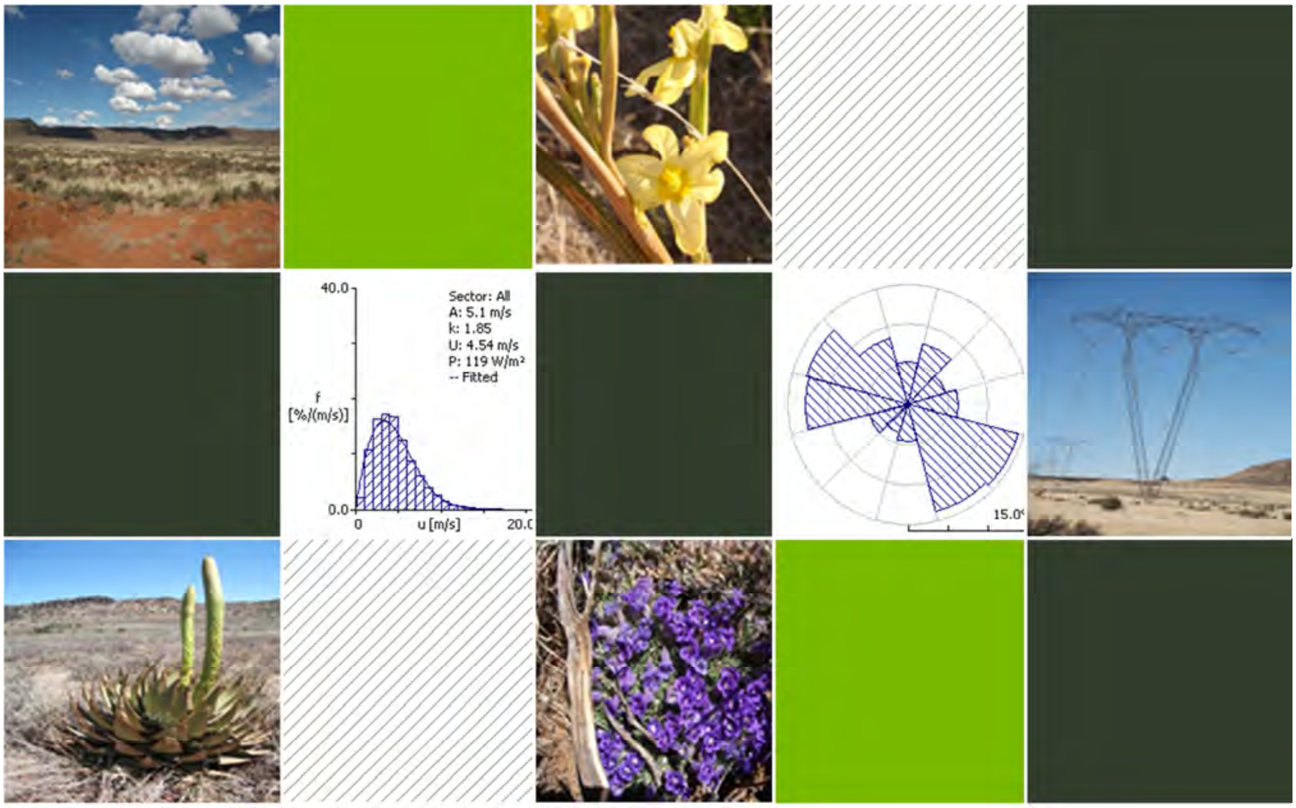

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS: PROPOSED WIND ENERGY FACILITIES (SOUTH & NORTH) SITUATED ON THE EASTERN PLATEAU NEAR DE AAR, NORTHERN CAPE

SOUTH : DEA REF. NO. 12/12/20/2463/1 / NEAS REF. NO. DEAT/EIA/0000577/2011
NORTH: DEA REF. NO. 12/12/20/2463/2 / NEAS REF. NO. DEAT/EIA/0000578/2011

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

March 2012

Report No: 5755

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PROJECT DETAILS

REFERENCE NO.	DEA REF. NO. 12/12/20/2463/1 (SOUTH) NEAS REF. NO. DEAT/EIA/0000577/2011 DEA REF. NO. 12/12/20/2463/2 (NORTH) NEAS REF. NO. DEAT/EIA/0000578/2011
PROJECT NO.	107512
TITLE	Draft Environmental Impact Assessment Report
AUTHORS & PREPARED BY	Simon Clark and Louise Corbett of Aurecon South Africa (Pty) Ltd
CLIENT	Mulilo Renewable Energy (Pty) Ltd
CLIENT REPRESENTATIVE	Constantin Hatzilambros
REPORT STATUS	Draft
REPORT NUMBER	5933/107512
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This report is to be referred to in bibliographies as: AURECON. 2011. Proposed Wind Energy Facilities (North & South) situated on the Eastern Plateau near De Aar, Northern Cape: Draft EIA Report. Report No. 5933

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GLOSSARY OF TERMS

Environment	The surroundings (biophysical, social and economic) within which humans exist and that are made up of i. the land, water and atmosphere of the earth; ii. micro organisms, plant and animal life; iii. any part or combination of (i) and (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing;
Environmental Impact Assessment (EIA)	A study of the environmental consequences of a proposed course of action.
Environmental Impact Report Assessment (EIAR)	A report assessing the potential significant impacts as identified during the Scoping phase.
Environmental impact	An environmental change caused by some human act.
Environmental Management Programme (EMP)	A document that provides procedures for mitigating and monitoring environmental impacts, during the construction, operation and decommissioning phases.
Public Participation Process	A process of involving the public in order to identify needs, address concerns, in order to contribute to more informed decision making relating to a proposed project, programme or development
Scoping	A procedure for determining the extent of and approach to an EIA, used to focus the EIA to ensure that only the significant issues and reasonable alternatives are examined in detail
Scoping Report	A report describing the issues identified
Turbine	A wind turbine is a rotary device that extracts energy from the wind.

ABBREVIATIONS

ACO	Archaeology Contracts Office
CAA	Civil Aviation Authority
CARs	Civil Aviation Regulations
CARA	Conservation of Agricultural Resources Act
CO_2	Carbon Dioxide
CH	Methane
CRR	Comments and Response Report
DEA	Department of Environmental Affairs (previously Department of Environmental Affairs and Tourism)
DEA&DP	Department of Environmental Affairs and Development Planning
DEANC	Department of Environmental Affairs and Nature Conservations
DEIAR	Draft Environmental Impact Assessment Report
DM	District Municipality
DME	Department of Minerals and Energy
DoE	Department of Energy
DSR	Draft Scoping Report
DWA	Department of Water Affairs
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioner of South Africa
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMP	Environmental Management Programme
EMF	Environmental Management Framework
ERA	Electricity Regulation Act
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
FSR	Final Scoping Report
GHG	Greenhouse Gas emissions
GN	Government Notice
GWh	Gigawatt hours
ha	Hectares
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IEA	International Energy Agency
IEC	International Electro-technical Commission
IEIM	Integrated Environmental Information Management
IEP	Integrated Energy Plan
IPP	Independent Power Producer
IRP	Integrated Resource Plan
kV	Kilovolt
LOWMA	Lower Orange Water Management Area
LM	Local Municipality

MW	Megawatts
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NPAES	National Parks Area Expansion Strategy
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No. 25 of 1999)
NRTA	National Road Traffic Act
NSD	Noise Sensitive Development
NWA	National Water Act
REFIT	Renewable Energy Feed-In Tariffs
RFP	Request for Qualification and Proposals
SABAP	Southern African Bird Atlas Project
PAN	Peroxyacylnitrate
PSR	Potential Sensitive Receptor
SAHRA	South African Heritage Resources Agency
SACNSP	South African Council for Natural Scientific Professions
SACNSP	South African Council for Natural Scientific Professions
SAWS	South African Weather Service Station
SDF	Spatial Development Framework
SKA	Square Kilometre Array
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WEF	Wind Energy Facility
WMA	Water Management Area
WULA	Water Use Licence Application

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1 INTRODUCTION AND BACKGROUND

The purpose of this Chapter is to introduce the project and describe the relevant legal framework within which the project takes place. Other applicable policies and guidelines are also discussed. The Terms of Reference, scope of and approach to the Environmental Impact Assessment are described and assumptions and limitations are stated.

1.1 INTRODUCTION

Mulilo Renewable Energy (Pty) Ltd (Mulilo) proposes to construct two 155-360 MegaWatt (MW) wind energy facilities on the eastern plateau approximately 20 km east of De Aar, Northern Cape. Aurecon South Africa (Pty) Ltd (Aurecon) has been appointed to undertake the requisite environmental process as required in terms of the National Environmental Management Act (No. 107 of 1998), as amended, on behalf of Mulilo.

This Environmental Impact Assessment (EIA) is for the proposed wind energy facility (north) on the eastern plateau near De Aar, Northern Cape and the proposed wind energy facility (south) on the eastern plateau near De Aar, Northern Cape. The two proposed projects are adjacent to each other but are considered to be two separate projects. However, in order to avoid duplication of information, the two projects will be assessed in one EIA. This has the added advantage of considering cumulative impacts of the two projects in one report.

The associated infrastructure would include power lines to connect into the existing grid as well as access roads and cabling between turbines. The northern site is approximately 14 500 hectares (ha) in extent and consists of 14 portions of six farms, whilst the southern site is approximately 9 200 ha in extent and consists of nine portions of four farms (see **Figure 1-1**).

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended) (NEMA), the proposed projects trigger a suite of activities, which require authorisation from the competent environmental authority before they can be undertaken. As these proposed projects trigger a number of listed activities in terms of NEMA, they accordingly require environmental authorisation. Since the projects are for the generation of energy, and energy projects are dealt with by the national authority, the competent authority is the national Department of Environmental Affairs (DEA). DEA's decision will be based on the outcome of this EIA process.

This report serves to document the EIA Phase of the EIA process (the EIA process and sequence of documents produced as a result of the process are illustrated in **Figure 1-1.**

The EIA Phase is the last phase in the EIA process. Accordingly, this EIA Report (EIAR)[1] aims to collate, synthesise and analyse information from a range of sources to provide sufficient information for DEA to make an informed decision on whether or not the potential environmental

[1] Section 31 of EIA Regulation No. 543 of NEMA lists the content required in an EIAR.

impacts associated with the proposed project are acceptable from an environmental perspective (the EIA process and sequence of documents produced as a result of the process are illustrated in **Figure 1-2**). Accordingly the EIAR:

- Outlines the legal and policy framework;
- Describes the Public Participation Process undertaken to date;
- Describes strategic and planning considerations;
- Describes the proposed project and its alternatives;
- Describes the assessment methodology used; and
- Assesses potential impacts and possible mitigation measures.

1.2 LEGAL REQUIREMENTS

1.2.1 National Environmental Management Act, No. 107 of 1998

NEMA, as amended, establishes the principles for decision-making on matters affecting the environment. Section 2 sets out the National Environmental Management Principles which apply to the actions of organs of state that may significantly affect the environment. Furthermore, Section 28(1) states that "every person who causes or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring". If such pollution or degradation cannot be prevented then appropriate measures must be taken to minimise or rectify such pollution.

Mulilo has the responsibility to ensure that the proposed activity as well as the EIA process conforms to the principles of NEMA. In developing the EIA process, Aurecon has been cognisant of this need, and accordingly the EA process has been undertaken in terms of NEMA and the EIA Regulations promulgated on 18 June 2010[2].

In terms of the EIA regulations, certain activities are identified, which require authorisation from the competent environmental authority, in this case DEA, before commencing. Listed activities in Government Notice (GN) No. 545 require Scoping and EIA whilst those in GN No. 544 and 546 require Basic Assessment (unless they are being assessed under an EIA process). The activities being applied for in this EIA process are listed in Figure 1-2**.**

It should be noted that DEA has agreed (pers.comm. S Vilakazi, 13/09/2011) that the two applications can be assessed in one EIA process, in order to avoid duplication of information and duplication of time and effort on DEA's part in processing the two applications.

Since the proposed projects are based in the Northern Cape, DEA will work closely with the provincial Department of Environmental Affairs and Nature Conservation (DEANC), to ensure that the provincial environmental concerns are specifically identified and addressed.

