitivity mapping and pre-construction monitoring should inform the final turbine layout in order to proactively mitigate for this. If key species are found to collide in significant numbers post construction then mitigation options such as painting turbine blades, blade height adjustment and curtailment will need to be implemented.

The during construction and post construction bird monitoring programme outlined in the 12 Month Bird Monitoring report should be implemented by a suitably qualified avifaunal specialist. The post-construction monitoring of live birds should be conducted for at least 1 year and the measurement of bird fatalities through carcass searches for at least 3 years and repeated in years 5, 10, 15 etc after the commissioning of the facility. This should also include the grid connection power line.

The findings of the post-construction monitoring should be used to measure the effects of this facility on birds. If significant impacts are identified the wind farm operator will have to identify and implement suitable mitigation measures.

Significance Statement:

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	National	Mod Severe	Possible	**MODERATE -**
With mitigation					**MODERATE -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	N/A
With mitigation	N/A	N/A	N/A	N/A	N/A

7.2.3 Bats (Chiroptera)

Impact 5: Bat mortalities during foraging by turbine blades

Cause and Comment
Since bats have highly sophisticated navigation by means of their echolocation, it is puzzling as to why they would get hit by rotating turbine blades. It may be theorized that under natural circumstances their echolocation is designed to track down and pursue smaller insect prey or avoid stationary objects, not primarily focused on unnatural objects moving sideways across the flight path. Apart from physical collisions, a major cause of bat mortality at wind turbines is barotrauma. This is a condition where the lungs of a bat collapse in the low air pressure around the moving blades, causing severe and fatal internal haemorrhage. One study done by Baerwald, *et al*. (2008a) showed that 90% of bat fatalities around wind turbines involved internal haemorrhaging consistent with barotrauma. Some studies propose that bats may be attracted to the large turbine structure as roosting space, or that swarms of insects get trapped in low air pockets around the

turbine and subsequently attract bats. Whatever the reason for bat mortalities around wind turbines, the facts indicate this to be a very serious and concerning problem. During a study by Arnett, *et al.* (2009), 10 turbines monitored over a period of 3 months showed 124 bat fatalities in South-central Pennsylvania (America), which can cumulatively have a catastrophic long term effect on bat populations, if such a rate is persistent. Most bat species only reproduce once a year, bearing one young per female, meaning their numbers are slow to recover.

Mitigation and Management

The **correct placement** of wind farms and of individual turbines can significantly lessen the impacts on bat fauna in an area. The localities of turbines within the areas marked as sensitive should be critically revised. Sensitive areas include drainage valleys, with densely vegetated slopes, where bat activity is very likely to be higher.

From the 12 Month Long-term Bat Monitoring study, there are no turbines located within High Bat Sensitivity areas and Moderate Bat Sensitivity areas. Turbine 21 is located on the boundary of a High Bat Sensitivity buffer zone; turbines 20 and 22 are positioned within Moderate Bat Sensitivity buffer zones. Turbines 5, 8, 9, 10, 11 and 12 are close to high sensitivity buffers, and these will need to be monitored closely and have the following mitigation measures in place:

During the operational phase **curtailment** can be implemented as a mitigation measure to lessen bat mortalities. Curtailment is when a turbine is kept stationary at a lower wind speed and then allowed to rotate once the wind exceeds a specific speed. The theory behind curtailment is that there is a negative correlation between bat activity and wind speed, causing bat activity to decrease as the wind speed increases.

A test done by Baerwald *et al*. (2008b) where they altered the wind speed trigger of 15 turbines at a site with high bat fatalities in south-western Alberta, Canada, during the peak fatality period, showed a reduction of bat fatalities by 60%. Under normal circumstances the turbine would turn slowly in low wind speeds but only starts generating electricity when the wind speed reaches 4 m/s. During the experiment the Vestas V80 type turbines were kept stationary during low wind speeds and only allowed to start turning and generate electricity at a cut-in speed of 5.5 m/s. Another strategy used in the same experiment involved altering blade angles to reduce rotor speed, meaning the blades were near motionless in low wind speeds which resulted in a significant 57.5% reduction in bat fatalities.

Long term field experiments and studies done by Arnett *et al.* (2010) in Somerset County, Pennsylvania, showed a 44 – 93% reduction in bat fatalities with marginal annual power generation loss, when curtailment was implemented. However, when using a cut-in speed of 6.5 m/s the annual power loss was 3 times higher than when using a 5.0 m/s cut-in speed. Their study concluded that curtailment can be used as an effective mitigation measure to reduce bat fatalities at wind energy facilities. It is **strongly recommended** that the curtailment mitigation measure be implemented at all turbines on the site (prioritizing the ones in areas of Moderate Bat Sensitivity), combined with bat mortality monitoring during the operational phase to quantify the effects of this mitigation and subsequently make adjustments as needed.

Although the optimum cut-in speed to reduce bat fatalities and keep power loss at a minimum needs to be researched and determined in the local context, a cut-in wind speed of 5.0 m/s to 5.5 m/s (meters per second) is preliminarily recommended. During the long term pre-construction monitoring, general bat activities and activity patterns of different species can be compared to meteorological data gathered to determine the most effective cut-in speed/weather conditions that may result in low numbers of bat mortalities and marginal power generation loss.

An ultrasonic deterrent device is a device emitting ultrasonic sound in a broad range that is not audible to humans. The concept behind such devices is to repel bats from wind turbines by creating a disorientating or irritating airspace around the turbine. Research in the field of ultrasonic deterrent devices is progressing and yielding some promising results, although controversy about

the effectiveness and a lack of large scale experimental evidence exists.

Nevertheless, a study done by Szewczak & Arnett (2008), who compared bat activity using an acoustic deterrent with bat activity without the deterrent, showed that when ultrasound was broadcasted only 2.5-10.4% of the control activity rate was observed. A lab test done by Spanjer (2006) yielded promising results, and a field test of such devices done by Horn *et al.* (2008) indicated that many factors are influencing the effectiveness of the device although it did deter bats significantly from turbines. It may be feasible to install such devices on selected functional turbines, and the results being monitored by an appropriately qualified researcher. If collaboration with local academic and research institutions is established to monitor and improve such devices/methods during the functional stage of the wind farm, it can lessen the impacts of the wind farm on bat populations.

It is the opinion of the EAP that the mitigation measures should be applied in a phased approach. Initially, the 12 month pre-construction monitoring programme will guide the final turbine positions. This should be followed by a post-construction monitoring programme of at least 12 to 24 months coupled with the deployment of acoustic deterrents. If the monitoring programme then identifies that bat mortalities reach unacceptable levels at any point, curtailment should then be implemented. As curtailment reduces the output potential of the turbines, this approach would eliminate any premature measures being implemented that may unnecessarily affect the financial viability of the project.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long Term	Study Area	Moderate	Probable	**HIGH -**
With mitigation	Long Term	Study Area	Slight	May occur	**MODERATE -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

Impact 6: Bat mortalities during migration by turbine blades, a cumulative impact

Cause and Comment

The migration paths of South African bats are virtually unknown. Cave dwelling species like *Miniopterus natalensis* and *Myotis tricolor* undertake annual migrations, and since these species were recorded in the project area there is a high probability of a cave being present in the area. The existence of this cave was confirmed by the heritage study. The project area is not in any direct line of a known migration route, but literature data on exact South African bat migration routes are insufficient to accurately assess this impact at this stage of the study. With the increased amount of wind farms proposed to be concentrated in certain parts of the country, the cumulative impacts on cave dwelling bat migration over long distances (up to 260 km according to Van der Merwe, 1973) can be detrimental if no mitigation or precautions are taken

Mitigation and Management

Long-term pre-construction monitoring studies can provide some insight on migration paths of these species, and provide valuable information on their seasonal variations in migration activities. Turbine localities should be revised after the analysis of the long term monitoring data if any turbines are located in suspected migration paths. If the project area falls within the path of a migration route, aggressive seasonal mitigations would be essential.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long Term	National	Severe	May Occur	**HIGH -**
With mitigation	Long Term	National	Slight	Unlikely	**MODERATE -**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2.4 Archaeology

Impact 7: Impact on Heritage Resources

Cause and Comment

Heritage sites are fixed features in the environment, occurring within specific spatial confines. Any impact upon them is permanent and non-reversible. Archaeological or other heritage materials occurring in the path of any surface or sub-surface disturbances associated with any aspect of the development are highly likely to be subject to destruction, damage, excavation, alteration, or removal.

The objective should be to limit such impacts to the primary activities associated with the development and hence to limit secondary impacts during the medium and longer term working life of the facility. Those resources that cannot be avoided and that are directly impacted by the development can be excavated/recorded and a management plan can be developed for future action.

Those sites that are not impacted on can be written into the management plan, from where they can be avoided or cared for in the future.

Mitigation and Management

- Protection of archaeological, historical and any other site or land considered being of cultural value within the project boundary against vandalism, destruction and theft.
- The preservation and appropriate management of new discoveries in accordance with the NHRA, should these be discovered during construction.
- Known sites should be located and isolated, e.g. by fencing them off. All workers should be informed that these are no-go areas, unless accompanied by the individual or persons representing the Environmental Control Officer.
- Provision for on-going heritage monitoring which provides guidelines on what to do in the event of any major heritage feature being encountered during any phase of development or operation.
- Inclusion of further heritage impact consideration in any future extension of infrastructural elements.
- Immediate reporting to relevant heritage authorities of any heritage feature discovered during any phase of development or operation of the facility.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	Localised	Slight	May Occur	**MODERATE -**
With mitigation	Permanent	Localised	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Permanent	Localised	Beneficial	May Occur	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2.5 Noise

Impact 8: Predicted noise levels for the Wind Turbines Generators

The tables and figures below indicate the isopleths for the noise generated by the turbines at wind speeds from 3m/s to 12m/s. The areas shaded red in the tables indicate where the day / night 45dB(A) recommended limit is exceeded. The results of ambient noise level measurements are presented in Table7.6.

Table 7-6: Predicted noise levels at the NSAs during the operational phase

Location of Sensitive Receptor	Wind speed [m/s]	Maximum Noise Demand [dB(A)]	Noise From WTGs [dB(A)]	Noise Demand Met
Jakkelsdraai Farm House	4	45	22.1	Yes
	6	45	29.1	Yes
	8	45	30.1	Yes
	10	45	30.1	Yes
	12	45	30.1	Yes
Honeykop Lodge	4	45	26.2	Yes
	6	45	33.2	Yes
	8	45	34.2	Yes
	10	45	34.2	Yes
	12	45	34.2	Yes
Honeykop Farmhouse	4	45	20.9	Yes
	6	45	27.9	Yes
	8	45	28.9	Yes
	10	45	28.9	Yes
	12	45	28.9	Yes
Peynes Kraal Farm House	4	45	37.0	Yes
	6	45	44.0	Yes
	8	45	45.0	Yes
	10	45	45.0	Yes
	12	45	45.0	Yes
Workers House	4	45	35.4	Yes
	6	45	42.4	Yes
	8	45	43.4	Yes

Location of Sensitive Receptor	Wind speed [m/s]	Maximum Noise Demand [dB(A)]	Noise From WTGs [dB(A)]	Noise Demand Met
	10	45	43.4	Yes
	12	45	43.4	Yes
Workers House	4	45	21.1	Yes
	6	45	28.1	Yes
	8	45	29.1	Yes
	10	45	29.1	Yes
	12	45	29.1	Yes
Workers House	4	45	36.4	Yes
	6	45	43.4	Yes
	8	45	44.4	Yes
	10	45	44.4	Yes
	12	45	44.4	Yes
Fairview Farm House	4	45	31.3	Yes
	6	45	38.3	Yes
	8	45	39.3	Yes
	10	45	39.3	Yes
	12	45	39.3	Yes
Coombs Vale House	4	45	26.3	Yes
	6	45	33.3	Yes
	8	45	34.3	Yes
	10	45	34.3	Yes
	12	45	34.3	Yes
Jakkelsdraai Farmhouse (Main)	4	45	22.2	Yes
	6	45	29.2	Yes
	8	45	30.2	Yes
	10	45	30.2	Yes
	12	45	30.2	Yes