Further information on the EIA approach is provided in **Section 0**.

[2] GN No. R 543, 544, 545, 546 and 547 in Government Gazette No. 33306 of 18 June 2010.

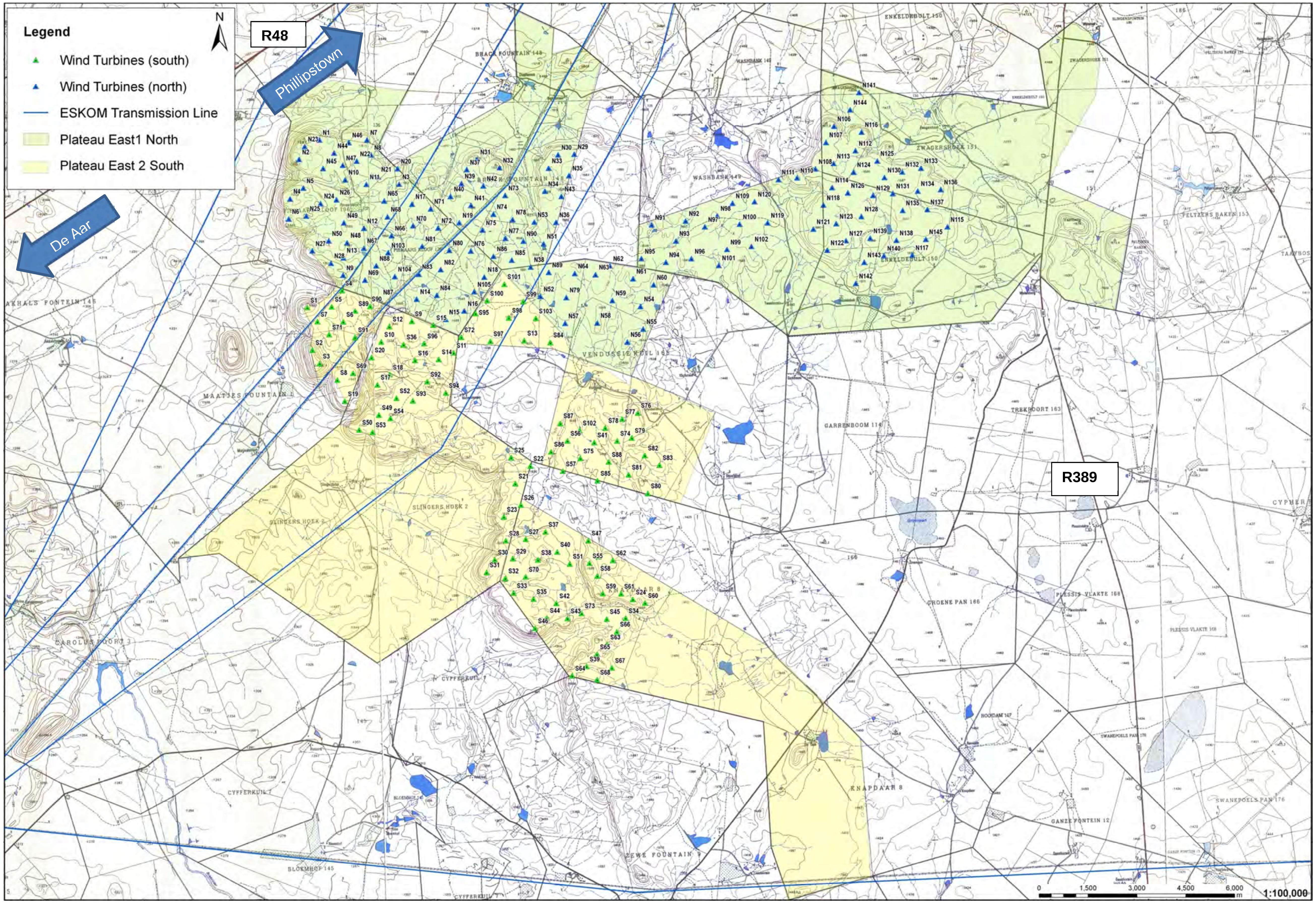

Figure 1-1: Revised locations of the proposed wind energy facilities (north and south) situated on the eastern plateau near De Aar, Northern Cape[3].

[3] This original layout as proposed in the FSR has subsequently been revised with cognisance of specialist recommendations to mitigate the potential impacts.

Table 1-1: Listed activities in terms of NEMA GN No. 544, 545 and 546, 18 June 2010, to be authorised for the proposed wind energy facilities

NO.	LISTED ACTIVITY	
	GN No. R544, 18 June 2010	
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; or ii. inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.	The wind turbine generators would be connected to a 22 kV transmission line, where the power would be evacuated via five onsite substations into Eskom's existing 220 kV and 132 kV transmission lines.
11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	Wetlands and drainage lines are scattered across the proposed sites and one or more structures would need to cross these lines.
18	a) The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 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-	North and South Projects- A number of roads would need to be constructed across drainage lines and would cumulatively result in the depositing of more than 5 m^3.

NO.	LISTED ACTIVITY	
	but excluding where such infilling, depositing, dredging, excavation, removal or moving; (a) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (b) occurs behind the development setback line.	
	GN No. R545, 18 June 2010	
1	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	The proposed wind energy facilities are expected to have total capacities of 155-360 MW depending on final turbine numbers.
	GN No. R546, 18 June 2010	
14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for. (1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes; (2) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded from this list; (3) the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.	A vegetated area of approximately 200 ha would need to be cleared for the proposed projects, which are located in a rural area. The vegetation is comprised of 75 % or more indigenous vegetation.

1.2.2 National Heritage Resources Act, No. 25 of 1999

In terms of the National Heritage Resources Act (No. 25 of 1999) (NHRA), any person who intends to undertake "*any development … which will change the character of a site exceeding 5000 m^2 in extent*", *"the construction of a road…powerline, pipeline…exceeding 300 m in length"* or *"the rezoning of site larger than 10 000 m^2 in extent…"* must at the very earliest stages of initiating the development notify the responsible heritage resources authority, namely the South African Heritage Resources Agency (SAHRA) or the relevant provincial heritage agency. These agencies would in turn indicate whether or not a full Heritage Impact Assessment (HIA) would need to be undertaken.

Section 38(8) of the NHRA specifically excludes the need for a separate HIA where the evaluation of the impact of a development on heritage resources is required in terms of an EIA process. Accordingly, since the impact on heritage resources would be considered as part of the EIA process outlined here, no separate HIA would be required. SAHRA or the relevant provincial heritage agency would review the EIA reports and provide comments to DEA, who would include these in their final environmental decision. However, should a permit be required for the damaging or removal of specific heritage resources, a separate application would have to be submitted to SAHRA or the relevant provincial heritage agency for the approval of such an activity, if Mulilo obtains authorisation and makes the decision to pursue the proposed projects further.

1.2.3 Astronomy Geographic Advantage Act, No. 21 of 2007

The Astronomy Geographic Advantage Act (No. 21 of 2007) provides for the preservation and protection of areas within South Africa that are uniquely suited for optical and radio astronomy; for intergovernmental co-operation and public consultation on matters concerning nationally significant astronomy advantage areas and for matters connected thereto.

Chapter 2 of the act allows for the declaration of astronomy advantage areas whilst Chapter 3 pertains to the management and control of astronomy advantage areas. Management and control of astronomy advantage areas include, amongst others, the following:

- Restrictions on use of radio frequency spectrum in astronomy advantage areas;
- Declared activities in core or central astronomy advantage area;
- Identified activities in coordinated astronomy advantage area; and
- Authorisation to undertake identified activities.

In line with this act, the Northern Cape, excluding Sol Plaatje Municipality, was declared an astronomy advantage area in Government Gazette No. 33462 on 20 August 2010.

On 19 February 2010, the Minister of Science and Technology (the Minister) declared the whole of the territory of the Northern Cape province, excluding Sol Plaatje Municipality, as an astronomy advantage area for radio astronomy purposes in terms of Section 5 of the Act and on 20 August 2010 declared the Karoo Core Astronomy Advantage Area for the purposes of radio astronomy.

The area consists of three pieces of farming land of 13 407 hectares in the Kareeberg and Karoo Hoogland Municipalities purchased by the National Research Foundation. The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the core planned Square Kilometre Array (SKA) radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. The proposed wind energy facilities fall outside of the Karoo Core Astronomy Advantage Area.

The Minister may still declare that activities prescribed in Section 23(1) of the Act may be prohibited within the area, such as the construction, expansion or operation of any fixed radio frequency interference sources and the operation, construction or expansion of facilities for the generation, transmission or distribution of electricity. It should be noted that wind energy facilities are known to cause radio frequency interference. However, it is unlikely that the proposed projects would affect the SKA project due to the distant location of SKA (approximately 270km). While the Minister has not yet prohibited these activities it is important that the relevant astronomical bodies are notified of the proposed projects and provided with the opportunity to comment on the proposed projects.

1.2.4 Aviation Act, No. 74 of 1962

In terms of Section 22(1) of the Aviation Act (Act No 74 of 1962) (13th amendment of the Civil Aviation Regulations (CARs) 1997) the Minister promulgated amendments pertaining to obstacle limitation and markings outside aerodromes or heliports. In terms of this act no buildings or objects higher than 45 metres above the mean level of the landing area, or, in the case of a water aerodrome or heliport, the normal level of the water, shall without the approval of the Commissioner be erected within a distance of 8 kilometres measured from the nearest point of the boundary of an aerodrome or heliport. No building, structure or other object which will project above the approach, transitional or horizontal surfaces of an aerodrome or heliport shall, without the prior approval of the Commissioner, be erected or allowed to come into existence. Structures lower than 45 m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and, in addition, their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircrafts.

Section 14 relates specifically to wind energy facilities and it is stated that due to the potential of wind turbine generators to interfere with radio navigation equipment, no wind farm should be built closer than 35 km from an aerodrome. In addition, several other conditions relating specifically to wind turbines are included in Section 14. In terms of the proposed wind energy facilities, Mulilo would need to obtain the necessary approvals from the Civil Aviation Authority (CAA) for erection of the proposed wind turbines and a detailed study is currently being undertaken in this regard.

It should be noted that while no aerodromes are located near the sites, a small airstrip is located south west of the site near De Aar, approximately 24 km and 26 km for the southern and northern sites respectively.

1.2.5 National Road Traffic Act, No. 93 of 1996 (as amended)

The National Road Traffic Act (Act No. 93 of 1996) (as amended) (NRTA) makes provision for all matters pertaining to the use and management of roads within South Africa. In terms of this policy certain vehicles and loads cannot be moved on public roads without exceeding the limitations in terms of the dimensions and/or mass as prescribed in the Regulations of the NRTA. Where such a vehicle or load cannot be dismantled without disproportionate effort, expense or risk of damage, into units that can travel or be transported legally, it is classified as an abnormal load. When the movement of an abnormal load is considered to be in the economic and/or social interest of the country, a special permit may be issued to allow it to operate on a public road for a limited period. Permits are normally issued by the Provincial Road Authorities and, if necessary, input is obtained from local and metropolitan authorities. As the movement of wind turbines would be seen as an abnormal load, Mulilo would need to obtain the necessary road permits from the relevant Road Authorities.

1.2.6 National Water Act, No. 36 of 1998

The National Water Act (NWA) (Act No 36 of 1998) provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that national government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.

In terms of Section 21 (c) and (i)[4] of the NWA any activity which takes place within 500 m radius of the boundary of any wetland is excluded from General Authorisation for these water uses and as such, must be licenced. The only significant feature is a small endorheic pan located within the study area at Slingershoek however a number of smaller freshwater features are also found on site. A buffer of 75 m would be maintained around the Slingershoek pan and 30 m around other identified freshwater features. Further to this a water use authorization application may need to be submitted to the Department of Water Affairs Northern Cape Regional Office for approval for the proposed activities. If a water use licence application is required it would fall outside of the scope of this EIA and would be addressed by Mulilo as part of their broader project planning. Comment will be sought from DWA as part of the EIA process.

1.2.7 Conservation of Agricultural Resources Act, No. 43 of 1983

The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) makes provision for the conservation of the natural agricultural resources of South Africa through maintaining the production potential of land, combating and preventing erosion, preventing the weakening or destruction of the water sources, protecting vegetation, and combating weeds and invader plants. Regulation 15 of CARA lists problem plants (undesired aliens, declared weeds, and plant invaders). Plants listed in this regulation must be controlled by the landowner.

As part of the EIA process, recommendations should be made to ensure that measures are implemented to maintain the agricultural production of land, prevent soil erosion, and protect any water bodies and natural vegetation on site. Mulilo together with the relevant landowners should also ensure the control of any undesired aliens, declared weeds, and plant invaders listed in the regulation that may pose as a problem as a result of the proposed projects.

[4] (c) impeding of diverting the flow of water in a watercourse; (i) altering the bed, banks, course or characteristics of a watercourse

1.3 TERMS OF REFERENCE AND SCOPE OF THE EIA

In September 2011, Mulilo appointed Aurecon to undertake an EIA process, in terms of the EIA Guidelines (GN No. 543 of 18 June 2010) in terms of NEMA, for the proposed wind energy facilities (north and south) near De Aar in the Northern Cape.

This EIA process specifically excludes any upgrades of existing Eskom infrastructure (i.e. the existing grid) that may be required, however it does include connections to the grid.

1.3.1 Guidelines

This EIA process is informed by the series of national Environmental Guidelines[5] where applicable and relevant:

- Integrated Environmental Information Management (IEIM), Information Series 5: Companion to the NEMA EIA Regulations of 2010 (DEA, 2010);
- Implementation Guidelines: Sector Guidelines for the EIA Regulations (draft) (DEA, 2010);
- IEIM, Information Series 2: Scoping (Department of Environmental Affairs and Tourism (DEAT), 2002);
- DEAT. 2002. IEIM, Information Series 3: Stakeholder Engagement (DEAT, 2002);
- IEIM, Information Series 4: Specialist Studies (DEAT, 2002);
- IEIM, Information Series 11: Criteria for determining Alternatives in EIA (DEAT, 2004);
- IEIM, Information Series 12: Environmental Management Plans (DEAT, 2004);
- Integrated Environmental Management Guideline Series, Guideline 4: Public Participation, in support of the EIA Regulations. Unpublished (DEAT, 2005); and
- Integrated Environmental Management Guideline Series, Guideline 7: Detailed Guide to Implementation of the Environmental Impact Assessment Regulations. Unpublished (DEAT, 2007).

The following guidelines from the Department of Environmental Affairs and Development Planning (Western Cape) (DEA&DP) were also taken into consideration:

- DEA&DP. 2011. Guideline on Alternatives, EIA Guideline and Information Document Series. (DEA&DP, October 2011).
- DEA&DP. 2011. Guideline on Need and Desirability, EIA Guideline and Information Document Series. (DEA&DP, October 2011).
- DEA&DP. 2011. Guideline on Public Participation, EIA Guideline and Information Document Series. (DEA&DP, October 2011).

[5] Note that these Guidelines have not yet been subjected to the requisite public consultation process as required by Section 74 of R385 of NEMA.

1.4 APPROACH TO THE PROJECT

As outlined in **Figure 1-2**, there are three distinct phases in the EIA process, as required in terms of NEMA, namely the Initial Application Phase, the Scoping Phase and the EIA Phase. This report covers the third phase, *viz.* the EIA Phase.

1.4.1 Initial Application Phase

The Initial Application Phase entailed the submission of the EIA Application Form to notify DEA of the projects, submitted on 26 September 2011. Acknowledgement of receipt of the EIA Application Form was received from DEA on 10 October 2011. The Application Forms and DEA's letters of acknowledgement are included in the Scoping Report.

1.4.2 The Scoping Phase

Scoping is defined as a procedure for determining the extent of, and approach to, the EIA Report phase and involves the following key tasks:

- Involvement of relevant authorities and I&APs;
- Identification and selection of feasible alternatives to be taken through to the EIA Phase;
- Identification of significant issues/impacts associated with each alternative to be examined in the EIA Report; and
- Determination of specific Terms of Reference (ToR) for any specialist studies required in the EIA Report (Plan of Study for the EIA Report).

The Scoping Phase involved a desktop review of relevant literature, including a review of previous environmental studies in the area. These included, *inter alia*, the following:

- Pixley ka Seme District Municipality (DM) Integrated Environmental Management Program (IEMP)(African EPA, 2007);
- Pixley ka Seme District Municipality Spatial Development Framework (SDF) (2007);
- Emthanjeni LM SDF (Macroplan, 2007);
- Vegetation Map of South Africa (Mucina and Rutherford, 2006);
- Proposed Photovoltaic Facility on a site South East of De Aar, Northern Cape Province. Draft Scoping Report (DSR)(Savannah Environmental, 2011);
- Groundwater Resources in the Northern Cape Province (DWA, 2008);
- Proposed wind farm in De Aar. Draft Environmental Impact Assessment Report (EIAR) (DJ Environmental Consultants (DJEC), 2010a);
- Proposed solar energy facility near De Aar. Draft Environmental Impact Assessment Report (EIAR) (DJEC, 2010b); and
- Proposed wind monitoring masts on the farms Wagt en Bittje and Carolus Poort near De Aar, Northern Cape (Final Basic Assessment Report) (Aurecon, 2009).

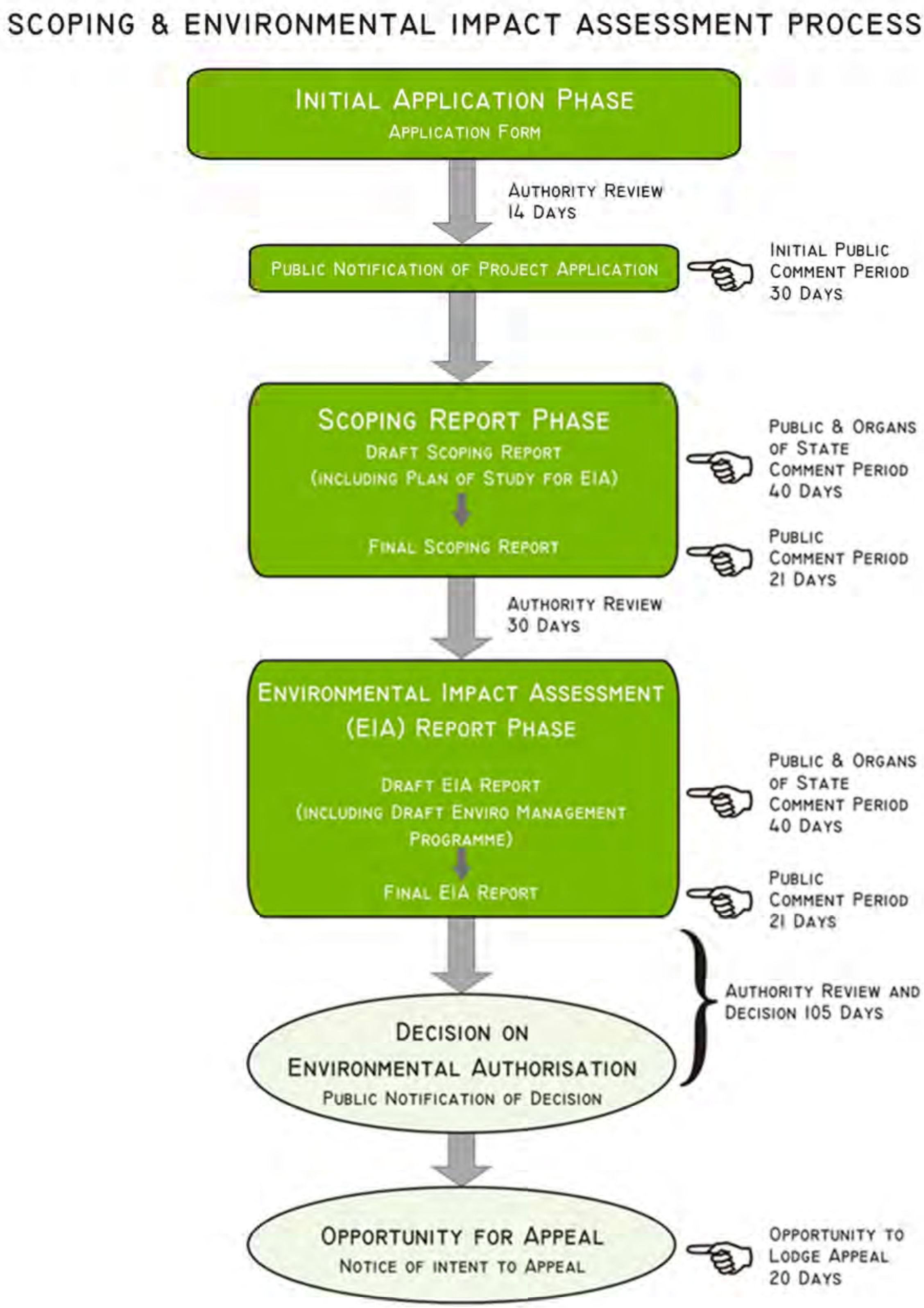

Figure 1-2: The EIA process in terms of NEMA

Other tasks undertaken included:

- Advertisements were placed in local newspapers, the Echo and Die Volksblad, notifying the broader public of the initiation of the EIA and inviting them to register as Interested and Affected Parties (I&APs) from 4 November 2011;
- Site notices were erected on the perimeter fences of the farms on 8 November 2011;
- Lodging the Draft Scoping Report (DSR) at the Emthanjeni LM (De Aar) municipal buildings and the De Aar and Phillipstown Public Libraries and on the Aurecon website from 8 November 2011. All registered I&APs were notified of the availability of the DSR and of a public meeting by means of a letter sent by post and/or e-mail on 8 November 2011. The notification letters also included a copy of the Executive Summary of the DSR in English and Afrikaans.
- Holding a public meeting on Wednesday, 30 November 2011 to present and discuss the findings of the DSR at the De Aar Civic Hall (also known as the Community Hall) from 16h00-18h00. Notes of the public meeting were sent to all those who attended on 8 November 2011;
- I&APs had 40 days, until the 5 January 2012 to submit their written comments on the DSR, however due to a mailing error the period was extended to 9 January 2012, (see **Annexure B** for a copy of the letter sent to I&APs regarding the extension). Cognisance was taken of all comments when compiling the final report, and the comments, together with the project team and proponent's responses thereto, were included in final report.
- The Final Scoping Report (FSR) was made available to the public for review and comment until 7 February 2012at the same locations as the DSR from18 January 2012. All registered I&APs were informed of the lodging of the FSR by means of a letter posted on 18 January 2012, (see **Annexure B** for a copy of the letter regarding the availability of the FSR). The FSR outlined the full range of potential environmental impacts and feasible project alternatives and how these were derived. Moreover, it included a Plan of Study for EIA, which outlined the proposed approach to the current EIA Phase, including the requisite specialist investigations to be undertaken;
- The FSR and associated Plan of Study for EIA was submitted to DEA on 13 January 2012 and accepted on 21 February 2012 (see **Annexure A** for a copy of the acceptance letter). DEA indicate a list of information to be submitted with the Final EIAR.
- Two comments were received on the FSR and have been included and responded to in **Annexure C**.

An inception field trip was held on 4 & 5 of October 2011 with the EIA team. The purpose of the field trip was to facilitate an understanding of the key aspects such as:

- Biophysical issues:
    - Terrestrial fauna and flora; and
    - Groundwater aspects;
    - Visual aspects.
- Social issues:
    - Heritage issues; and
    - Location of local communities.
- Construction phase issues.

The information gathered during the site visit was used in refining the Plan of Study for the EIA process and ToR for the specialist studies undertaken during the EIA Phase.

1.4.3 The EIA Phase

The Scoping Phase is followed by the EIA Phase, during which the specialist investigations are undertaken, and a comprehensive EIAR documents the outcome of the impact assessments.