Plate 7-2 – Nordex N117/3000 result 4 m.s^{-1}wind speed

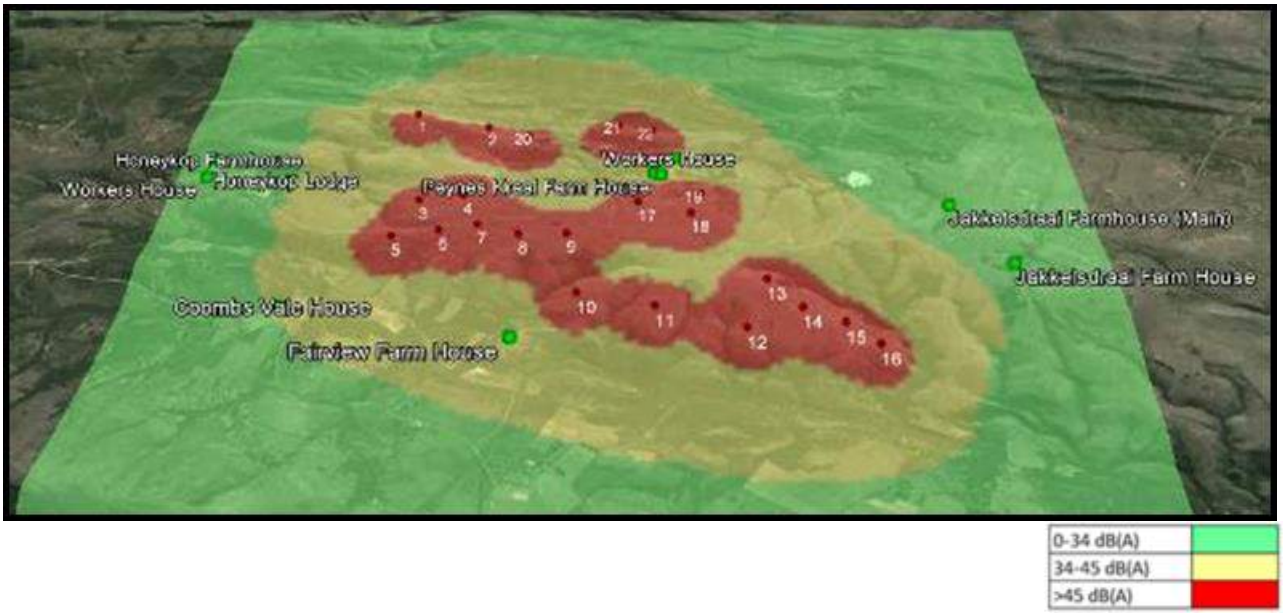

Plate 7-3 – Nordex N117/3000 result 12m.s^{-1} wind speed

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	Localised	Low	Definite	**MODERATE -**
With mitigation	Permanent	Localised	Slight	Unlikely	**LOW -**
No-Go					
Without mitigation	Permanent	Localised	Beneficial	May Occur	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2.6 Visual

Impact 9: Potential landscape impact

Cause and Comment

The landscape is not pristine and is not valued for its scenic views, largely because of the ubiquity of high voltage power lines; disturbed vegetation and cultivated land.

Mitigation Measures

There are no mitigation measures that will change the significance of the landscape impact other than avoiding the site entirely. A reduction in wind turbine numbers are unlikely to have an appreciable effect since even a few wind turbines will still have high visibility. It is also possible that the wind farm will become a tourist attraction and the impact is therefore not necessarily negative. A visitor centre with information on the wind farm as well as tours to wind turbines may enhance its positive aspects.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operational phase					
Without mitigation	Long term	Regional	Slight	Definite	**MODERATE-**
With	Long term	Regional	Slight	Definite	**MODERATE-**

mitigation					
No-Go					
Without mitigation	Permanent	Regional	Slight	May Occur	**MODERATE-**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

The duration of the impact is long term (and not permanent) since the turbines can be removed from the landscape after their life span has been reached. The extent is regional due to the visibility and size of the project. The severity of the impact is expected to be slight since the landscape has a low sensitivity to the development type. The likelihood of the impact occurring is definite due to the size of the wind farm and its components, their high visibility and the novelty aspect. The significance of the landscape impact according to the rating methodology is therefore expected to be **moderate** due to the long duration, extent and low severity of the impact.

In the event that the wind farm is not built (No-Go alternative) then it is likely that the landscape will remain the same for the foreseeable future.

Impact 10: Impact of shadow flicker on residents in close proximity to wind turbines

Cause and Comment

Result indicated that none of the buildings identified wioo be subject to more than 30 hours/year, or 30 minutes on the worst affected day.

Mitigation Measures

None required.

Significance Statement

The duration or temporal scale of the effect is *long term (3)* (life time of the development). The spatial scale is *study area (2)* since only a small number of residents living within 1km of a turbine may be affected. Only one building will be affected slightly more than the threshold set by the guidelines which makes for a *slight severity (1)*, and the likelihood that the effect occurs for these buildings is possible (*may occur (2)*) since the shadow flicker modelling assumes a worst case scenario that is seldom if ever actualised. The significance of the impact is therefore rated as **moderate (8)** according to the rating methodology (effect = 6; likelihood = 2) before mitigation measures. Mitigation measures will reduce the likelihood of the impact occurring (i.e. hours of shadow flicker above threshold) to *unlikely (1)* which means the significance of the impact after mitigation is **low (7)**.

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operational phase					
Without mitigation	Long term	Study Area	Slight	May Occur	**LOW-**
With mitigation	Long term	Study Area	Slight	Unlikely	**LOW-**
No-Go					
Without mitigation	N/A	N/A	N/A	N/A	**N/A**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2.7 Agriculture

Impact 11: Possible change of use of agricultural land

Cause and Comment

The construction of infrastructure for the erection of the turbines will impact on the current land use. The client has advised that the total area impacted upon by construction is 11.79 ha, itemised as follows:

Roads	86 406.96 m²
Foundations	1 039.08 m²
Hard-standings	30 375 m²
Buildings	100 m²
Total (m²)	117 921.04 m²
Total (ha)	**11.79 ha**

The project may require an authorisation in terms of the "change of use of agricultural land" and possible re-zoning and such a decision would be made by the Department of Agriculture – Eastern Cape

Mitigation Measures
The report writer has been advised that livestock are known to become used to the use/operation of the turbines and should be able to utilise grazing up to the footprint areas of the turbines. Existing cultivated arable lands are not impacted upon so production can continue on these. The total impacted area of 11.79 ha of the 2,500 ha, calculated as a percentage is 0.4716% of the study area. The 11.79 ha can be considered as natural grazing area. Assuming an average of 6 ha per Large Stock Unit one can assume that the current carrying capacity will be reduced by 2 LSU. This can be considered as insignificant in terms of the overall carrying capacity of the remaining 2,488 ha. It is recommended that the positioning of the turbines be discussed with staff of the Department of Agriculture to align the project with the Conservation of Agricultural Resources Act.

Significance Statement

Impact	Effect			Risk or Likelihood	Overall Significance
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Permanent	Study Area	Moderate	May occur	**MODERATE-**
With mitigation	Short Term	Study Area	Slight	May occur	**LOW-**
No-Go					
Without mitigation	Permanent	Study Area	Moderately Beneficial	Don't Know	**MODERATE +**
With mitigation	N/A	N/A	N/A	N/A	**N/A**

7.2.8 Socio-Economic

Impact 12: Sustainable increase in production and GDP-R nationally and locally

Cause and Comment
The proposed facility will generate approximately R230.29 million in revenue annually and will require annual operational expenditure of R16.14 million of which approximately R5.65 million will be spent locally in the country on an annual basis. The total impact on production in the country as a result of the project's operations will equate to R12.86 million per annum in 2012 prices. Of the

R12.86 million in production generated, it is anticipated that with local expenditure related to the annual spending on labour and procurement of local goods and services, new business sales within Makana Local Municipality will increase by R6.63 million on an annual basis, over and above current business sales. Aside from the utilities sector, industries that will experience the greatest stimulus from the project on a national scale will include the transport and transport equipment industries, chemical and chemical product industries as well as the trade and business services industries.

Through indirect and induced effects brought on by this injection to the local and national economy, a total of R 5.64 million of GDP-R will be generated per annum from the project within the whole of South Africa. A total of R2.99 million in value add will be generated in the Makana Local Municipality alone. The production and consumption induced multiplier effects of the project are considered to be relatively small compared to conventional electricity generating industries. This is due to the energy source used to produce electricity by the proposed wind energy facility is free, unlike conventional power stations where raw inputs (i.e. coal) and the transport therefore comprise a significant portion of operating expenditure. It is for this reason that such a facility is a highly attractive business venture.

Mitigation Measures

The operator of the wind energy facility should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	National	Moderate	Highly probable	**Medium +**
With mitigation	Long term	National	Moderate	Highly probable	**Medium +**
No-Go					
See below					

The NO-GO Impact

This NO-GO analysis applies to all the impacts identified for the operations phase. In the table below is a comparison of the Socio-economic no-go option for the development of the Grahamstown Wind Farm.

Potential annual losses from a reduction in tourist numbers	Potential injection into the local Makana economy from annual wind farm expenditure	Average annual revenue from local hunting/ tourism properties surveyed	Potential annual average revenue from the Grahamstown wind farm
R6.13 million	R17.32 million	R0.92 million	R230.29 million

Impact 13: Creation of sustainable employment positions nationally and locally

Cause and Comment

The proposed facility is anticipated to create 25 new permanent employment positions throughout the country once fully operational. This figure includes approximately 8-10 direct employment opportunities on site, translating into the creation of a total of 16 new employment positions within Makana Local Municipality. Of the direct employment position created, 20% to 40% will be semi-skilled and unskilled labourers, the remainder being skilled and highly skilled. The skilled positions will comprise facilities managers, technicians and environmental engineers. Unskilled and low

skilled staff will include positions such as security personnel.

Due to the spatial allocation of procurement spending and direct employment created, most of the indirect and induced positions will also be created within the local Makana area. The trade, agriculture and community and personal services sectors will benefit the most from these new employment opportunities.

Mitigation Measures

- Where possible, local labour should be considered for employment so as to increase the positive impact on the local economy.
- As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	National	Moderate	Highly probable	**Medium +**
With mitigation	Long term	National	Moderate	Highly probable	**Medium +**
No-Go					
See impact 12					

Impact 14: Skills development of permanently employed workers

Cause and Comment

As of 2013, South Africa has a very limited number of large-scale wind energy facilities that are currently in full operation, thus the skills base to operate and maintain such facilities is not readily available. It is likely that highly skilled personnel would need to be recruited from outside of the Makana Local Municipality. These employees would include skilled mechatronics engineers (specialised in both electrical and mechanical engineering) likely to be recruited from larger Metropolitan areas and trained by the manufacturer, as well as less skilled services such as safety and security and mechatronic assistants.

These employees will undertake a variety of maintenance activities throughout the lifetime of the turbines. A maintenance schedule usually involves an initial inspection after commissioning, semi-annual inspection, an annual inspection and two and five year inspections but this varies according to the turbine. Typical activities during maintenance include changing of oil, replacement of brake lining and cleaning of components.

Mitigation Measures

The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the wind energy facility and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Local economy	Low	Highly probable	**Medium +**
With mitigation	Long term	Local economy	Low	Definite	**Medium +**
No-Go					

See impact 12

Impact 15: Improved standards of living for the benefiting households

Cause and Comment

The creation of approximately 25 FTE employment positions throughout the country will generate approximately R4.82 million of personal income (2012 prices), which will be sustained for the entire duration of the project's lifespan. Given the average household size in affected local municipalities and nationally, this increase in household earnings will support up to 92 people. The sustainable income generated as a result of the project's operation will positively affect the standard of living of all benefitting households. This is specifically applicable to the Makana Municipality as the average income per employee at the facility would far exceed the average household income within the region currently. In Makana Local Municipality alone, it is anticipated that total worker income to the region will increase by R1.14 million on an annual basis.