This report covers the third and final phase of the EIA process, namely the EIA Phase. The purpose of the EIAR is to describe and assess the range of feasible alternatives identified during the Scoping process in terms of the potential environmental impacts identified. The ultimate purpose is to provide a basis for informed decision making, firstly by the applicant with respect to the option(s) they wish to pursue, and secondly by the environmental authority regarding the environmental acceptability of the applicant's preferred option.

The approach to the EIA Phase entailed undertaking further review of relevant literature and specialist studies. The results of this have been used to describe and assess the significance of the identified potential impacts associated with the proposed project. This EIA Report synthesises the key issues arising out of the PPP to date, to provide a balanced view of the proposed activities and the implications for the environment.

1.4.4 The public participation process

Consultation with the public forms an integral component of this EIA investigation and enables I&APs (e.g. directly affected landowners, national, provincial and local authorities, environmental groups, civic associations and communities), to identify their issues and concerns, relating to the proposed activities, which they feel should be addressed in the EIA process. To create a transparent process and to ensure that I&APs are well informed about the project, as much information as is available has been included upfront to afford I&APs numerous opportunities to review and comment on the proposed projects. A summary of the public participation process is provided in **Annexure B**.

Currently there are 57 I&APs are registered on the project database (see **Annexure B** for a list of current I&APs).

Two comments were received on the Final Scoping Report (see **Annexure B**). DWA provided comment requesting assessment of water use activities and volumes expected, as well as EMP guidelines on hazardous compound spillages, dust pollution and sedimentation management. SAHRA indicated satisfaction that a Heritage Impact Assessment (including both archaeology and paleoentology components) were being undertaken. These comments have been responded to in CRR 2 (see **Annexure C**).

1.4.5 Authority involvement

The EIA Application Form was submitted to DEA, and copied to the Northern Cape DEANC, to notify them of the proposed projects. DEA Acknowledged receipt of the EIA Application Forms and issued reference numbers for the proposed projects.
As indicated earlier, DEA will fulfil the role of the competent environmental authority for this project and will make a decision in light of the information presented in the final EIA Report. However, given that the project is located in the Northern Cape Province, DEA will work closely with DEA&NC in the decision-making process.

There are other authorities who have a commenting role to play in the EIA process. Their comments on the EIA Report will help to inform DEA's decision making. These authorities include:

- Department of Environmental Affairs;
- Emthanjeni Local Municipality LM;
- Renosterberg Local Municipality LM;
- Pixley ka Seme District Municipality DM;
- Northern Cape DEANC;
- South African Heritage Resources Agency;
- Department of Agriculture (Northern Cape);
- Department of Water Affairs; and
- Eskom.

1.4.6 Decision making

The Final EIAR, together with all I&AP comments on the Draft EIAR, will be submitted to DEA for their review and decision-making. DEA must, within 60 days, do one of the following:

- Accept the report;
- Notify the applicant that the report has been referred for specialist review;
- Request amendments to the report; or
- Reject the report if it does not materially comply with regulations.

If the report is accepted, DEA must within 45 days:

- Grant authorisation in respect of all or part of the activity applied for; or
- Refuse authorisation in respect of all or part of the activity.

Once DEA issues their decision on the proposed project, all registered I&APs on the project database will be notified of the outcome of the decision within 12 calendar days of the Environmental Authorisation having been issued. Should anyone (a member of public, registered I&AP or the Applicant) wish to appeal DEA's decision, a Notice of Intention to Appeal in terms of **Chapter 7** of the EIA Regulations (GN No. 543) in terms of NEMA must be lodged with the Minister of Water and Environmental Affairs within 20 calendar days of the decision being issued and the substantive Appeal must be lodged within 30 days of the Notice.

1.5 ASSUMPTIONS AND LIMITATIONS

1.5.1 Assumptions

In undertaking this investigation and compiling the EIA Report, the following has been assumed:

- The strategic level investigations undertaken by the Department of Energy regarding South Africa's proposed energy mix prior to the commencement of the EIA process are technologically acceptable and robust;
- The information provided by the applicant is accurate and unbiased; and
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed wind energy facilities and connections to the grid. The EIA does not include any infrastructure upgrades which may be required from Eskom to allow capacity in the local grid for the proposed projects.

1.5.2 Gaps in knowledge

This EIA Report has identified the potential environmental impacts associated with the proposed activities. However, Mulilo is undertaking further work on the proposed project and investigations in parallel with this EIA process from a technical feasibility perspective. As such the nature and significance of the impacts presented in this report could change, should new information become available, or as the project description is refined. The purpose of this section is therefore to highlight gaps in knowledge when the EIA Phase of the project was undertaken, namely that the planning for the proposed facility is at a feasibility level and therefore some of the specific details are not available to the EIA process. This EIA process forms a part of the suite of feasibility studies, and as these studies progress, more information will become available. This will require the various authorities, and especially DEA, to issue their comments and ultimately their environmental decision to allow for the type of refinements that typically occur during these feasibility studies and detailed design phase of projects. Undertaking the EIA process in parallel with the feasibility study does however have a number of benefits, such as integrating environmental aspects into the layout and design and therefore ultimately encouraging a more environmentally sensitive and sustainable project.

1.6 INDEPENDENCE

Aurecon nor any of its sub-consultants are subsidiaries of Mulilo, nor is Mulilo a subsidiary to Aurecon. Furthermore, all these parties do not have any interests in secondary or downstream developments that may arise out of the authorisation of the proposed projects.

1.7 DETAILS AND EXPERTISE OF THE EAPS WHO COMPILED THE EIA REPORT

The Project Director, Mr Brett Lawson, Project Manager, Miss Louise Corbett, and the Project Staff, Mr Simon Clark, are appropriately qualified and registered with the relevant professional bodies. Mr Lawson is a certified Environmental Assessment Practitioners of South Africa (EAPSA), and both Mr Lawson and Miss Corbett are registered as Professional Natural Scientists with the South African Council for Natural Scientific Professions (SACNSP). Aurecon is bound by the codes of conduct for EAPSA and SACNASP. The CV summaries of the key Aurecon staff are included in the Plan of Study for EIA contained in Chapter 5 of the FSR.

1.8 STRUCTURE OF THE EIA REPORT

As outlined above, the EIA process undertaken to date has culminated in the production of a comprehensive Scoping Report, which provided detailed information relevant to the project. However, for the sake of being succinct, information contained within the Scoping Report is not repeated within this EIA Report unless it has direct bearing on the issues under discussion. **Accordingly, to ensure a holistic understanding of the project, the nature of the activities and the substance of the EIA process, it is critical that this EIA Report is read in conjunction with the FSR (Aurecon, 2011)**.

Table 1-2 presents the structure of the EIA report as well as the applicable sections that address the required information in terms of NEMA. Specifically, Section 31 of the EIA Regulations requires that the following information is provided:

Table 1-2: NEMA requirements for EIA Reports and location in this EIAR

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	Section 31(2) of Regulation 543	
(a)	Details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an EIA;	Section 0 (summaries of EAP CVs provided in Chapter 5 of FSR)
(b)	a detailed description of the proposed activity;	Chapter 3
(c)	a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is: (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken;	Chapter 4
(d)	a description of the environment that may be affected by the activity and	Chapter 4

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	
(e)	details of the public participation process conducted in terms of subregulation (1), including- (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties;	Section 0 and **Annexure B**
(f)	a description of the need and desirability of the proposed activity;	Section 3.1
(g)	a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;	Section 3.3 and Chapter 4
(h)	an indication of the methodology used in determining the significance of potential environmental impacts;	**Annexure D**
(i)	a description and comparative assessment of all alternatives identified during the environmental impact assessment process;	Chapter 4
(j)	a summary of the findings and recommendations of any specialist report or report on a specialised process;	Chapter 4
(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;	Chapter 4
(l)	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 4
(m)	a description of any assumptions, uncertainties and gaps in knowledge;	Section 1.5
(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;	Section 5.5.2
(o)	an environmental impact statement which contains-	Chapter 5

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	(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;	
(p)	a draft environmental management programme containing the aspects contemplated in regulation 33;	**Annexure M**
(q)	copies of any specialist reports and reports on specialized processes complying with regulation 32;	**Annexures E-L**
(r)	any specific information that may be required by the competent authority; and	**Annexure N**
(s)	any other matters required in terms of sections 24(4)(a) and (b) of the Act.	
	Section 31(3) of Regulation 543	
	The EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by Section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in subregulation 31(2)(g), exist.	Chapter 3 and 4

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2 RELEVANT ENERGY LEGISLATION AND POLICIES

This chapter provides an overview of the policy and legislative context in which the development of renewable energy projects takes place in South Africa. The following policies and legislative context are described:

- Policies regarding greenhouse gas and carbon emission;
- White Paper on the Energy Policy of the Republic of South Africa (1998);
- White Paper on Renewable Energy (2003);
- National Energy Act (No. 34 of 2008) and Electricity Regulation Act (ERA) (No. 4 of 2006);
- Integrated Energy Plan for the Republic of South Africa (2003);
- Integrated Resource Plan (2010); and
- Regional Methodology for Wind Energy Site Selection (Department of Environmental Affairs and Development Planning (DEA&DP), 2006) Guideline document).

2.1 POLICIES REGARDING GREENHOUSE GAS AND CARBON EMISSION

Gases that contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH), water vapour, nitrous oxide, chlorofluorocarbons (CFC's), halons and peroxyacylnitrate (PAN). All of these gasses are transparent to shortwave radiation reaching the earth's surface, but trap longwave radiation leaving the earth's surface. This action leads to a warming of the earth's lower atmosphere, resulting in changes in the global and regional climates, rising sea levels and extended desertification. This in turn is expected to have severe ecological consequences and a suite of implications for mankind.

Electricity generation using carbon based fuels is responsible for a large proportion of CO_2 emissions worldwide. In Africa, the CO_2 emissions are the result of fossil fuel burning and industrial processes such as coal-fired power stations. South Africa accounts for some 38 % of Africa's CO_2 emissions. The global per capita CO_2 average emission level is 1.23 metric tonnes. In South Africa however, the average emission rate is 2.68 metric tonnes per person per annum. The International Energy Agency (2007) estimates that nearly 50 % of global electricity supplies will need to come from renewable energy sources in order to halve carbon dioxide emissions by 2050 and minimise significant, irreversible climate change impacts The United Nations Framework Convention on Climate Change (UNFCCC) has initiated a process to develop a more specific and binding agreement on the reduction of greenhouse gas (GHG) emissions. This led to negotiations with a particular focus on the commitments of developed countries, and culminated in the adoption of the Kyoto Protocol in 1997, which came into effect in February 2005. Using the above framework to inform their approach, the Kyoto Protocol has placed specific legal obligations in the form of GHG reduction targets on developed countries and countries with 'Economies in Transition'. The developed countries listed in Annex 1 of the

UNFCCC are required to reduce their overall emissions of six GHGs by at least 5 % below the 1990 levels between 2008 and 2012. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly. More recently under the Copenhagen Accord 2010, countries representing over 80 % of global emissions have submitted pledges on emission reductions.

South Africa`s commitment is to reduce GHG emissions 34 % by 2020 and 42 % by 2025. The Kyoto Protocol, to which South Africa is a signatory, was informed by the principles of sustainable development which resulted in related policies and measures being identified to promote energy efficiency while protecting and enhancing the 'sinks and reservoirs' of greenhouse gases (forests, ocean etc.). Other methods/ approaches included encouraging more sustainable forms of agriculture, in addition to increasing the use of new and renewable energy and the adoption/implementation of advanced and innovative environmentally sound technologies. South African policies are being informed by the Kyoto Protocol (which is valid until 2012) and its partial successor the Copenhagen Accord 2010 and associated sustainable development principles whereby emphasis is being placed on industries for 'cleaner' technology and production.

2.2 WHITE PAPER ON THE ENERGY POLICY OF THE REPUBLIC OF SOUTH AFRICA (1998)

As required by the Constitution of the Republic of South Africa (Act No. 108 of 1996), the White Paper on the Energy Policy of the Republic of South Africa (1998) was published by the Department of Minerals and Energy in response to the changing political climate and socio-economic outlook. Key objectives are identified in terms of energy supply and demand, as well as co-ordinated with other social sectors and between energy sub-sectors.

The White Paper commits to government's focused support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications. With the aim of drawing on international best practice, specific emphasis is given to solar and wind energy sources, particularly for rural and often off-grid areas.

While considering the larger environmental implications of energy production and supply, the White Paper looks into the future to adopting an integrated resource planning approach, integrating the environmental costs into economic analysis. It is with this outlook that the renewable energy, including wind energy, is seen as a viable, attractive and sustainable option to be promoted as part of South Africa's energy policy towards energy diversification.

2.3 WHITE PAPER ON RENEWABLE ENERGY (2003)

Published by the Department of Minerals and Energy (DME) in 2003, the White Paper on renewable Energy supplements the above-mentioned Energy Policy which identified the medium- and long-term potential for renewable energy as significant. The White Paper sets out the vision, policy principles, strategic goals and objectives in terms of renewable energy. At the outset the policy refers to the long term target of "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013."* The aim of this 10-year plan is to meet this goal via the production of mainly biomass, wind, solar and small-scale hydro sources. It is estimated that this would constitute approximately 4 % of projected energy demand for 2013. The White Paper estimates that up to 1 % of that could be supplied by wind energy.

The White Paper presents South Africa's options in terms of renewable energy as extensive and a viable and sustainable alternative to fossil fuel options. A strategic programme of action to develop South Africa's renewable energy resources is propose, particularly for power generation and reducing the need for coal-based power generation. The starting point will be a number of initial investments spread across both relatively low cost technologies, such as biomass-based cogeneration, as well as technologies with larger-scale application, such as solar water heating, wind and small-scale hydro.

Addressing environmental impacts and the overarching threats and commitments to climate change, the White Paper provides the platform for further policy and strategy development in terms of renewable energy in the South African energy environment. It states that "*wind energy is a clean, renewable resource and should be developed in South Africa…"*

2.4 NATIONAL ENERGY ACT (NO. 34 OF 2008) AND ELECTRICITY REGULATION ACT (NO. 4 OF 2006)

South Africa has two acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act (No. 34 of 2008); and
ii. The Electricity Regulation Act (ERA) (No. 4 of 2006).

In May 2011, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy[6].

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) (see **Section 2.7**) has been developed by the DoE and sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This required, new generation capacity must be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be undertaken in accordance with the specified capacities and technologies listed in the IRP[7].

[6] http://www.eskom.co.za/c/73/ipp-processes/ (accessed 29/10/11)
[7] http://www.eskom.co.za/c/73/ipp-processes/ (accessed 29/10/11)

2.5 IPP PROCUREMENT PROCESS

South Africa aims to procure 3 725 MW capacity of renewable energy by 2016 (the first round of procurement). This 3 725 MW is broadly in accordance with the capacity allocated to renewable energy generation in IRP2010.

On 3 August 2011, DoE formally invited interested parties with relevant experience to submit proposals for the finance, operation and maintenance of renewable energy generation facilities adopting any of onshore wind, solar thermal, solar photovoltaic, biomass, biogas, landfill gas or small hydro technologies for the purpose of entering, *inter alia*, an Implementation Agreement with DoE and a Power Purchase Agreement with a buyer (Eskom)[8] in terms of the ERA. This Request for Qualification and Proposals (RFP) for new generation capacity was issued under the IPP Procurement Programme. The IPP Procurement Programme has been designed to contribute towards the target of 3 725 MW and towards socio-economic and environmentally sustainable growth, and to start and stimulate the renewable industry in South Africa[9].

In terms of this IPP Procurement Programme, Bidders will be required to bid on tariff and the identified socio-economic development objectives of DoE. The tariff will be payable by the Buyer should the project be selected. Although earlier information was that the 2009 Renewable Energy Feed In Tariff would act as an upper limit on price, the actual caps are set out in **Table 2-1**[10]. A bid will be 'non-compliant' and automatically rejected during the qualification phase if the price cap is exceeded. Bid Responses which are submitted must be accompanied by a Bid Guarantee in the form of a bank guarantee for an amount equal to R 100 000 per MW of the proposed installed capacity[11].

The generation capacity allocated to each technology is set out in **Table 2-1**.

Table 2-1: Generation capacity and price cap per each technology

Technology	MW	Price cap (per MWh)
Onshore wind	1 850	R 1 150
Concentrated solar thermal	200	R 2850
Solar photovoltaic	1 450	R 2850
Biomass solid	12.5	R 1070
Biogas	12.5	R 800
Landfill gas	25	R 600
Small hydro	75	R 1 030
Small projects[12]	100	As above
TOTAL	**3 725**	

[8] http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (accessed 30/10/11)
[9] http://www.ipp-renewables.co.za/ (accessed 30/10/11)
[10] http://www.nortonrose.com/knowledge/publications/54959/south-africa-renewable-energy-ipp-request-for-proposals (accessed 30/10/11)
[11] http://www.ipp-renewables.co.za/wp-content/uploads/2011/08/Tender_Notice.png (accessed 30/10/11)
[12] Small projects are less than 5 MW.

Each project procured in terms of this IPP Procurement Programme will be required to achieve commercial operation by not later than 2016.

The submission and selection dates for projects for the RFP are given in **Table 2-1**.

Table 2-2: Bid submission dates, selection of preferred bidders and signing of agreements[13]

Submission no.	Submission date	Preferred bidder selection date	Signing of agreements date
First	4 November 2011	25 November 2011	19 June 2012
Second	5 March 2012	TBA	13 December 2012
Third	20 August 2012	TBA	31 May 2013
Fourth	4 March 2013	TBA	13 December 2013
Fifth	13 August 2013		26 May 2014

The selection process to determine the preferred bidders will be based on both price and other economic development criteria in a 70 %/ 30 % ratio respectively (Creamer, T. 2011). If the maximum MW allowance for any particular technology has been allocated during any particular window, then the subsequent bidding opportunities will not be opened for that technology.

IPPs that wish to connect to Eskom's network will be required to apply for a connection, pay a connection charge and sign a connection and use-of-system agreement[14]. All IPPs will be provided non-discriminatory access to Eskom's network, subject to the IPP's obtaining its required approvals such as EIA's and a generating and trading licence from NERSA.

2.6 INTEGRATED ENERGY PLAN FOR THE REPUBLIC OF SOUTH AFRICA

Commissioned by DME in 2003, the Integrated Energy Plan (IEP) aims to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance in providing low cost electricity for social and economic developments, ensuring security of supply, and minimising the associated environmental impacts.

The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP concluded that, based on energy resources available in South Africa, coal would be the primary fuel source in the 20 year planning horizon, which was specified as the years 2000 to 2020, although other cleaner technologies continue to be investigated as alternatives in electricity generation options. Therefore, though the next two decades of energy generation are anticipated to remain coal-based, alternative technologies and approaches are available and need to be contextually considered.

[13] http://www.ipp-renewables.co.za/?page_id=524 (accessed 30/10/11)
[14] http://www.eskom.co.za/c/article/150/independent-power-prodicers-ipp/ (accessed 30/10/11)

2.7 INTEGRATED RESOURCE PLAN

The Integrated Resource Plan (IRP) is a National Electricity Plan, which is a subset of the Integrated Energy Plan. The IRP is also not a short or medium-term operational plan but a plan that directs the expansion of the electricity supply over the given period.

The IRP, indicating the schedule for energy generation programmes, was first gazetted on 31 December 2009. A revised schedule was gazetted on 29 January 2010 and the schedule has once again been revised and the final IRP (IRP2010-2030) was gazetted on 6 May 2011.

Developed for the period of 2010 to 2030, the primary objective of the IRP2010, as with its predecessors, is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing, and cost. While promoting increased economic development through energy security, the IRP2010 aims to achieve a "*balance between an affordable electricity price to support a globally competitive economy, a more sustainable and efficient economy, the creation of local jobs, the demand on scarce resources such as water and the need to meet nationally appropriate emission targets in line with global commitments*".

As can be seen by **Table 2-3** below the final IRP provides for an additional 20 409 MW (shaded in grey) of renewable energy in the electricity mix in South Africa by 2030.

Table 2-3: Policy adjusted scenario of the IRP2010 as gazetted on 6 May 2011

	Total generating capacity in 2030		Capacity added (including committed) from 2010-2030		New (uncommitted) capacity options from 2010-2030	
Technology	**MW**	**%**	**MW**	**%**	**MW**	**%**
Coal	41 074	45.9	16 383	29.0	6 250	14.7
OCGT	7 330	8.2	4 930	8.7	3 910	9.2
CCGT	2 370	2.6	2 370	4.2	2 370	5.6
Pumped Storage	2 912	3.3	1 332	2.4	0	0
Nuclear	11 400	12.7	9 600	17.0	9 600	22.6
Hydro	4 759	5.3	2 659	4.7	2 609	6.1
Wind	9 200	10.3	9 200	16.3	8 400	19.7
CSP	1 200	1.3	1 200	2.1	1 000	2.4
PV	8 400	9.4	8 400	14.9	8 400	19.7
Other	890	1.0	465	0.8	0	0
Total	**89 532**	**100**	**56 539**	**100**	**42 539**	**100**

The final IRP2010 reflects both the consultation process on the draft IRP2010 currently being undertaken with stakeholders and the further technical work undertaken in this period. It is noted that *"given the rapid changes in generation technologies and pricing, especially for "clean" energy sources, the IRP will have to be reviewed on a regular basis, for instance every two years, in order to ensure that South Africa takes advantage of emerging technologies. This* *may result in adjustments in the energy mix set out in the balanced revised scenario within the target for total system capacity."*

2.8 REGIONAL METHODOLOGY FOR WIND ENERGY SITE SELECTION- A DEA&DP GUIDELINE DOCUMENT (2006)

In May 2006 DEA&DP published the *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape: Towards a Regional Methodology for Wind Energy Site Selection.* With the aim of paving the way for wind energy as a viable, clean, renewable energy development in the Western Cape the following vision was developed: "*The vision for the Western Cape is to establish a policy on the implementation of regional criteria for the identification of areas suitable for the establishment of wind energy projects. This will promote the implementation of wind energy projects while balancing national interests of promoting alternative energy generation with local strategic environmental objectives. This will also avoid conflict between local and national interests through a proactive environmental planning process."*

Further to the above the Guideline aims to facilitate:

- Policy on the implementation of a methodology to be used for the identification of areas suitable for the establishment of wind energy projects;
- Alignment with the White Paper on Energy Policy for the Republic of South Africa;
- Coordinated implementation;
- Responsible and rational wind energy developments to benefit both developers as well as affected communities;
- Avoidance of unsuitable sites;
- Public awareness; and
- Guidance in terms of environmental assessments processes.

In a total of seven volumes two alternative assessment methodologies, a criteria based/quantitative method, and a landscape based/qualitative method are presented. The comparative assessment pointed towards restricted, negotiable, preferred areas as well as cumulative impacts. The methodology delineates areas appropriate for wind energy development including negative and positive thresholds (buffers), cumulative impacts as well as landscape character, value, sensitivity and capacity. The methodology stops short of addressing local level issues and indicates the need to address these on a site-specific level. The methodologies were tested on a large study area on the Cape West Coast.

The document is designed to guide planners and decision-makers to appropriate areas for wind farm development based on planning, infrastructure, environmental and landscape criteria. As many of these criteria are also applicable to other areas, outside the Cape West Coast, reference has been made to this guideline here.

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3 THE PROPOSED ACTIVITY

This chapter considers the need for the proposed projects, describes the components of the proposed projects that could have an impact on the environment, then summarises the suite of alternatives that were proposed for further consideration in the Scoping Report.

3.1 THE NEED FOR THE PROPOSED ACTIVITY

As can be seen by the numerous policies and legislation described in **Chapter 2** the need for renewable energy is well documented. Reasons for the desirability of wind energy include:

- Creating a more sustainable economy;
- Reducing the demand on scarce resources such as water;
- Meeting nationally appropriate emission targets in line with global climate change commitments;
- Reducing and where possible eliminating pollution;
- Alleviating energy poverty by providing energy in rural areas;
- Local economic development;
- Local skills development; and
- Enhancing energy security by diversifying generation.