Mitigation Measures

- Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy.
- As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Local economy	Moderate	Probable	**Medium +**
With mitigation	Long term	Local economy	Moderate	Probable	**Medium +**
No-Go					
See impact 12					

Impact 16: Sustainable increase in national and local government revenue

Cause and Comment

The annual operation and related expenditure of the proposed facility will contribute towards both local and national government revenue in the form of a variety of tax payments i.e. to SARS and to the Local Municipality. At a local level the project will contribute to local government through payments for utilities used in the operation of the facility. It will also increase its revenue through an increase in property taxes compared to the current levels. The land where the proposed facility is to be established is currently zoned for agricultural purposes and is used for low intensive agricultural activities. In order for the facility to proceed it is likely that the affected properties will have to be rezoned from agriculture to special purpose. This change in zoning is also likely to lead to an increase in the existing property tariff given that under the current tariff regime properties zoned for farming pay the lowest tariff rate. The increased tariff will however not adversely affect existing landowners as any additional tariff brought about by the development will be borne by the developer.

Given that the Makana Local Municipality has a relatively small economy and judging by the rates income derived by the municipalities (Makana IDP, 2012), the municipality would benefit significantly from any increase in rates revenue derived from zoning changes. This money generated can in turn be used by Makana to fund poverty alleviation and other social upliftment projects at their discretion. On a national level, the revenue derived by the project during its operations, as well as the payment of salaries and wages to permanent employees will contribute

to the national fiscus. Although it is impossible to trace exactly how such revenue is allocated, any additional revenue generated means that national governments can increase its spending on public goods and services.

Mitigation Measures

None.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	National	Low	Highly probable	**Medium +**
With mitigation	Long term	National	Low	Highly probable	**Medium +**
No-Go					
See impact 12					

Impact 17: Local economic and social development benefits derived from the project's operations

Cause and Comment

The proposed Plan-8 Infinite Wind Energy Facility will make a notable contribution to poverty and social and community development in the area. It is anticipated that a Community Trust will be established and funded through income generated by the development. Members of this trust will be both previously disadvantaged individuals and living within close proximity to the proposed facility. This entity will share in profits derived by the proposed project and will thus benefit financially from its activities. Government prescribes that between 1% and 1.5% of the revenue derived by a project should be allocated towards the needs of the community (Tait, 2012). However the intention of the developers is to contribute between 2% and 5% to such initiatives. Thus, the Community Trust's share of the project revenue can subsequently be utilised for local social development projects. This represents extensive funding to uplift rural communities and is to be coupled with a high degree of accountability from the Department of Energy.

Furthermore, the Community Trust will be engaged in numerous local welfare projects and community development initiatives that will be directed at uplifting local people and improving their standards of living. The Community Needs Analysis Report developed in conjunction with this report should be consulted for a full presentation of the proposed economic and social development projects identified to be potentially funded by the developers.

Mitigation Measures

- The Community Needs analysis and Assessment Report programmes and projects should be supported throughout the project's lifespan.
- This plan should constantly be refined in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits.
- These plans should be reviewed on an annual basis and, where necessary, updated.
- When identifying enterprise development initiatives, the focus should be on creating sustainable and self sufficient enterprises.
- In devising the programmes to be implemented through the Community Trust allocations, the developer should take into account all updates to the Makana's Integrated Development Plans and Local Economic Development Strategies.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Local economy	Moderate	Definite	**High +**
With mitigation	Long term	Local economy	High	Definite	**High +**
No-Go					
See impact 12					

Impact 18: Negative changes to the sense of place

Cause and Comment

The effects on the community's sense of place will initially be felt during the construction period and will continue into the operational phase. 68% of respondents to the survey indicated that they had concerns about negative changes to the area's sense of place (in relation to its function as a tourism destination). This must however be counterbalanced by the fact that the operation of the facility may be seen by other members of the wider community as contributing positively towards a more sustainable or 'green' future through an increase in the use of renewable energy sources. Such positive sentiment may in itself create opportunities for tourism (e.g. educational tours by schools from the area). It is however important to note that over 50% of survey respondents felt that the operation of the facility would have negative impacts on their sense of place. As survey respondents were mostly constituted of stakeholders that work on, live in or own land in the area, it is evident that the local community would feel negatively affected by the operation of the centre's impact on their sense of place. This then means that the majority of people that would feel that the operation of the facility would have an impact on their sense of place do not live in, work in or own land from the affected area. As such, visitors to the area would possibly appreciate the wind farm's contribution to the area's sense of place, whilst locals would view it in a negative light. The extent of this impact is thus stated as the site surrounding the area.

Mitigation Measures

- The mitigation measures proposed by the visual and noise specialists should be adhered to
- Natural areas that are not affected by the footprint should remain as such. Efforts should also be made to avoid disturbing such sites during construction

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Surrounding area	High	Definite	**Medium -**
With mitigation	Long term	Surrounding area	Moderate	Highly probable	**Medium -**
No-Go					
See impact 12					

Impact 19: Negative impact on local tourism, game farming and associated industries

Cause and Comment

The negative effects on the local tourism and game farming industry are expected to be created during the construction phase of the development. Such negative impacts are expected to ensue

as a result of noise and most importantly visual disturbance, which will alter the natural and cultural landscape features of the environment and subsequently the experience of visitors to local tourism destinations and game farms. The full extent of the negative impact will however most probably be achieved during the operational phase of the project when the word about the proximity of the project to local game farms spread amongst potential tourists and repeat visitors.

Proposals for wind farm developments commonly receive resistance from the tourism and game farming industry, who believe such developments are likely to adversely affect the tourism potential of an area. Several issues are raised by these stakeholders including the visual impact of the wind turbines on the scenery; the cumulative effect of providing bad publicity to an area; and the detrimental effects on birds and other wildlife (especially for companies offering outdoor activities) (NFO WorldGroup, 2003). The visual impact of wind farms causes the greatest concern for local tourist companies – especially in countries known for their natural environment (NFO System Three, 2002). Tourism companies, who in addition to being concerned about the actual turbines, also express concern about additional infrastructure linked to the proposed wind farm i.e. roads and cablings (NFO System Three, 2002). This supporting infrastructure is also seen as having a negative visual affect. A number of these concerned tourism stakeholders however believe that these adverse visual impacts can be mitigated through having wind farms “sensitively site” so as to avoid important tourism sites (NFO System Three, 2002).

People have also expressed positive perceptions about wind farm development within their area. Some studies have suggested that wind farms themselves can actually act as tourism attractions in themselves and can increase “green tourism” in the area (AusWEA, 2003; NFO WorldGroup, 2003; BWEA, 2006; CanWEA, 2008). Another survey found that wind farms can have a positive effect on tourism by enhancing the reputation of a region or country as an environmentally friendly destination (NFO System Three, 2002). In addition, wind farms can also bring temporary visitors and possibly create access to more remote areas thereby providing some revenue to these areas (NFO System Three, 2002; NFO WorldGroup, 2003).

Determining how wind farms directly affect the tourism industry is therefore very difficult, and thus many authors and organisations are of the opinion that it is not possible to draw conclusions. As a result, many surveys have been conducted with tourists to determine how the sight of wind farms affected their visit to the area. It should be noted that most of these surveys bear out the finding that a significant number of tourists (between 70% and 91%) are not overly concerned by the presence of wind farms (NFO System Three, 2002; NFO WorldGroup, 2003; BWEA, 2006). No studies that look specifically at the impact of wind farms on hunting based tourism (as found in the Makana area) in a South African context have been undertaken however.

Besides direct effects, business activities generate production and consumption induced effects. Any decline in business sales then, would lead to a decrease in demand through backward linkages that stimulate production-induced impacts. This could potentially stimulate a decline in the consumption effect through salaries and wages earned by employees. It is estimated that every R 1 spent in the game farming industry R 1.02 of new business sales are created elsewhere in the economy through both indirect and induced impacts. The production multiplier for the tourism industry is estimated at R 1.96 for every R 1.00 spent by domestic tourists, and R 1.90 for every R1.00 spent by international tourists (Saayman, Saayaman & Naude, 2000).

The potential losses to the local tourism and taxidermy industry need to be considered as part of the proposed wind farm development. Since one of the drivers of these losses could be the altered aesthetics and visual resources of the area, mitigation of this impact should be focused on addressing these aspects (i.e. the focus should be on the cause rather than the effect). This means that mitigation measures to reduce the potential impact on the local tourism and associated industries would need to comprise the measures suggested by the visual specialists.

It should be acknowledged that not all visual impacts will be possible to mitigate given the size and extent of the development. In certain cases the developer should engage with the owner of the

affected farm and find a solution that is acceptable to both parties.

Mitigation Measures

- It is advisable to consult owners of the game farms during the design and construction process to take into account their requests with respect to mitigation of long term visual disturbances and come up with practical solutions that would be acceptable to both parties.
- The mitigation measures proposed by the visual specialists should be adhered to.
- The mitigation measures proposed by the noise specialists should be adhered to.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Local economy	High	Probable	**Medium -**
With mitigation	Long term	Local economy	Moderate	Probable	**Medium -**
No-Go					
See impact 12					

Impact 20: Negative impact on the livelihoods of the household's dependant on the local tourism, game farming and association industries

Cause and Comment

The potential decline in the number of tourists visiting local game farms is likely to reduce the revenue of these businesses. This in turn could have a negative impact on the livelihoods of the households that are directly or indirectly dependent on the tourism and game industry in the visually affected area. The households that could be affected include:

- *Owners of the businesses and their households:* The decrease in the number of tourists and subsequent decline in the revenue of local game farms would most likely reduce the personal income of the owners of these farms and subsequently their households. Reduced income levels would result in lower household consumption expenditure, savings or investment levels. This lower personal income translates into less business sales and business development activity elsewhere in the local economy.
- *Employees of the local game farms and their households, as well as households indirectly dependent on the activities on these farms:* The decline in local game farms revenue could have a negative impact on the number of employment positions that are created and sustained on an annual basis by these businesses. Based on a 2011 report on eco-tourism based private game reserves in the Eastern Cape commissioned by Indalo the average employment multiplier amongst local game farms is five employment positions per R 1 million in business revenue/sales (Muir, Skowno and Kerley, 2011). If the proposed facility were to result in the loss of revenue, it could potentially be associated with the loss of employment. Alternatively, it could lead to a reduction in the salaries and wages paid to employees. Due to the multiplier effect, the decline in game farms revenue could lead to further employment losses locally and elsewhere in the country. Since these FTE positions however represent a combination of employment person years to be lost in different sectors, it would mostly likely be translated into a decline in revenue rather than actual employment losses. Regardless of the outcome annual household earnings could decline, which will negatively affect livelihoods and worsen the standard of living of the affected households.

It is important to note that the hunting related-economy is interlinked across vertical and horizontal value chains. An example is thus given as follows:

- Properties that rear hunting animals as a sole source of income would not be negatively affected by a change in the sense of place of the area, as the activity of animal rearing itself would not be negatively affected by the construction or operation of the Grahamstown wind farm.
- It may be posited that a significant percentage of properties in the area that operate solely as rearing operations for hunting purposes (without any hunting take place on the said property) do so on the basis of the growth and location of hunting activity in other farms in nearby areas.
- If such properties sell the majority of their animals to hunting operations within the affected vicinity, then a possible reduction in tourist numbers would affect the revenue of these properties

Depending on the actual effect of the facility on tourist numbers and subsequently on the revenues of the farms, the negative effect could translate into lower income levels and social benefits of dependent households (in the best-case scenario) or into the loss of employment and support of dependent households (in the worst-case scenario).

One of the causes of these outcomes is the visual disturbance created by the facility that changes the aesthetics and visual resources of the environment. Some of these factors can be mitigated and any measures aimed at reducing the visual effect and preserving the “Wild Africa” image of the area should be considered and implemented where feasible.

Mitigation Measures

- Implement all measures suggested to mitigate the impact on the sense of place.
- In the case when employees of nearby farms are retrenched and a strong casual link can be established between the retrenchments and the project activities, the developer should assist the retrenched workers to find alternative employment by either recruiting them to work at the facility or assisting them through the enterprise development programme and/or social development funding allocations prescribed by government.
- In order to avoid exerting a negative impact on the families dependent on local game farms and any other household that could be effected by the project, the developer should seek to partner with the various game farms to support affect families and ensure that the aid given to them is retained.