Furthermore, the IRP provides for an additional 20 409 MW of renewable energy in the electricity mix in South Africa by 2030. While there are a number of renewable energy options (including, *inter alia,* wind, solar and hydropower) being pursued in South Africa, many more renewable energy projects are required to meet the targets set by the IRP. Consequently, based on this requirement for renewable energy, Mulilo has identified a number of projects for wind energy generation and these proposed project will be their second proposed wind energy facilities to initiate the necessary environmental studies.

3.2 DESCRIPTION OF THE PROPOSED ACTIVITY

Initially, Mulilo proposed to construct two 150 - 200 MW wind energy facilities on the eastern plateau approximately 20 km east of De Aar, Northern Cape. The two proposed wind energy facilities would be located on the northern and southern portion of the plateau approximately 20 km east of the town of De Aar. The northern portion would have potentially consisted of 145 wind turbines and the southern portion, 105 wind turbines with a combined total capacity of 150 – 200 MW each. Subsequent to this initial proposal, the turbine layouts were revised in order to incorporate specialist recommendations that buffers be implemented around sensitive features and areas. The revised layouts for the northern portion would now potentially consist of 144 wind turbines with a potential capacity to produce between 216 - 360 MW and the southern portion with 103 wind turbines with a potential capacity of 155 – 258 MW. The power generated by the two proposed projects would be transmitted to the national grid via five proposed substations with three on the southern site and two on north site, connecting into the three existing transmission lines crossing the site and linking into the Hydra substation near De Aar. The proposed sites are situated in the Emthanjeni and Renosterberg LM in the Northern Cape. The northern site is approximately 14 500 ha in extent and consists of 14 portions of six farms, whilst the southern site is approximately 9 200 ha in extent and consists of nine portions of four farms. The landowners of the farms comprising the sites have entered into a long term agreement with Mulilo for the proposed projects. The farms are zoned Agriculture and are currently used for grazing sheep, goats and cattle.

Subsequent to the original proposal the layouts for both the north and south facilities have been revised, to take cognisance of sensitivity buffers recommended by the various specialists, and these revised layouts are provided in **Figure 3-1.**

The corner point co-ordinates of the two sites are given in Annexure D of the FSR.

3.2.1 Components of a wind turbine

Wind turbines can rotate about either a horizontal or a vertical axis. Turbines used in wind farms for commercial production of electricity are usually horizontal axis, three-bladed and pointed into the wind by computer-controlled motors, as is proposed for this project. These have high tip speeds of over 320 km/hour, high efficiency, and low torque ripple, which contribute to good reliability.

The main components a wind turbine is made up are listed and described below:

- Rotor and blades;
- Nacelle;
- Generator;
- Tower; and
- Foundation.

a) Rotor and blades

The rotor has three blades that rotate at a constant speed, approximately 15 revolutions per minute (rpm) in the case of the turbines being considered at De Aar. The blades are usually coloured light grey and, in the case of the proposed project, would approximately 40 – 60 m long (80 - 120 m diameter).

b) Nacelle

The speed of rotation of the blades is controlled by 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').

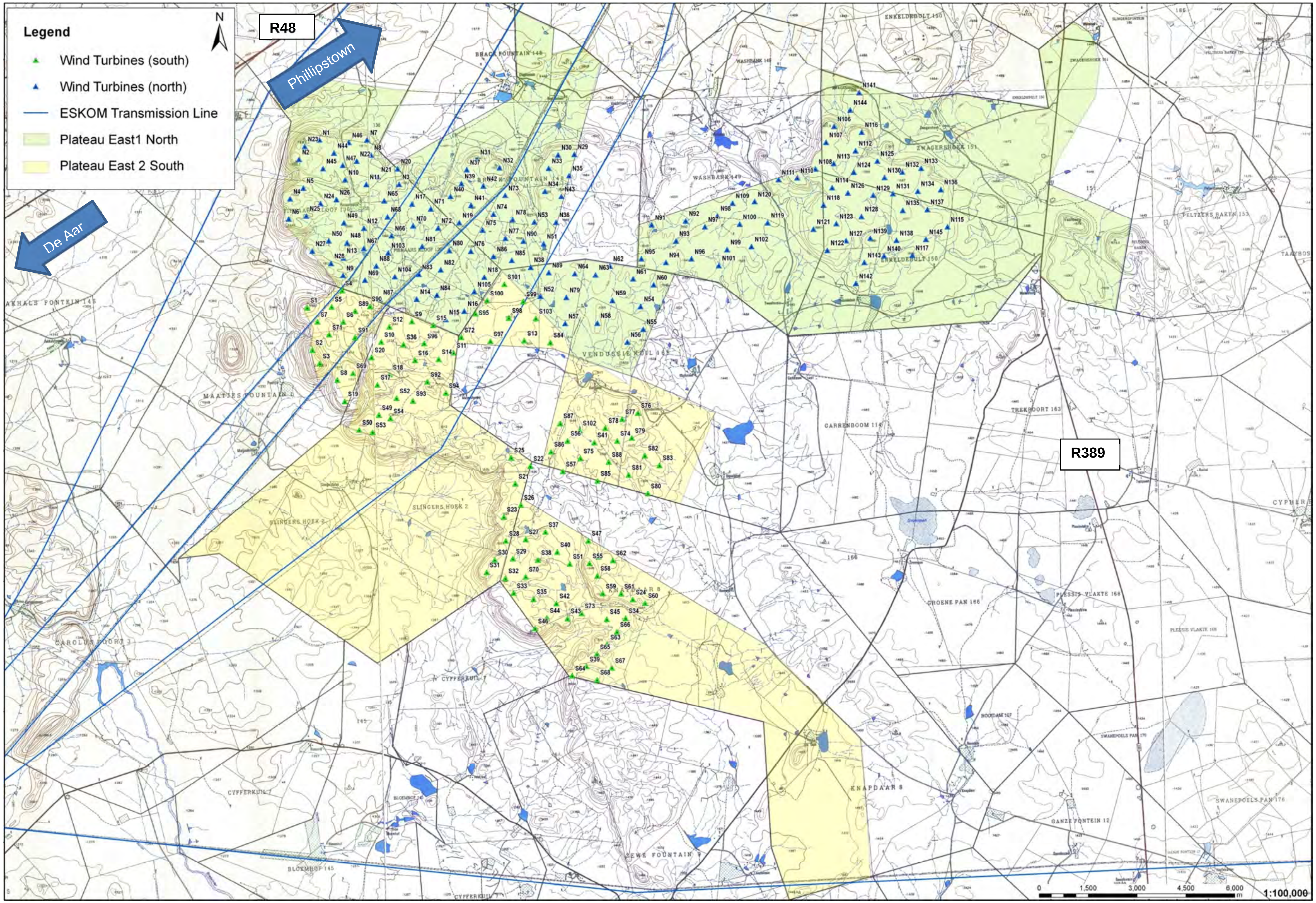

Figure 3-1: Revised layout, dated February 2012, for the proposed wind energy facility (north and south)

Figure 3-2: West Wind located at Terawhiti Station and Makara Farm west of Wellington, New Zealand[15]

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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/h (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. The nacelle controls 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.

c) 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 that steps up the voltage to match the transmission line frequency and voltage for electricity evacuation/distribution.

[15] http://www.energy.siemens.com/br/en/power-generation/renewables/wind-power/references.htm#content=APAC%20 (accessed 01/11/11)

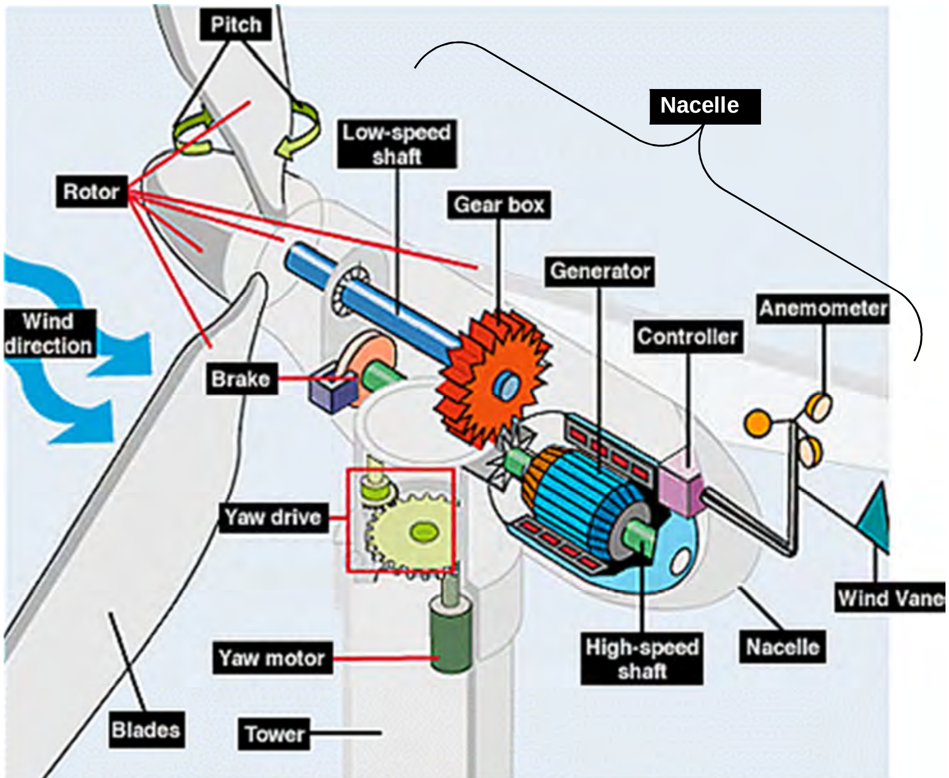

Figure 3-3: Typical components of a horizontal axis wind turbine[16]

d) Tower

The tower is constructed from tubular steel and supports the rotor and nacelle. For the proposed project the tower would be either 65 or 100 m tall, depending on the selected turbine. Wind has greater velocity at higher altitudes, therefore increasing the height of a turbine increases the expected wind speeds.

e) Foundation

Foundations are designed to factor in both weight (vertical load) and lateral wind pressure (horizontal load). Considerable attention is given when designing the footings 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 15 m x 15 m and an average of 2 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.

3.2.2 Construction and operation of the proposed wind energy facilities

The turbine tower comprises sections, the first is bolted to the concrete foundation and subsequent sections are lifted on site by a crane, manoeuvred into position and bolted together.

[16] Source http://www1.eere.energy.gov/windandhydro/images/illust_large_turbine.gif (accessed 15/11/2010)

A permanent hard standing made of compacted gravel and approximately 20 m x 40 m would be constructed adjacent to each turbine location for the crane. **Figure 3-4** shows turbines in the process of being erected.

Gravel surface access roads of approximately 4 m wide would also be required between each turbine. Cables connecting each turbine would interconnect with overhead transmission lines that will follow the route of the access roads.

Each turbine would have a transformer that steps up the voltage from 690 Volt to 22 kilovolt (kV). This transformer is housed within each turbine tower or immediately outside the turbine. The cabling between the turbines would traverse the site to the three sub-stations, where the power from all the turbines would be metered.

The electricity distribution infrastructure comprises of three existing distribution lines (1 x 132 kV and 2 x 220 kV) traversing the site. The transmission lines terminate at Eskom's Hydra substation located 9.5 km to the north east of De Aar. The proposed project would connect to the grid via these transmission lines from one of five proposed alternative onsite substations to the Hydra substation, as indicated in **Figure 3-1**. The turbines would connect to the proposed onsite substations via a 22 kV overhead transmission line that would follow the route of the proposed access roads. The proposed route for the southern site is approximately 70 km long, and the northern site approximately 50 km long. At the substation the voltage would be increased and evacuated via the existing Eskom power lines. The final connection would be dependent on the technical requirements and cost set out by Eskom.

A preliminary approximation of the water requirements for the construction phase is 140 000 cubic meters (m^3) of water for the northern project and 90 000 m^3 of water for the southern project. Mulilo has indicated that water would be obtained from the Emthanjeni LM or another Water Service Provider. No water based lubricants would be used for the running of the turbines or for maintenance. No refuse removal would be required on site, and all sewage would be treated and held in septic tanks, compostable toilets or similar, on site. During operation of the wind farms no electrical services would be required from the local municipality.

Turbines are designed to operate continuously, unattended and with low maintenance for more than 20 years or greater than 120 000 hours of operation. Once operating, the proposed wind energy facilities would be monitored and controlled remotely, with a mobile team for maintenance, when required.

Approximately 420 and 320 job during the pre-construction and construction phases for the proposed northern and southern facilities, respectively and 35 and 30 jobs during the operational phase for the proposed northern and southern facilities, respectively, would be created. The proposed projects would make use of local labour as much as possible, and a minimum of 50 % of the jobs would be filled by people local to De Aar and Phillipstown. A breakdown of the employment opportunities per skill set and per phase of the proposed projects is provided in **Table 3-1** below.

Figure 3-4: Wind turbines in the process of being erected[17]

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[17] Source http://www.windpowerninja.com/wind-power-government-industry-news/massive-opportunity-for-wind-turbine-production-in-us-66460/ (accessed 15/11/2010) and http://www.wind-energy-the-facts.org/en/part-i-technology/chapter-3-wind-turbine-technology/technology-trends/transport-and-installation.html (accessed 21/10/11)

Table 3-1: Employment opportunities, and breakdown per skill set, per phase of the proposed north and south wind energy facilities

Phase	Permanent	Temporary	Highly Skilled	Skilled	Unskilled
North					
Construction	180	240	20%	50%	30%
Operation	25	10	30%	50%	20%
South					
Construction	120	200	20%	50%	30%
Operation	20	10	30%	50%	20%

Training would be provided for technicians to operate the facilities by the suppliers of the turbines.

As per **Section 2.5**, Mulilo is applying for an IPP contract in August 2012 and should this be awarded the proposed project would need to be constructed by 2016. The construction period is anticipated to last some 18 months.

3.2.3 Decommissioning of the proposed wind energy facilities

The proposed projects have a project lifespan of 20-30 years, based on the mechanical characteristics of the turbines. However, as all the infrastructure, such as roads, transmission, substations and foundations would already be established, and the energy source (wind) is a renewable one, the proposed projects would most likely continue to be operated after 20-30 years. Turbines would be upgraded to make use of the latest technology available. All redundant equipment that was replaced would be removed from site and would be sold off.

The following activities would form part of any decommissioning:

1. Site preparation activities would include confirming the integrity of the access to the site to accommodate the required equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.
2. A large crane would be brought on site to disassemble the turbine and tower sections. These components would be reused, recycled and disposed of in accordance with regulatory requirements. All parts of the turbines would be considered reusable or recyclable, except for the blades.

If the facility is decommissioned then the site would be fully rehabilitated in accordance with requirements in terms of relevant legislation such as the National Environmental Management Act. The concrete bases of the turbines, transformers and transmission lines could be removed, but would most likely be left under the ground, to avoid disturbing rehabilitated areas once more. The turbines would be removed as described above. All roads would be left on site, as it would assist the farmer in accessing his land.

A rehabilitation cost of R52 million has been budgeted for decommission of the plant.

3.3 CONSIDERATION OF ALTERNATIVES

3.3.1 Introduction

NEMA requires that alternatives are considered during the EIA process. An important function of the Scoping Phase is to screen alternatives to derive a list of feasible alternatives that need to be assessed in further detail in the EIA Phase. An alternative can be defined as a possible course of action, in place of another, that would meet the same purpose and need (DEAT, 2004).

"alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include 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;
(e) the **operational** aspects of the activity; and
(f) the option of not implementing the activity.

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The alternatives most pertinent to the proposed project include the following:

- Location alternatives - alternative locations for the entire project proposal or for components of the project proposal;
- Activity (type) alternatives - also referred to as project alternatives. Requires a change in the nature of the proposed activity. This category of alternatives is most appropriate at a strategic decision-making level;
- Layout alternatives- site layout alternatives permit consideration of different spatial configurations of an activity on a particular site; and
- Technology alternatives – technology alternatives permit consideration of different types of technology used in the project.

The above categories of alternatives are the ones most pertinent to this EIA process, and were explored in detail in **Section 2.3** of the FSR. The purpose of this section of the report is to identify (scope) and describe all potential alternatives and determine which alternatives should be carried through to the EIA Phase of the project for further assessment. A summary of the alternatives is provided below.

3.3.2 Location alternatives

South Africa is on the verge of increasing the percentage contribution made by renewable energy power generation to the existing energy mix. In response to this potential for the implementation of a large scale renewable energy production, and in particular the 1 850 MW which is required from wind energy, Mulilo has identified many potential sites across the country and is currently pursuing the best suited locations for wind energy production. The De Aar region has a favourable wind resource, large areas of unutilised (little intensive agricultural, industrial or urban development) land is available and good access the Hydra substation, one of the largest substations in the country. Hydra offers very good grid connectivity as many major transmission lines connect Hydra to all parts of the country.

The north and south sites were considered to be favourable for wind energy for a number of characteristics, namely:

- Power yield: The site could generate a high volume of energy annually;
- Existing land use: No existing intensive agriculture, only grazing which could continue below turbines;
- Grid connectivity: Good access to the grid through power lines crossing the sites. Hydra is particularly strong and is able to distribute to most parts of South Africa;
- Accessibility: De Aar has good road access from ports at Port Elizabeth and Cape Town via the national roads. The sites are accessible from the east for vehicles carrying large components, such as turbines blades; and
- Social upliftment opportunities: The sites are relatively near De Aar and Phillipstown, where high levels of unemployment are experienced; hence the proposed projects would uplift the local community through job creation, training and a community trust to benefit the community directly from the power being generated.

Given the favourable wind regime characteristics of the site and the ready market for renewable energy it was decided to pursue wind energy facilities on the two sites. Based on the selection process undertaken by Mulilo in selecting the two sites, no other site location alternatives are assessed in the EIAR.

3.3.3 Activity alternatives

As can be seen by the numerous policies and legislation described in **Section 1.2.3** the need for additional energy generation in South Africa is well documented. Furthermore, numerous policies and legislation have been promulgated indicating the mixture of renewable and non-renewable energy which South Africa wishes to pursue. These strategic documents provide the road map for the activity alternatives available to South Africa. The IRP2010 allows for an additional 20 409 MW of renewable energy in the electricity mix in South Africa by 2030 and based on this requirement for renewable energy Mulilo has identified a number of projects for wind energy generation.

The sites could also be suitable for solar power given the high level of solar radiation experienced at De Aar. However, the sites are on uneven and rugged terrain which is unsuitable for solar energy and as such the most suitable activity to make use of the available renewable energy would wind energy facilities. As such the only activity alternative, other than the no-go alternative, which is investigated in this project specific EIA is wind energy.

The no-go alternative is the baseline against which all alternatives are assessed. It consists of the *status quo*, and as such is not being explicitly assessed.

3.3.4 Site layout alternatives

A number of layouts were considered throughout the EIA process, and these have changed as more technical information and requirements of the IPP process were provided. The layout considered in the Scoping Report, provided in **Figure 3-5** and included 145 and 105 turbines for the north and south sites respectively. The layouts had considered technical constraints such as spatial orientation requirements of turbines and associated infrastructure (e.g. roads) and the layout relative to other existing infrastructure, such as power lines.

These original layouts were considered by specialists for the EIA Phase. These layouts were later updated, based on specialist input, in February 2012, see **Figure 3-6** and **Figure 3-7** after specialist reports were received and sensitive ecological, aquatic, archaeological, avifauna and bat areas were identified. The revised layout includes 144 and 103 turbines for the north and south sites respectively taking into account sensitive features and areas. The layout was adjusted to minimise potential impacts on the environment. This layout is likely to be adjusted once a year's worth of wind data has been collected. However, the amendments are unlikely to be significant and sensitive areas indicated by specialists would be avoided. The final layout would need to be submitted to DEA for final approval.

Based on the evolution of the layout described above, only the latest layout, namely the February 2012 layout (see **Figure 3-6** and **Figure 3-77**), is assessed in the EIAR. It should however be noted that specialists assessed the original layout but also provided comment on the February 2012 layout.

3.3.5 Technology alternatives

The most important factors that need consideration when selecting a turbine for any site is the annual average wind speed, reference wind speed, the return period for extreme wind conditions and wind direction (i.e. wind resource profile). Other determining factors when selecting the preferred turbine are efficiency, full load hours and the capacity factor. Based on these characteristics as well as data obtained from the wind monitoring masts currently on site Mulilo would ultimately select a turbine which is best suited to the sites. Mulilo has indicated that the turbines ultimately selected are likely to range between 65–100 m in tower height with a blade length of 40-60 m. In order to assess the potential impacts of the turbines, the extremes of this range will be considered, namely 105 m (65+40 m) and 160 m (100+60 m). It should however be borne in mind throughout the EIA process that the turbine dimensions could be anything between this range.

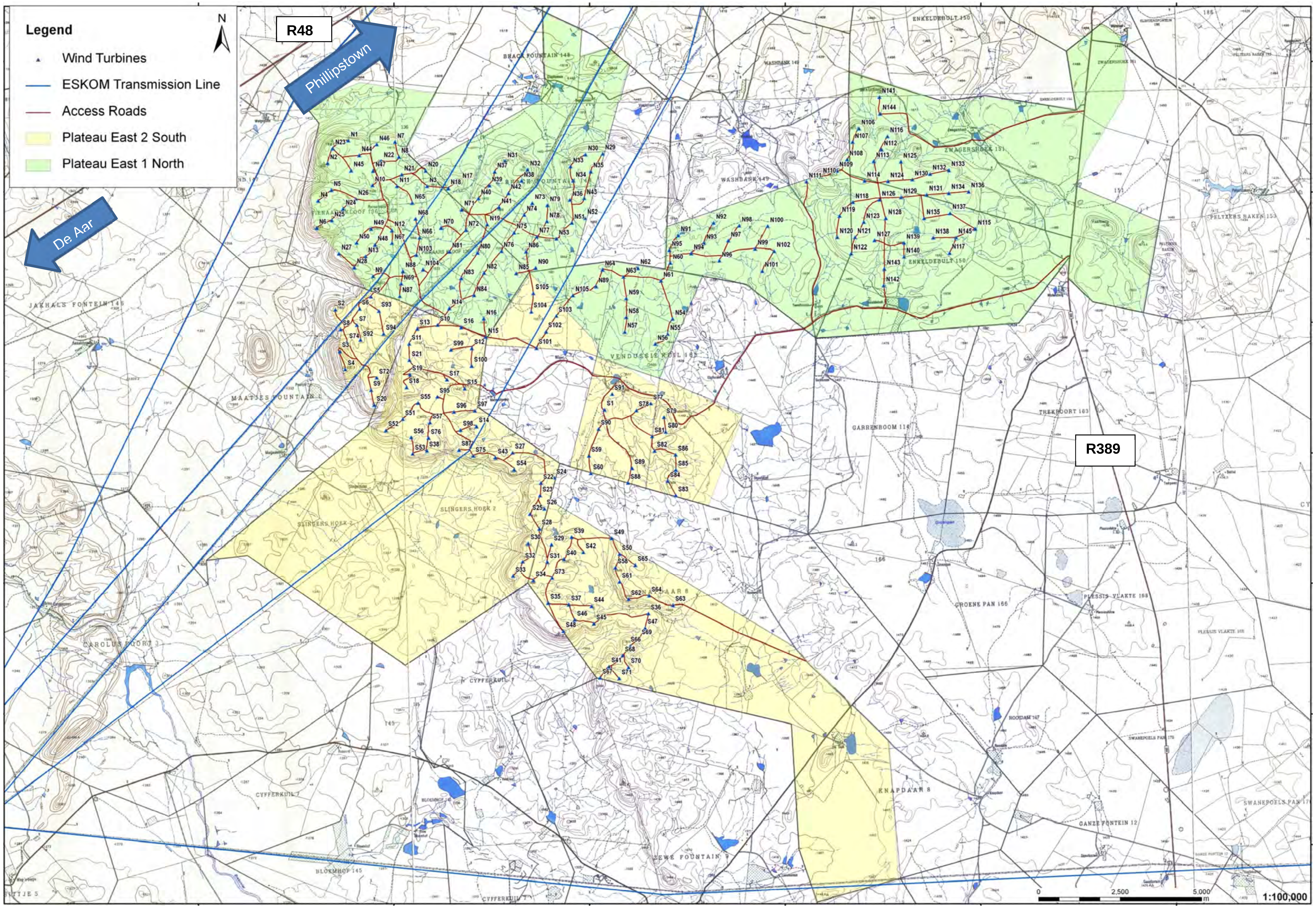

Figure 3-5:Original layout considered in the Scoping Phase for the proposed wind energy facility (south).