Significance Statement

Impact	Effect			Risk or Likelihood	Total Score
	Temporal Scale	Spatial Scale	Severity of Impact		
Operation phase					
Without mitigation	Long term	Local economy	High	Highly probable	**High -**
With mitigation	Long term	Local economy	Low	Probable	**Medium -**
No-Go					
See impact 12					

7.3 Cumulative Impacts

Cumulative Impacts result from effects that act together to affect similar resources or receptors, and are a combined effect of other related projects in the general area. To a great extent, cumulative impacts are associated with regional impacts, rather than the local site scale impacts, Thst is, if an activity has a regional impact it also has a cumulative impact. Potential cumulative impacts on the local landscape character and visual feature of an area depend on the topography of the area, the sensitivity of the existing landscape and the presence of visual receptors.

When assessing the cumulative impacts of wind energy facilitiesthe (WEFs) the proximity of other wind farms needs to be considered in conjunction with their synergistic impact on the region in which the current project is located. If other factors of a different nature, such as high voltage power lines or any other development activities are assessed in conjunction with the WEF, cumulative impacts on the regional area will occur.

The Infinite Plan 8 EIA takes into account the cumulative impact of all currently approved EIA processes in the local area as shown in Figure 7.1. It is clearly illustrated in the map there is an increase in number of WEFs in the area will most probably result in sterilisation of large areas of land for large bird species expected to occur in the region, such as the Blue Cranes and Denham Bustards,neither of which were recorded during the avifaunal monitoring period. This is mainly due to the fact that these species avoid areas where turbines have been erected. Currently a number of environmental assessments are being completed for WEFs in the central Eastern Cape region. Several projects have received environmental authorisation, as follows:

Peddie Wind Energy Facility: 25km from the Plan 8 site.
Canyon Springs Wind and Solar Facility: approximately 45km from the Plan 8 site.
Uncedo Lwethu Wind Energy Facility: approximately 50km from the Plan 8 site.
Riverbank Wind Energy Facility: adjacent to Uncedo Lwethu, approximately 50kmfrom the P{lan 8 site.
Lushington Park WEF: approximately 65 km from the Plan 8 site.

Other proposed WEF in the area includes:

- The proposed Terra Power Solutions Riebeeck East WEF (approximately 30 km away)
- The Spitskop WEF (approximately 45 km away)
- The Amakhala Emoyeni WEF (approximately 70 km away)

Other cumulative impacts are discussed below and take into consideration impacts like the increase in bird and bat mortalities (specifically during migration), disturbance to birds/bats, changes in temperature, noise, disruption in local bird/bat movement patterns, socio-economic, and visual cumulative impacts.

Displacement & disturbance

Long-term cumulative impact of habitat loss in the immediate and surrounding region may occur as a result of birds avoiding the wind farm vicinity and its surrounding area due to turbine operation and visitation/maintenance at the site and other approved wind farms in the area. This can have a barrier effect whereby birds are deterred from using normal roosting or feeding sites. This effect may be significant with an increase in turbine installations in the area.

Change in Temperature

Wind turbines can potentially raise temperatures by up to 1°C, especially at night. The blades churn up the air, mixing the various temperature layers. The turbulence created by a wind farm can be measured several kilometres downwind and can change airflow patterns. An increase in wind turbine presence in the region increases the magnitude of this impact thus altering avian atmospheric environment. Wind farms reduce the wind speed downwind of the turbines. This, in turn, reduces the strength of vertical turbulence, which is heat being transferred from the land surface into the lower atmosphere. Turbines decrease airflow from high pressure to low pressure areas, affecting places far from the wind farms.

Noise

Most modern wind turbines are designed to keep noise levels at or below 45dB (decibels) at 350m distance, which should drop to 35 - 40dB at 1 000m. However, typical background noise levels in natural environments are often less than 30dB. This factor affects animals that use hearing for prey detection, predator avoidance or mate selection might be more sensitive to the new noise, therefore experience high levels of stress.

Landscape and Visual Impacts

Significant change in the landscape character of the area may alter the natural visual setting of the area affecting the natural behaviour of both fauna and avifauna. As already identified and discussed, a number of highly sensitive visual receptors will potentially be affected by the proposed wind farm. These include residents of, and viewpoints in, game farms and eco-tourism operations in the region. There are not many urban areas within 20-25km of the development site, but a few rural villages north of the Fish River are about 10km away and residents here often have scenic views of the hills on which the turbines will be built. Since the duration of the impact is long term, it is also identified as a cumulative impact. However, this impact is not considered to be permanent as the assessment identified that the turbines can be removed from the landscape after their life span has been reached.

Direct Mortality

The cumulative effects of bird and bat collision must be considered over the projected operating life of the wind farm, normally 20 to 25 years. These effects may also be cumulative across separate wind farms and consideration of this should be taken in the planning approval process.

As identified in the operational phase of the project, direct bird and bat collisions are a concern, hence the need for 12-month monitoring programmes being conducted. Specifically with bats, their migration paths are virtually unknown. Cave dwelling species like *Miniopterus natalensis* and *Myotis tricolor* undertake annual migrations, and since these species were recorded in the project area there is a high probability of a cave being present in the area. The existence of this cave was confirmed by the heritage study. The project area is not in any direct line of a known migration route, but literature data on exact South African bat migration routes are insufficient to accurately assess this impact at this stage of the study. With the increased amount of wind farms proposed to be concentrated in certain parts of the country, the cumulative impacts on cave dwelling bat migration over long distances (up to 260 km according to Van der Merwe, 1973) can be detrimental if no mitigation or precautions are taken. The long term potential for bird and bat mortality due to direct collisions with or pressure changes due to turbines, disruption to migratory routes and flight pathways and barrier effects reducing available flying space remains a concern. Mitigation measures identified in the impact assessment must be instituted to ensure that the impacts are reduced over time.

The loss of habitat and bird and bat mortality due to turbine collisions may combine to have a greater impact on the viability of a particular species than when considered separately.
Indirect Mortality.

As more facilities with larger turbines are built, the cumulative effects of this rapidly growing industry may initiate or contribute to the decline of some wildlife populations present in the region. This however can only be confirmed by long stating monitoring studies.

Socio-economic

The cumulative socio-economic benefit this and other WEFs will bring to the Eastern Cape is positive. The proposed facility itself will generate approximately R230.29 million in revenue annually and will require annual operational expenditure of R16.14 million of which approximately R5.65 million will be spent locally in the country on an annual basis. The total impact on production in the country as a result of the project's operations will equate to R12.86 million per annum in 2012 prices. Of the R12.86 million in production generated, it is anticipated that with local expenditure related to the annual spending on labour and procurement of local goods and services, new business sales within Makana Local Municipality will increase by R6.63 million on an annual basis, over and above current business sales. Aside from the utilities sector, industries that will experience the greatest stimulus from the project on a national scale will include the transport and transport equipment industries, chemical and chemical product industries as well as the trade and business services industries.

Through indirect and induced effects brought on by this injection to the local and national economy, a total of R 5.64 million of GDP-R will be generated per annum from the project within the whole of South Africa. A total of R2.99 million in value add will be generated in the Makana Local Municipality alone. The production and consumption induced multiplier effects of the project are considered to be relatively small compared to conventional electricity generating industries. This is due to the energy source used to produce electricity by the proposed wind energy facility is free, unlike conventional power stations where raw inputs (i.e. coal) and the transport therefore comprise a significant portion of operating expenditure. It is for this reason that such a facility is a highly attractive business venture.

In addition, this project will provide free clean energy for an already ailing electricity provider and contribute positively to the Government's renewable energy strategy to providing additional sources of energy other than the conventional use of coal.

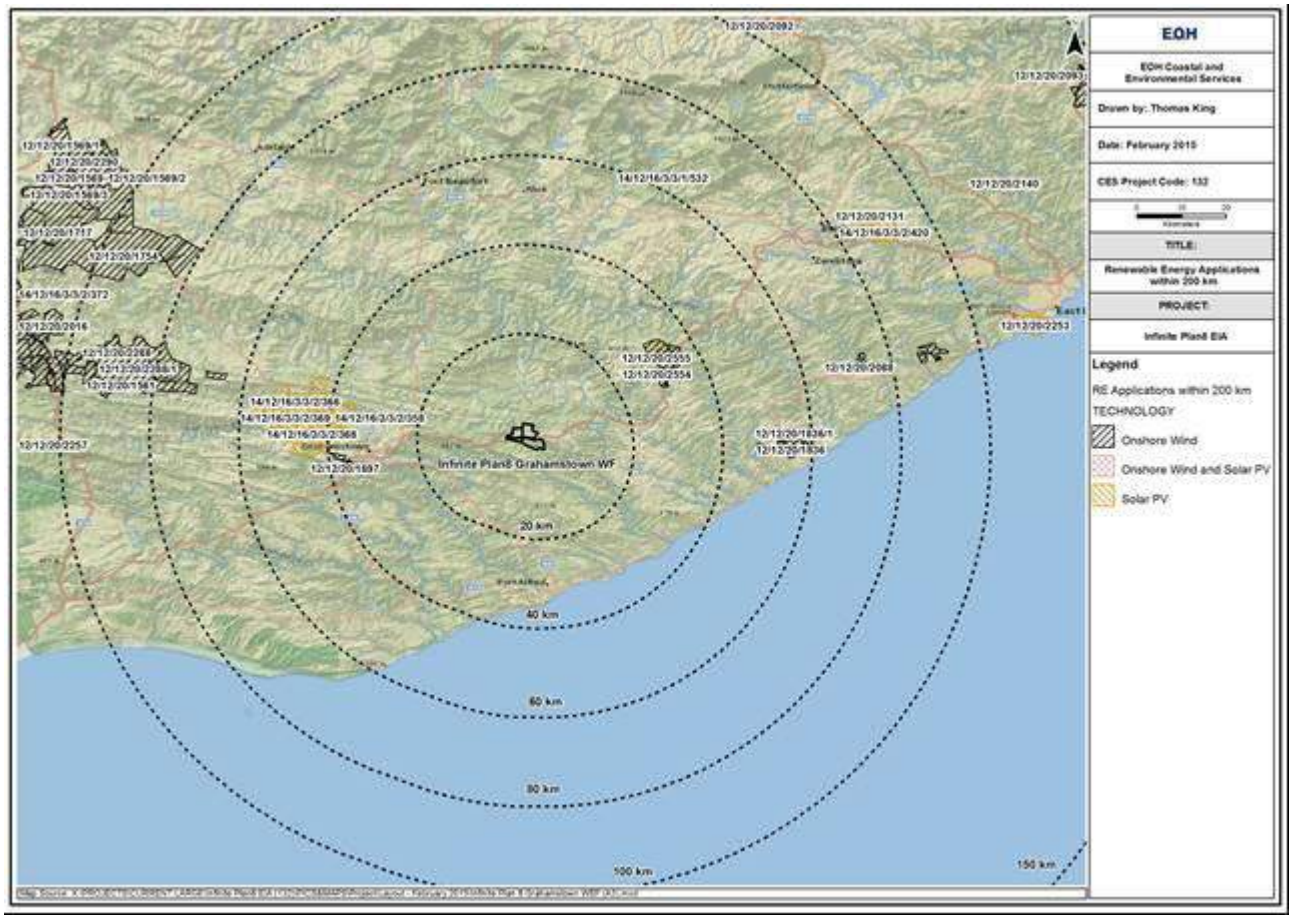

Figure 7-1: Renewable enrgy projects in the general area of the proposed Plan8 WEF

8 CONCLUSIONS AND RECOMMENDATIONS

In terms of section 31 (2) of the EIA regulations (2010), ***an environmental impact assessment report must include:-***

(n) 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;

(o) An environmental impact statement which contains -
(i) a summary of the key findings of the EIA; and
(ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives.

In line with the above-mentioned legislative requirement, this Chapter of the EIR provides a summary of the findings of the proposed Plan 8 Grahamstown Wind Energy Project EIA process, a comparative assessment of the positive and negative implications of the proposed project and identified alternatives. In addition, this Chapter provides the EAP's opinion as to whether the activity should or should not be authorised as well as the reason(s) for the opinion.

8.1 Summary of the Key Findings of the EIA

The proposed wind farm is of moderate size - 22 turbines - compared to other wind farm developments, and there will be few areas in the region that will not have views on a turbine or at least a moving blade on the horizon due to the nature of the surrounding topography.

There are several sensitive visual receptors on surrounding farms which may be affected by the proposed wind farm development, but their current views are likely to contain elements which reduce the quality of the turbine views. Shadow flicker analysis conducted on potentially sensitive receptors indicated that none of these receptors would be subject to more than 30 min/day or 30 hours/yr. It must also be noted that the assumptions of the model were based on worst case scenarios.

In terms of noise impacts there will be an impact on the immediate surrounding environment from the construction activities, especially if pile driving is to be done. This however will only occur if the underlying geological structure requires piled foundations. The area surrounding the construction site will be affected for a short periods of time in all directions, should several pieces of construction equipment be used simultaneously. The number of construction vehicles that will be used in the project will add to the existing ambient levels and will most likely cause a short term disturbing noise. The ambient day time noise levels, measured on the 10th of November 2011 at the Peyneskraal and Jakkelsdraai NSAs, were 49.5 and 45.6dB(A) respectively. The ambient night time noise levels, in dB(A), measured on the 29th of June and 23rd of July 2012, were Peyneskraal (43.2 and 31.2), Jakkelsdraai (47.7 and 41.4), and and Honey Kop (43.2 and 37.1).

The noise produced by the Nordex N117/3000 wind turbines will not exceed the 45dB(A) day/night limit at any of the sensitive receptors identified, but will exceed the 35dB(A) night-time limt at some recepotors.

Amendments have been made to the purbine layout proposed in the November 2013 EIAR to address the most sensitive avifaunal aspect of this project, a nesting pair of African Crowned Eagles, and the other avifaunal impacts can be satisfactorily mitigated by the diligent and sustained implrmentation of recommended mitigation measures.

With regard to the vegetation on the proposed wind energy facility site, the wind farms have very little impact on the vegetation post construction and it may be possible to retain the areas of moderate sensitivity as corridor areas. It should be noted that the presiding sensitivity was based on the flora and vegetation as the vegetation units, representing habitats, and show varying

degrees of ecological integrity and that these values directly influenced the impact rating scores.

In general, the anticipated terrestrial ecological impacts on the fauna and flora of the receiving environment will be of low significance, with no high sensitive areas reported.

As the overall impact on paleontological heritage of the proposed wind farm project is of very low negative significance and will not compromise local fossil heritage. It is has therefore been recommended that exemption from further specialist paleontological studies be granted for the Wind Energy Project.

With regard to impacts on heritage sites in cases where the turbines would be erected in close vicinity of sites, it is recommended buffer zones of at least 15m from the outer edge of each heritage site are set out prior to construction taking place.

From a socio-economic perspective it is acknowledged that the area in proximity to the proposed wind farm has experienced a boom in recent years through tourism-related activity. This has resulted in the creation of employment in hunting, eco-tours, conservation of endangered species, taxidermy, employment, transportation, catering and several other sub industries. This has been matched by significant investments into land rehabilitation, economic infrastructure such as roads and fences, property upgrades, animal holdings and training of employees in critical skills. This has made the region to the east of Grahamstown a growth-spot in terms of nature-based tourism. As a result of this, formerly stagnant or declining incomes from conventional farming were replaced by a revenue stream from both local and international tourists. This has also realised the profile of the area nationally. Such investments and activity have resulted in a robust local economy based on tourism.

Based on survey responses regarding visitor statistics potential production losses to the local tourism sector associated with visual exposure are estimated at between R0.94 million and R6.13 million per year. These are to be compared with the proposed wind farm's capital injection of R107.25 million into the Makana Local Economy. This is estimated as potentially creating a further R185.74 million for the local economy through indirect and induced production effects and a further R70.69 million through GDP-R impacts. Benefits accruing to the region from investments and activity in the tourism sector are thus however outweighed by those that would arise from the construction and operation of a wind farm. The amount of money to be invested, together with its indirect and induced impacts is considerably more than that involved with the local tourism sector. It is also not anticipated that in future the local tourism sector would be able to raise investment capital equal or more than that related to the Grahamstown wind farm. As such, this report recommends that the Grahamstown wind farm be undertaken on the basis of its positive benefits outweighing negative outcomes accruing to the local tourism industry.

Eighteen of the 24 target bird species identified at the start of the 12-month bird preconstruction monitoring were observed on site during the monitoring.

Table 8.1: Target bird species with presence on site confirmed after 12 months monitoring.

Common name	Taxonomic name	Presence on site
African Crowned Eagle	*Stephanoaetus coronatus*	Confirmed
African Fish-Eagle	*Haliaeetus vocifer*	Confirmed
African Goshawk	*Accipiter tachiro*	Confirmed
African Harrier-Hawk	*Polyboroides typus*.	Confirmed
African Marsh-Harrier	*Circus ranivorus*	Confirmed
Amur Falcon	*Falco amurensis*	Confirmed
Black Harrier	*Circus maurus*	Confirmed
Black (Yellow-billed) Kite	*Milvus migrans*	Confirmed
Black Stork	*Ciconia nigra*	Not recorded
Black-shouldered Kite	*Elanus caeruleus*	Confirmed
Black-winged Lapwing	*Vanellus melanopterus*	Not recorded
Booted Eagle	*Aquila pennatus*	Confirmed
Steppe Buzzard	*Buteo vulpinus*	Confirmed
Denham's Bustard	*Neotis denhamii*	Not recorded
Jackal Buzzard	*Buteo rufofuscus*	Confirmed
Long-crested Eagle	*Lophaetus occipitalis*	Confirmed
Lanner Falcon	*Falco biarmicus*	Confirmed
Martial Eagle	*Polemaetus bellicosus*	Confirmed
Rock Kestrel	*Falco rupicolus*	Confirmed
Peregrine Falcon	*Falco peregrinus*	Confirmed
Secretarybird	*Sagittarius serpentarius*	Not recorded
Verreaux's Eagle	*Aquila verreauxi*	Not recorded
White-bellied Korhaan	*Eupodotis senegalensis*	Confirmed
White Stork	*Ciconia ciconia*	Not recorded

Source: Smallie, J. 2015. Final pre-construction bird monitoring report: Grahamstown Wind Energy Facility Plan8 Infinite Energy (Pty) Ltd.

A total of 102 small bird species were recorded on site by Walked Transects, with a peak in species richness in spring and summer. A number of southern African endemics were included in this set of species, but no Red Listed species were recorded. No particularly sensitive avifaunal aspects are evident from this data set. Eight large bird species were recorded on and near the site by Vehicle Transects, with a peak in spring once again. Martial Eagle (Endangered) was the only Red Listed species recorded by this method.

An African Crowned Eagle nest site was found in a small gorge immediately to the west of the site. As of late January 2015, a large chick was on the nest, not yet fledged. This is the most sensitive avifaunal aspect of this project and requires careful management. Verreaux's Eagle was not recorded on or near site during the duration of this programme. No evidence of either current or historic nests was found in the gorges that were surveyed. Martial Eagle was recorded on site several times in spring, but no breeding sites for this species were found in the gorges.

Fifteen target bird species were recorded flying on site during Vantage Point observations, five of which are Red Listed: the Martial Eagle (Endangered); Lanner Falcon (Vulnerable); Black Harrier (Endangered); African Crowned Eagle (Vulnerable) and African Marsh-Harrier (Endangered). The most frequently recorded species was Jackal Buzzard, followed by Rock Kestrel and Booted Eagle. Based on the species' mean flight height above ground, and percentage of flight time spent at rotor height (approximately 30 – 150m), the species likely to be most at risk of collision with turbines appear to be Jackal Buzzard and Rock Kestrel. A spatial 'collision risk index' was created for the site, and indicates two key areas of higher collision risk, close to Turbines 19 and 20 and Turbine 08. Since the flight records responsible for these scores are mostly long flights of Booted Eagle, Rock Kestrel and Jackal Buzzard (none of which are Red Listed), no mitigation action in these areas is required.

Based on the 12 month bird monitoring, the following recommendations have been made and included in the mitigation measures in the impact assessment of this report:

(i) No infrastructure should be built in the area identified as HIGH sensitivity in this report. This is a buffer area of 1.2 kilometre radius around the African Crowned Eagle nest site. Turbine 19 will need to be either discarded or moved approximately 250 metres east to avoid this area. No changes should be made to the layout of infrastructure which may infringe on the MEDIUM sensitivity areas.

(ii) During construction, a specialist should monitor the effect of construction activities on the African Crowned Eagle during breeding season to measure the effectiveness of the above mitigation measure.

(iii) All power line linking the turbines and linking turbine strings to the on-site substation should be placed underground. Where this is not possible this should be discussed with the specialist and a compromise reached that provides acceptable protection for birds.

(iv) The power line linking the site to the Eskom grid will be above ground but must conform to all Eskom standards in terms of bird-friendly monopole structures with Bird Perches on every pole top (to mitigate for bird electrocution), and anti-bird collision line marking devices (to mitigate for bird collision). It is particularly important that the collision mitigation devices used are durable and remain in place on the line for the full lifespan of the power line. It will be Plan8/Eskom's responsibility to maintain these devices in effective condition for this period. Systematic patrols of this power line should be conducted during post construction bird monitoring for the wind energy facility, in order to monitor the impacts, the effectiveness of mitigation, and the durability of the mitigation measures.

(v) A final avifaunal walk through should be conducted prior to construction to ensure that all the avifaunal aspects have been adequately managed and to ground truth the final layout of all infrastructure. This will most likely be done as part of the site specific Environmental Management Plan. This will also allow the development of specific management actions for the Environmental Control Officer during construction and training for relevant on site personnel if necessary.

(vi) The 'during' construction and post-construction bird monitoring programme outlined by this report should be implemented by a suitably qualified avifaunal specialist. In particular the post construction monitoring of live birds should be conducted for at least 1 year and the measurement of bird fatalities through carcass searches for at least 3 years, and repeated in years 5, 10, 15 etc. after the commissioning of the facility (see Jenkins *et al,* 2014). As mentioned above this monitoring should include the grid connection power line.

(vii) The findings of post-construction monitoring should be used to measure the effects of this facility on birds. If significant impacts are identified the wind farm operator will have to identify and implement suitable mitigation measures.

After 12 months of bat monitoring the following species were confirmed present on site or have been assigned a probability of occurrence.

Table 8.2: Bat species confirmed on site or their probability of occurrence.

Species	Common name	Probability of occurrence (%)	Conservation status	Likelihood of risk of fatality (Sowler and Stoffberg 2014)
Chaerephon pumilus	Little free-tailed bat	Confirmed	Least Concern	High
Cistugo lesueuri	Lesueur's wing-gland bat	Confirmed	Vulnerable	Low
Eptesicus hottentotus	Long-tailed serotine	20 - 30	Least Concern	Medium
Kerivoula lanosa	Lesser woolly bat	10 - 20	Least Concern	Low
Miniopterus natalensis	Natal long-fingered bat	Confirmed	Near Threatened	Medium - High
Myotis tricolor	Temmink's myotis	60 - 70	Least Concern	Medium - High
Neoromicia capensis	Cape serotine	Confirmed	Least Concern	Medium - High
Nycteris thebaica	Egyptian slit-faced bat	90 - 100	Least Concern	Low
Pipistrellus hesperidus	Dusky pipistrelle	70 - 80	Least Concern	Medium
Rhinolophus capensis	Cape horseshoe bat	30 - 40	Near Threatened	Low
Rhinolophus clivosus	Geoffroy's horseshoe bat	40 - 50	Least Concern	Low
Rhinolophus swinnyi	Swinny's horseshoe bat	40 - 50	Near Threatened	Low
Scotophilus dinganii	Yellow-bellied house bat	Confirmed	Least Concern	Medium - High
Tadarida aegyptiaca	Egyptian free-tailed bat	Confirmed	Least Concern	High
Taphozous mauritianus	Mauritian tomb bat	70 - 80	Least Concern	High

Probability of occurrence is assigned based on consideration of the presence of roosting sites and foraging habitats, compared to literature described preferences for particular species. Risk of fatality utilises a methodology devised by Sowler and Stoffberg (2014) and is based on species distribution, altitudes at which they fly and distances they traverse; it assumes a 100% probability of occurrence.

Based on the 12 month bat monitoring, the following recommendations have been made and included in the mitigation measures in the impact assessment of this report:

From the sensitivity map, it can be seen that no turbines are located within High Bat Sensitivity areas and Moderate Bat Sensitivity areas. Turbine 21 is located on the boundary of a High Bat Sensitivity buffer zone; turbines 20 and 22 are positioned within Moderate Bat Sensitivity buffer zones. Turbines 5, 8, 9, 10, 11 and 12 are close to high sensitivity buffers and will require more stringent active mitigation measures noted in the impact assessment and increased operational monitoring efforts are required.

The High Bat Sensitivity areas are expected to have elevated levels of bat activity and support greater bat diversity. High Bat Sensitivity areas are 'no – go' areas due to expected elevated rates of bat fatalities due to wind turbines. Moderate Bat Sensitivity buffers must be prioritised during operational monitoring and may require mitigation measures if bat mortalities are found to be unacceptably high.

The No-Go Option will have two highly beneficial/positive impacts with regards to the following:

- Faunal biodiversity
- Faunal SSC

The continuation of the current land use in the project area, the vast majority of no-go impacts will be in effect a conservation measure, resulting in the prevention of habitat degradation (bats), and the restoration of any visible/uncovered archaeological remains and the prevention of elevated noise levels arising from both construction and operational phases.

Project layout in relation to all sensitive areas is presented in Figure 8.1.

A summary of the various construction and operational phase and no-go impacts are contained in Tables 8-1 to 8-3 below.

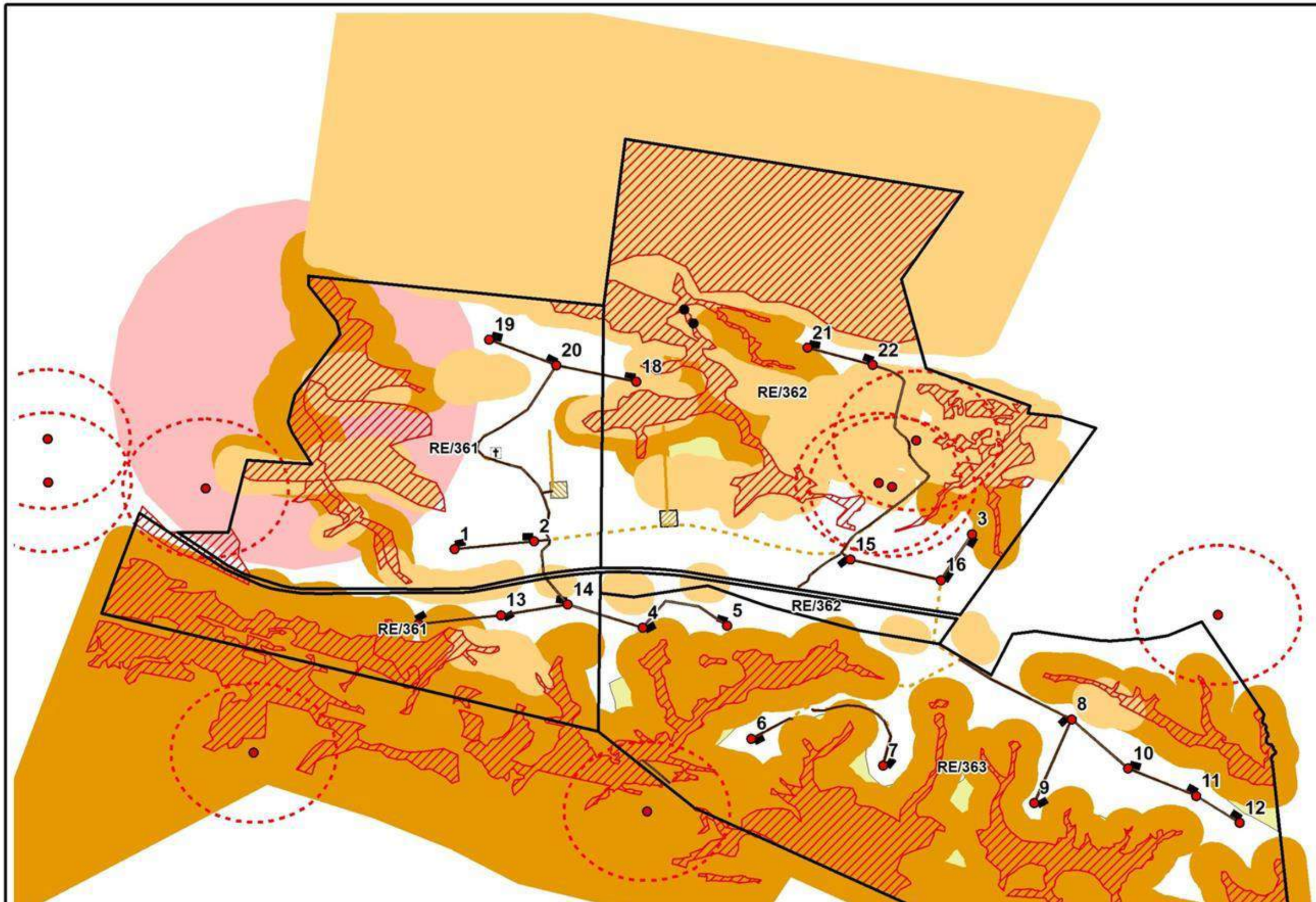
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Table 8-3: Summary of the impacts associated with the proposed Plan 8 Grahamstown Wind Energy Project during the construction phase

Construction Phase				
Impact Study	**Impact #**	**Impact Type**	**Significance**	
			Without mitigation	**With mitigation**
Ecological	**1**	Loss of Degraded thicket	**LOW-**	**LOW-**
	2	Loss of Fynbos	**LOW-**	**LOW-**
	3	Loss of Fynbos, Thicket, Karoo mosaic	**LOW-**	**LOW-**
	4	Loss of Thicket mosaic	**LOW-**	**LOW-**
	5	Loss of plant species of special concern	**HIGH-**	**LOW-**
	6	Loss of animal species of special concern	**LOW-**	**LOW-**
	7	Loss of Biodiversity	**MOD-**	**LOW-**
	8	Fragmentation of vegetation and edge effects	**LOW-**	**LOW-**
	9	Invasion of alien species	**MOD-**	**MOD+**
Avifauna	**10**	Habitat destruction	**LOW-**	**LOW-**
	11	Disturbance of birds	**MOD-**	**LOW-**
Bat	**12**	Destruction of bat foraging habitat	**MOD-**	**LOW-**
	13	Destruction of bat roosts	**MOD-**	**LOW-**
Heritage	**14**	Impact on heritage resources	**MOD-**	**LOW-**
Noise	**15**	Potential construction noise sources (construction vehicles)	**LOW-**	**LOW-**
Visual	**16**	Impact of construction activities on sensitive visual receptors	**HIGH-**	**HIGH-**
	17	Intrusion of large, highly visible wind turbines on the existing views	**HIGH-**	**HIGH-**
	18	Impact of night lights of a wind farm on existing nightscape	**MOD-**	**MOD-**
Agriculture	**19**	Loss of vegetation	**VERY HIGH-**	**HIGH-**
	20	Pollution of water sources	**HIGH-**	**MOD-**
	21	Erosion and construction on land with a gradient	**VERY HIGH-**	**MOD-**
Socio Economic	**22**	Temporary stimulation of the national and local economy	**HIGH +**	**HIGH +**
	23	Temporary increase in employment in the national and local economies	**MOD +**	**MOD +**
	24	Contribution to skills development in the country and local economy	**MOD +**	**MOD +**
	25	Temporary increase in household earnings	**MOD +**	**MOD +**
	26	Temporary increase in government revenue	**MOD +**	**MOD +**
	27	Negative changes to the sense of place	**MOD -**	**MOD -**
	28	Negative impact on the local tourism, game industry and associated industries	**MOD -**	**LOW -**
	29	Temporary increase in social conflicts associated with the influx of people	**MOD -**	**LOW -**
	30	Impact on economic and social infrastructure	**MOD -**	**LOW -**
	31	Impact on real estate dynamics and business activity in the immediately affected area	**HIGH -**	**MOD -**

Table 8-4: Summary of the impacts associated with the proposed Plan 8 Grahamstown Wind Energy Project during the operational phase

Operational Phase				
Impact Study	**Impact #**	**Impact Type**	**Significance**	
			Without mitigation	**With mitigation**
Ecological	**1**	Invasion of alien species	**HIGH-**	**MOD+**
Avifauna	**2**	Bird collision and electrocution on overhead power lines, Impact on Red Listed and other species	**MOD -**	**LOW -**
	3	Bird disturbance and displacement from area as result of wind turbines and other infrastructure	**LOW -**	**LOW -**
	4	Bird collision with turbine blades	**MOD -**	**MOD -**
Bat	**5**	Bat mortalities during foraging by turbine blades	**HIGH-**	**MOD-**
	6	Bat mortalities during migration by turbine blades	**HIGH-**	**MOD-**
Heritage	**7**	Impact on heritage resources	**MOD-**	**LOW-**
Noise	**8**	Predicted noise levels for wind turbine generators	**MOD-**	**LOW-**
Visual	**9**	Potential landscape impact	**MOD-**	**MOD-**
	10	Impact of shadow flicker on residents in close proximity to wind turbines	**LOW-**	**LOW-**
Agriculture	**11**	Possible change of use of agricultural land	**MOD-**	**LOW-**
Socio Economic	**12**	Sustainable increase in production and GDP-R nationally and locally	**MOD +**	**MOD +**
	13	Creation of sustainable employment positions nationally and locally	**MOD +**	**MOD +**
	14	Skills development of permanently employed workers	**MOD +**	**MOD +**
	15	Improved standards of living for the benefiting households	**MOD +**	**MOD +**
	16	Sustainable increase in national and local government revenue	**MOD +**	**MOD +**
	17	Local economic and social development benefits derived from the project's operations	**HIGH +**	**HIGH +**
	18	Negative changes to the sense of place	**MOD -**	**MOD -**
	19	Negative impact on local tourism, game farming and associated industries	**MOD -**	**MOD -**
	20	Negative impact on the livelihoods of the household's dependant on the local tourism, game farming and association industries	**HIGH -**	**MOD -**

Table 8-5: Summary of the impacts associated with the proposed Plan 8 Grahamstown Wind Energy Project assuming the NO-GO option

No Go				
	Impact Study	**Impact #**	**Impact Type**	**Significance**
CONSTRUCTION	**Ecological**	**1**	Loss of Degraded thicket	MOD-
		2	Loss of Fynbos	MOD-
		3	Loss of Fynbos, Thicket, Karoo mosaic	MOD-
		4	Loss of rocky Fynbos	N/A
		5	Loss of Thicket	N/A
		6	Loss of Thicket mosaic	MOD-
		7	Loss of plant species of special concern	MOD-
		8	Loss of animal species of special concern	MOD-
		9	Loss of Biodiversity	MOD-
		10	Fragmentation of vegetation and edge effects	LOW-
		11	Invasion of alien species	HIGH-
	Avifauna	**12**	Habitat destruction	N/A
		13	Disturbance of birds	N/A
	Bat	**14**	Destruction of bat foraging habitat	N/A
		15	Destruction of bat roosts	N/A
	Heritage	**16**	Impact on heritage resources	MOD+
	Noise	**18**	Potential construction noise sources (construction vehicles)	MOD+
	Visual	**19**	Impact of construction activities on sensitive visual receptors	N/A
		20	Intrusion of large, highly visible wind turbines on the existing views of sensitive visual receptors	N/A
		21	Impact of night lights of a wind farm on existing night scape	N/A
	Socio-Economic	**See Table 8**		

OPERATIONAL	**Ecological**	**1**	Invasion of alien species	HIGH-
	Avifauna	**2**	Bird collision and electrocution on overhead power lines, Impact on Red Listed and other species	N/A
		3	Bird disturbance and displacement from area as result of wind turbines and other infrastructure	N/A
		4	Bird collision with turbine blades	N/A
	Bat	**5**	Bat mortalities during foraging by turbine blades	N/A
		6	Bat mortalities during migration by turbine blades	N/A
	Heritage	**7**	Impact on heritage resources	MODERATE+
	Agriculture	**8**	Not proceeding with wind farm construction	MODERATE-
	Noise	**9**	Predicted noise levels for wind turbine generators	MODERATE+
	Visual	**10**	Potential landscape impact	MODERATE+
		11	Impact of shadow flicker on residents in close proximity to wind turbines	N/A
	Socio-economic	**See Table 8**		

Table 8-6: Comparison of the Socio-economic no-go option for the development of the Grahamstown Wind Farm - Operational Phase

Potential annual losses from a reduction in tourist numbers	Potential injection into the local Makana economy from annual wind farm expenditure	Average annual revenue from local hunting/ tourism properties surveyed	Potential annual average revenue from the Grahamstown wind farm
R6.13 million	R17.32 million	R0.92 million	R230.29 million

8.2 EAP's Recommendation

The decision regarding whether to proceed with the proposed development should be based on weighing up the positive and negative impacts as identified and assessed by the independent specialists. In addition to the findings of the specialist studies, it is also necessary to consider the following when making a decision:

- The majority of the impacts associated with the proposed project can be mitigated by applying specialist study findings and recommendations or the realignment of a minimum number of turbines (albeit that they may potentially be in less efficient locations for electricity generation) and this is reflected further on in this report;
- The refined layout referred to above takes the identified environmental sensitivities and constraints into account in delineating road access, construction phase infrastructure and laydown area requirements;
- The nature of the site on which the facility is to be sited is suited to the development proposal with easy access provided from the N2 highway and relative proximity to the ports of Coega and Port Elizabeth;
- The project proponent has taken the issues raised by interested and affected parties into consideration and made changes to the layout where possible. These include the reduction of the visual and noise impacts for Honeykop Farm to the west of the project area and for the farm house and workers houses on the farm Peyne's Kraal. All the identified highly sensitive areas have been avoided and the recommended buffer zones not intruded on.
- The project has extensive potential environmental and socio-economic benefits including the generation of clean energy for Makana Local Municipality (MLM);
- The project will contribute directly and significantly to social upliftment of the local community; and
- This EIA process has enabled the provision of accurate and relevant information required for informed decision making.

Based on the above, it is believed that, with the implementation of appropriate mitigation measures and understanding that certain visual impacts cannot be mitigated, the cumulative benefits of the proposed Plan 8 Grahamstown Wind Energy Project will outweigh the negative impacts and it is the opinion of the EAP that the No-Go option should not be considered any further, and that the proposed Plan 8 Grahamstown Wind Energy Project should be granted authorisation.

In addition to this the proposed project will aid in:-

- The reduction of greenhouse gases by the use of alternatives to fossil fuel derived electricity will assist South Africa to begin demonstrating its commitment to meeting international obligations/legislative instruments such as the 1992 United Nations Framework Convention on Climate Change (FCCC) and the Kyoto Protocol (2002);
- Meeting the goals of the White Paper on the Energy Policy for South Africa (Energy White Paper) which aims to create energy security by diversifying energy supply and energy carriers and sets out the policy principles, goals and objectives to achieve, "*An energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa, thus contributing to sustainable development and environmental conservation*", and;
- The Department of Minerals and Energy (DME) (now the Department of Energy) Integrated Energy Plan (IEP) to develop the renewable energy resources, while taking safety, health and the environment into consideration setting a target of, "*10 000 GWh (0.8Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro*".
- South Africa has also often experienced major power shortages largely as a result of demand outstripping supply. This, in many cases, has resulted in financial losses (many of the sectors contributing to the GDP are practically driven by electricity) and impacted on quality of life (hospitals and schools were among the affected, jobs were lost etc.). The

national power utility, Eskom, has indicated that South Africa is not past this crisis and that the possibility of further power cuts remains. With local generation, the networks can be freed up to supply power to other areas and the local community will have a much better chance of more consistent supply. It is anticipated that the project can supply more than the MLM's current daytime electricity demand during all seasons.

In addition to the above, the EAP recommends that the project only be granted authorisation under certain conditions, in order to address those impacts with a high significance rating, included in the table below. One such condition strongly suggested that the recommendations made in *Volume 4: Environmental Management Programme Proposed Plan 8 Grahamstown Wind Energy Project* (CES, February 2015) also be followed.

Of particular relevance is the recently developed avifauna and bat monitoring programme. It is recommended that this programme become a standard condition of authorisation for all wind energy projects. It is recommended that the DEA further refine these programmes (for birds and bats) as a standard condition of authorisation. These monitoring programmes will be invaluable in guiding the micro-siting of the turbines as more data becomes available.

Study	Phase	Impact	Mitigation Measures
Avifauna	Operation	Bird collision & electrocution on overhead power lines, Impact on Red Listed and other species	Bury all 'on site' power lines underground. On power lines to grid, mark certain sections of the line with anti-collision marking devices on the earth wire to increase the visibility of the line and reduce likelihood of collisions. High risk sections of line can only be identified once the route of the power lines is available. Bird friendly pole/pylon designs should be used to prevent electrocutions and approved by avifaunal specialist.
		Bird disturbance and displacement from area as result of wind turbines and other infrastructure	It is very difficult to mitigate for this. Disturbance can be reduced to some extent by following general environmental best practice in terms of managing people, machines and equipment during operations and maintenance.
		Bird collision with turbine blades	This is extremely difficult to mitigate for post construction. Sensitivity mapping and pre-construction monitoring should inform the final turbine layout in order to proactively mitigate for this. If key species are found to collide in significant numbers post construction then mitigation options such as painting turbine blades, blade height adjustment and curtailment will need to be implemented.
	Construction	Disturbance of birds, Impact on Red Listed and other species during construction	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate fully for this as some disturbance is inevitable. The nest on site has been buffered by 1.2 km.
		Destruction or alteration of bird habitat, Impact on Red Listed and other species	Strict control should be maintained over all activities during construction, in particular heavy machinery and vehicle movements, and staff. It is difficult to mitigate fully for this as some habitat destruction is inevitable. Existing roads should be used as much as possible, as well as avoiding sensitive areas identified by this study.

Study	Phase	Impact	Mitigation Measures
Noise	Construction	Potential construction noise sources	All construction operations should only occur during daylight hours if possible. No construction piling should occur at night. Piling should only occur during the day to take advantage of unstable atmospheric conditions. Construction staff should receive "noise sensitivity" training. An ambient noise survey should be conducted during the construction phase. The noise impact should be remodelled when the micro-siting of the turbines take place.
	Operation	Predicted noise levels for wind turbine generators	The noise impact from the wind turbine generators should be measured during the operational phase, to ensure that the impact is within the recommended rating limits.
Agriculture	Operation	Possible change of use of agricultural land	No mitigation required as grazing can continue on the land unimpeded. Department of Agriculture, Forestry and Fisheries has been informed of the project, and has had an opportunity to comment on the turbine and infrastructure layout.
	Construction	Loss of vegetation	Permits may be required for the removal and transplanting of listed, protected species. A plant "search and rescue" operation should be conducted prior to construction (see ecological mitigation measures).
		Pollution of water sources	Construction activities adjacent to watercourses should not be closer than 100 m from the 1-in-100 year flood levels. Turbines should be sited at least 100 m away from earth dams and boreholes. Access roads must be provided with adequate drainage structures to control run-off water. A routine maintenance regime should be implemented as part of the operational plan for the lifespan of the project.
		Erosion and construction on land with a gradient	A construction regime should be specified by the design engineer to limit and control loss of vegetation and resultant increased run-off of storm water.
Ecological	Construction	Loss of Degraded Thicket	Keep removal of vegetation to a minimum. Set aside part of the project area for conservation. Do not remove vegetation in areas set aside for conservation.
		Loss of Fynbos	Keep removal of vegetation to a minimum. Set aside part of the project area for conservation. Do not remove vegetation in areas set aside for conservation.
		Loss of Fynbos, thicket, karoo mosaic	Keep removal of vegetation to a minimum. Set aside part of the project area for conservation. Do not remove vegetation in areas set aside for

Study	Phase	Impact	Mitigation Measures
			conservation.
		Loss of Thicket Mosaic	Keep removal of vegetation to a minimum. Set aside part of the project area for conservation. Do not remove vegetation in areas set aside for conservation.
		Loss of plant species of special concern	Areas containing species of special concern should be noted and every effort made to reduce the impacts of construction on these sections of vegetation. SSC in any area to be cleared should be identified and rescued. Some SSC will not transplant. These individuals should, as far as possible, be left untouched.
		Loss of animal species of special concern	If any fencing is to be done; the fences should have enough space between wires for small animals to move across them uninhibited. Workers should also be educated on conservation and should not be allowed to trap animals on site.
		Loss of biodiversity	An area within the site that can be set aside for conservation and actively managed as a corridor area would be ideal to mitigate loss of biodiversity. It is recommended that as much as possible of the high sensitivity areas be set aside as conservation areas and be managed as such by the land owners and wind farm developers.
		Disruption of ecosystem function and process	Fragmentation is unlikely to occur due to the nature of the development. However, it is important to make sure all fences have wide enough mesh to let small animals through, and that large areas of vegetation are not cleared, especially for roads
		Invasion of alien species	Removal of existing alien species should be consistently done. Rehabilitation of disturbed areas after the construction of the wind energy facility should be done as soon as possible after construction is completed. Invasive plant species are most likely to enter the site carried in the form of seeds by construction vehicles and staff; these should be cleaned before entering the site to prevent alien infestation.
	Operation	Invasion of alien species	Removal of existing alien species should be consistently done. Invasive plant species are most likely to enter the site carried in the form of seeds by vehicles and staff; these should be cleaned before entering the site to prevent alien infestation.
Visual	Operation	Introducing highly visible wind turbines into a rural-agricultural landscape	There are no mitigation measures that can reduce the perception of a negative impact significantly unless the site is avoided. But there are a number of measures that can enhance the positive aspects of the impact. It has been shown that uncluttered sites are preferred for wind farms (Gipe, 1995; Stanton, 1996; Vissering, 2005). In view of this the following mitigation measures and suggestions may enhance the positive visual

Study	Phase	Impact	Mitigation Measures
			aspects of the development: • Ensure that there are no wind turbines closer than 500m to a residence or farm building. • Maintenance of the turbines is important. A spinning rotor is perceived as being useful. If a rotor is stationary when the wind is blowing it is seen as not fulfilling its purpose and a negative impression is created (Gipe, 1995). • Signs near wind turbines should be avoided unless they serve to inform the public about wind turbines and their function. Advertising billboards should be avoided. • According to the Aviation Act, 1962, Thirteenth Amendment of the Civil Aviation Regulations, 1997: "Wind turbines shall be painted bright white to provide maximum daytime conspicuousness. The colours grey, blue and darker shades of white should be avoided altogether. If such colours have been used, the wind turbines shall be supplemented with daytime lighting, as required." • Lighting should be designed to minimise light pollution without compromising safety. Investigate using motion sensitive lights for security lighting. Turbines are to be lit according to Civil Aviation regulations. • An information kiosk (provided that the kiosk and parking area is located in a low visibility area) and trails along the wind farm can enhance the project by educating the public about the need and benefits of wind power. 'Engaging school groups can also assist the wind farm proponent, as energy education is paramount in developing good public relations over the long term. Instilling the concept of sustainability, and creating awareness of the need for wind farm developments, is an important process that can engage the entire community' (Johnston, 2001).
		Shadow flicker effect	Although the time periods during which shadow flicker could be experienced, assuming sunny conditions at all times, are very limited, number of mitigation measures can be discussed with the owner/resident of the dwelling should the effect prove to be an irritatioin to the residents: • Trees or high thicket are effective as a measure to reduce or eliminate the effect of shadow flicker. Windows where the shadow flicker effect will occur can be determined and trees can be planted such that the effect will be reduced. • Determine which turbine (or turbines) is the main cause of the potential shadow flicker effect and reposition this turbine in the final layout (without increasing the shadow flicker effect for other buildings). • Determine when the shadow flicker effect will be at its worst for the building and reduce the

Study	Phase	Impact	Mitigation Measures
			speed of the turbine rotor for this period. • There exists technology in the form of sensors which can be installed either in the room where shadow flicker is likely to occur, or on turbines which may cause shadow flicker (Marks 2011) which can control rotor speed to reduce the effect.
Visual	Construction	Intrusion of large and highly visible construction activity on sensitive viewers	The most obvious causes of impact cannot be mitigated for since the turbines are so tall and are visible from much of the surrounding landscape. The duration of the impact is short, though, and there are a number of mitigation measures that will curtail the intensity to some extent: • Construction of new roads should be minimised and existing roads should be used where possible. • The contractor should maintain good housekeeping on site to avoid litter and minimise waste. • Clearance of indigenous vegetation should be minimised and rehabilitation of cleared areas should start as soon as possible. • Erosion risks should be assessed and minimised as erosion scarring can create areas of strong visual contrast which can often be seen from long distances. • Laydown areas and stockyards should be located in low visibility areas (e.g. valleys between ridges) and existing vegetation should be used to screen them from views where possible. • Night lighting of the construction sites should be minimised within requirements of safety and efficiency. See section on lighting for more specific measures. • Fires and fire hazards need to be managed appropriately.
		Impact of night lights on existing nightscape	The aviation standards have to be followed and no mitigation measures are applicable in terms of marking the turbines. Lighting of ancillary buildings and structures should be designed to minimise light pollution without compromising safety. Motion sensitive lighting can be used for security purposes.
Heritage	Construction and Operation	Impact on heritage resources	It is recommended that; • Because of the overall lack in archaeological remains, it is suggested that – from an archaeological perspective - the proposed development may move beyond the scoping phase of assessment, • Surveyed areas (walk tracks) – with the exception of waypoints 1 and 34-35 – are suitable for the proposed activities, • Any areas outside the surveyed tracts might be archaeologically sensitive and therefore, placement of any activities outside the studied areas will require further archaeological investigation and assessment, • Once the final layout and placement of wind

Study	Phase	Impact	Mitigation Measures
			turbines and associated facilities and services are determined, an Archaeological Impact Assessment focusing on the affected areas should be undertaken, • Because shales occur in the study area the presence of fossils cannot be ruled out and therefore, a Palaeontological Impact Assessment (Desktop Study) should be conducted, and It is required that; • In the event that vegetation clearing and earthmoving activities expose archaeological materials, such activities must stop and the South African Heritage Resources Agency must be notified immediately. • If archaeological materials are exposed during vegetation clearing and/or earth moving activities, then they must be dealt with in accordance with the National Heritage Resources Act (No. 25 of 1999) and at the expense of the developer. • In the event of exposing human remains during construction, the matter will fall into the domain of the South African Heritage Resources Agency (Mrs. Colette Scheermeyer) and will require a professional archaeologist to undertake mitigation if needed. SAHRA recommends that: • The two unmarked graves that occur on site must be fenced off during construction. The fence should be 5 meters from the edge of the graves. • Turbines should not be placed within 50 meters of the fence surrounding the graves. Access roads should not be placed within 20 meters of the fence surrounding the graves. • The old plough should be fenced off. If the landowner agrees it should be moved undercover or indoors to protect it from degradation. • The work force should be educated as to the archaeological significance of the rock art occurring on the site. • SAHRA or a professional should be contacted if any archaeological sites or artefacts, palaeontological fossils, graves or other heritage resources are found during construction.
Bat	Construction	Destruction of bat foraging habitat	The footprint of the wind farm should be kept to a minimum, and areas designated as having a high sensitivity for bats be excluded from development.
		Destruction of bat roosts	Areas designated as having a high sensitivity for bats must be excluded from development.
Bat	Operation	Bat mortalities during foraging and migration	• Turbines should be curtailed during times when bats are active, low wind speeds at night is the best time (and when little

Study	Phase	Impact	Mitigation Measures
			electricity is being generated by the turbines). • It is recommended that bat fatalities, and their causes at the wind farm are monitored, as there is no information available for wind farms in South Africa. More applicable mitigation measures to reduce bat fatalities (see below) can be applied when there is more information. • Ultrasound broadcast can deter bats from flying into wind turbines. (Szewczak and Arnett 2007) • Minimizing turbine height will help to reduce bat fatalities (Barclay *et al*.,2007). • Turbine site placement around water bodies (dams) should be avoided (Brinkman *et al.*, 2006). • Wind turbine operating times should be restricted during times when bat activity is high (Brinkman *et al*., 2006). Bats are at higher risk of fatality on nights with low wind speeds (Horn *et al*., 2008). This is to be better assessed after sonar mitigation techniques are evaluated and assessed.
Socio-economic	Construction	Temporary stimulation of the national and local economy	• The developer should be encouraged by the EPC contractor to increase the local procurement practices and promote the employment of people from local communities, as far as feasible, to maximise the benefits to the local economies. • The developer should engage with local authorities and business organisations to investigate the possibility of procuring construction materials, goods and products from local suppliers were feasible.
		Temporary increase in employment in the national and local economies	• Organise local community meetings to advise the local labour force about the project that is planned to be established and the employment that can potentially applied for. • Establish a local skills desk (in Grahamstown) to determine the potential skills that could be sourced in the area. • Recruit local labour as far as feasible. • Employ labour-intensive methods in construction where feasible. • Sub-contract to local construction companies particularly SMME's and BBBEE compliant enterprises where possible. • Use local suppliers where feasible and arrange with the local SMME's to provide transport, catering and other services to the construction crews.
		Contribution to skills development in the country and local economy	• Facilitate knowledge and skills transfer between foreign technical experts and South African professionals during the pre-establishment and construction phases. • Set up apprenticeship programmes to build onto existing skill levels or develop new skills amongst construction workers especially those from local communities.

Study	Phase	Impact	Mitigation Measures
		Temporary increase in household earnings	• Recruit local labour as far as feasible to increase the benefits to the local households. • Employ labour intensive methods in construction where feasible. • Sub-contract to local construction companies where possible. • Use local suppliers where feasible and arrange with local SMME's and BBBEE compliant enterprises to provide transport, catering and other services to the construction crews.
		Temporary increase in government revenue	None.
		Negative changes to the sense of place	• The mitigation measures proposed by the visual and noise specialists should be adhered to. • Natural areas that are not affected by the footprint should remain as such. Efforts should also be made to avoid disturbing such sites during construction.
		Negative impact on the local tourism, game industry and associated industries	• Mitigation proposed by the visual specialists should be implemented during the beginning of the construction period to screen off visual disturbances as soon into the development phase as feasible. • Heavy vehicles travelling on secondary roads should adhere to low speed limits to minimise noise and dust pollution. • If feasible, no construction activities should be carried out during weekends and outside day time working hours.
		Temporary increase in social conflicts associated with the influx of people	• Adhere to strict labour recruitment practices that would reduce the desire of potential employment seekers to loiter around the properties in the hope of finding temporary employment. • Control the movement of workers between the site and areas of residence to minimise loitering around the facility. This should be achieved through the provision of scheduled transportation services between the construction site and area of residence. • Employ locals as far as feasible through the creation of a local skills database. • Establish a management forum comprising key stakeholders to monitor and identify potential problems that may arise due to the influx of employment seekers to the area. • Ensure that any damages or losses to nearby affected farms that can be linked to the conduct of construction workers are adequately reimbursed. • Assign a dedicated person to deal with complaints and concerns of affected parties.
		Impact on economic and social	• Engage with local authorities and inform them of the development as well as discuss with them their ability to meet the additional

Study	Phase	Impact	Mitigation Measures
		infrastructure	demands on social and basic services created by the in-migration of workers. • Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate through the use of social responsibility allocations.
		Impact on real estate dynamics and business activity in the immediately affected area	• The developer should offer some form of an agreement, incentive, or property value guarantee to the nearby farms to offset potential losses in property values provided they are proven to result from the establishment of the facility in the area. The nature and conditions of such agreements should be negotiated with the affected landowners and should be acceptable by both parties. • Mitigation measures to reduce the impact on the sense of place should also be implemented.
Socio-economic	Operation	Sustainable increase in production and GDP-R nationally and locally	• The operator of the wind energy facility should be encouraged to, as far as possible, procure materials, goods and products required for the operation of the facility from local suppliers to increase the positive impact in the local economy.
		Creation of sustainable employment positions nationally and locally	• Where possible, local labour should be considered for employment so as to increase the positive impact on the local economy. • As far as possible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.
		Skills development of permanently employed workers	• The developer should consider establishing vocational training programmes for the local labour force to promote the development of skills required by the wind energy facility and thus provide for the opportunities for these people to be employed in other similar facilities elsewhere.
		Improved standards of living for the benefiting households	• Where possible, the local labour supply should be considered for employment opportunities to increase the positive impact on the area's economy. • As far as feasible, local small and medium enterprises should be approached to investigate the opportunities for supply inputs required for the maintenance and operation of the facility.
		Sustainable increase in national and local government revenue	None
		Local economic and social development benefits derived	• The Community Needs analysis and Assessment Report programmes and projects should be supported throughout the project's lifespan.

Study	Phase	Impact	Mitigation Measures
		from the project's operations	• This plan should constantly be refined in consultation with local authorities and local communities to identify community projects that would result in the greatest social benefits. • These plans should be reviewed on an annual basis and, where necessary, updated. • When identifying enterprise development initiatives, the focus should be on creating sustainable and self sufficient enterprises. • In devising the programmes to be implemented through the Community Trust allocations, the developer should take into account all updates to the Makana's Integrated Development Plans and Local Economic Development Strategies.
		Negative changes to the sense of place	• The mitigation measures proposed by the visual and noise specialists should be adhered to. • Natural areas that are not affected by the footprint should remain as such. Efforts should also be made to avoid disturbing such sites during construction.
		Negative impact on local tourism, game farming and associated industries	• It is advisable to consult owners of the game farms during the design and construction process to take into account their requests with respect to mitigation of long term visual disturbances and come up with practical solutions that would be acceptable to both parties. • The mitigation measures proposed by the visual specialists should be adhered to. • The mitigation measures proposed by the noise specialists should be adhered to.
		Negative impact on the livelihoods of the household's dependant on the local tourism, game farming and association industries	• Implement all measures suggested to mitigate the impact on the sense of place. • In the case when employees of nearby farms are retrenched and a strong casual link can be established between the retrenchments and the project activities, the developer should assist the retrenched workers to find alternative employment by either recruiting them to work at the facility or assisting them through the enterprise development programme and/or social development funding allocations prescribed by government. • In order to avoid exerting a negative impact on the families dependent on local game farms and any other household that could be effected by the project, the developer should seek to partner with the various game farms to support affect families and ensure that the aid given to them is retained.

8.3 The Way Forward

Following comment from DEA on the Final EIR submitted on the 2nd August 2012 as well as comments submitted directly to DEA by several I& APS, public review of the Socio Economic

Impact Assessment, Community Needs Analysis and revised turbine type and layout, this EIR, together with the Specialist Volume (Volume 2) and the EMP (Volume 4), have been amended as necessary and finalised, incorporating any comments received. It will now be submitted for a 30 day public review period and to DEA. Comment resulting from the 30 day public review of the Revised Final EIR must be submitted directly to DEA.

Within 60 days of the receipt of the Final EIR, the competent authority must in writing either:

- Accept the report
- Notify the applicant that the report has been referred for specialist review
- Request that the applicant make amendments to the report in order for it to be accepted
- Reject the report

Within 45 days of accepting the report, the competent authority must:

- Grant an authorisation for all or part of the activities applied for
- Refuse an authorisation for all or part of the activities applied

Should an Environmental Authorisation be granted, it will carry Conditions of Approval. The project proponent is obliged to adhere to these conditions.

Within a period determined by the competent authority, all registered I&APs will be notified in writing of (i) the outcome of the application, and (ii) the reason for the decision. The public will then be given an opportunity to appeal the decision should they wish to do so. The appeals procedure, which is described in detail in the NEMA EIA Regulations, will also be communicated to I&APs by the EAP.

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