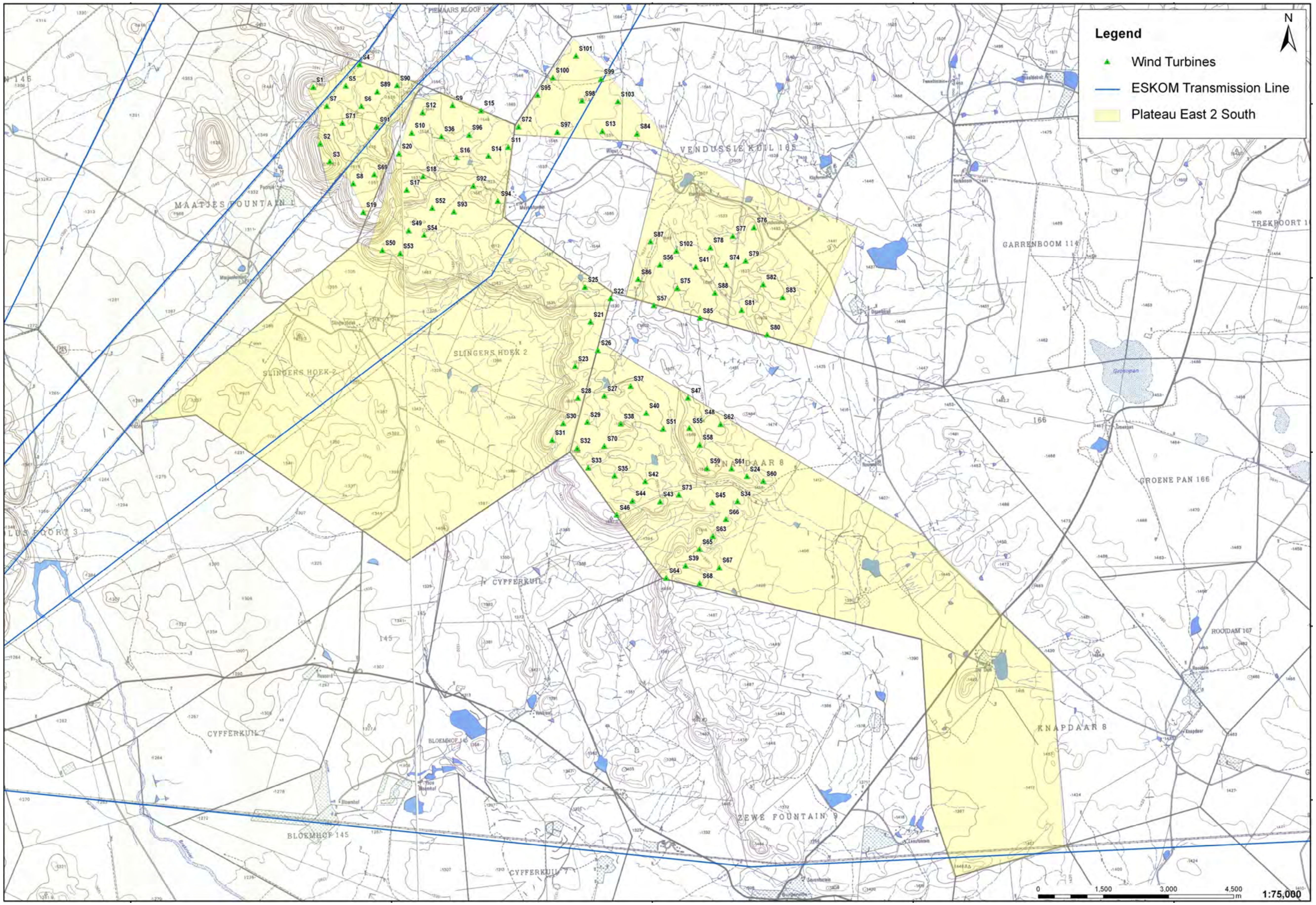

Figure 3-6: Revised layout considered in February 2012 for the proposed southern wind energy facility.

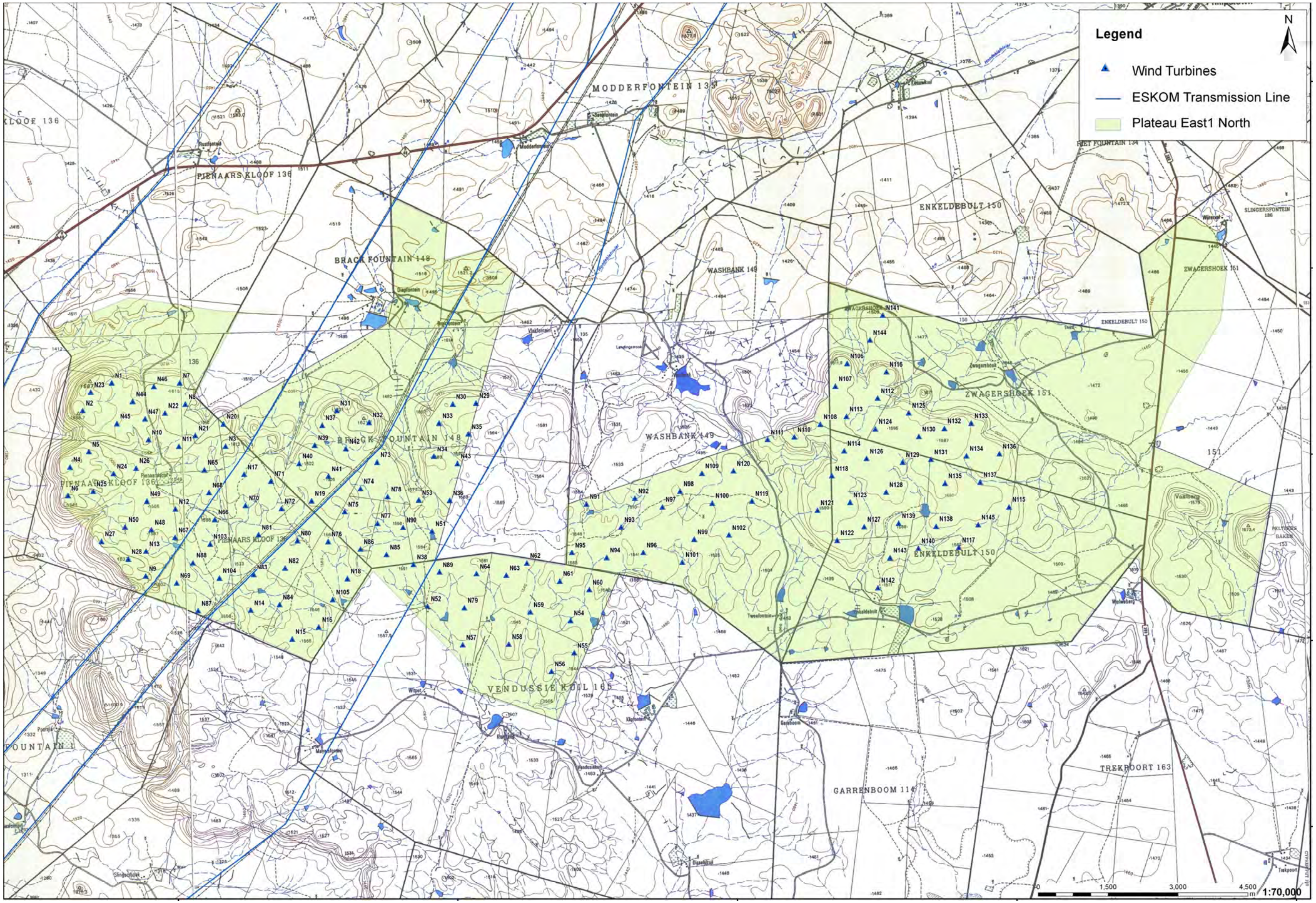

Figure 3-7: Revised layout considered in February 2012 for the proposed northern wind energy facility.

3.3.6 Summary of alternatives

To summarise, the feasible alternatives which will be assessed in the EIAR include the following:

- Location alternatives:
    - One location per proposed wind energy facility;
- Activity alternatives:
    - Wind energy generation via wind turbines; and
    - “No-go” alternative to wind energy production.
- Site layout alternatives:
    - One layout alternative per site;
- Technology alternatives:
    - Turbine towers of 65 m and a blade length of 40 m; and
    - Turbine towers of 100 m with a blade length of 60 m;

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4 ASSESSMENT OF POTENTIAL IMPACTS AND POSSIBLE MITIGATION MEASURES

This Chapter forms the focus of the EIAR. It contains a detailed assessment of the operational (or long-term) impacts as well as the construction phase impacts on the biophysical and socio-economic environments using the methodology described in **Annexure D**. A summary table of the assessment of all the potential impacts is also provided.

4.1 INTRODUCTION

This Chapter describes the potential impacts on the biophysical and socio-economic environments, which may occur due to the proposed activities described in **Chapter 3**. These include potential impacts, which may arise during the operation of the proposed development (i.e. long-term impacts) as well as the potential construction related impacts (i.e. short to medium term). The assessment of potential impacts will help to inform and confirm the selection of the preferred alternatives to be submitted to DEA for consideration. In turn, DEA's decision on the environmental acceptability of the proposed project and the setting of conditions of authorisation (should the project be authorised) will be informed by this chapter, amongst other information, contained in this EIAR.

The potential impacts identified during the Scoping Phase of this project, and updated where necessary, are as follows:

- Operational phase impacts on the biophysical environment:
  - Impact on ecology
  - Impact on avifauna;
  - Impact on bats;
  - Impact on climate change; and
  - Impact on freshwater.
- Operational phase impacts on the social environment:
  - Impact on heritage resources;
  - Visual impacts;
  - Impact on energy production;
  - Impact on local economy (employment) and social conditions;
  - Impact on agricultural land; and
  - Impact of noise.
- Construction phase impacts on the biophysical and social environments:
  - Disturbance of flora, avifauna, bats and fauna;
  - Sedimentation and erosion of water ways;
  - Impact on heritage resources;
  - Impact on palaeontology;
  - Visual impacts;

- o Impact on local economy (employment) and social conditions;
- o Impact on transport;
- o Noise pollution;
- o Storage of hazardous substances on site; and
- o Dust impact.

Each of these impacts is assessed in detail in a section below. The baseline and potential impacts that could result from the proposed developments are described and assessed. Mitigation measures are recommended. Finally, comment is provided on the potential cumulative impacts[18] which could result should these developments, and others like it in the area, be approved.

The methodology used to assess the potential impacts is detailed in **Annexure D**. The (+) or (-) after the significance of an impact indicates whether the impact is positive or negative, respectively.

Only the latest layout, namely the February 2012 layout (see **Figure 3-6** and **Figure 3-7**), is assessed below. It should however be noted that specialists assessed the original layout but also provided comment on the February 2012 layout and this is included along with the full specialist studies.

4.2 Operational phase impacts on biophysical environment

4.2.1 Impact on Ecology

Currently the sites are in a mostly natural condition. Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. The proposed wind energy facilities would potentially impact on the ecology of the study area including the biodiversity, sensitive habitats and ecosystem function. As such Dr David Hoare was appointed to undertake a desktop Ecological Impact Assessment. A site visit was conducted by Dr Hoare on 23 and 24 November 2011 in order to inform the assessment. The study considered climate, topography, soil, fauna and flora together with the functioning of ecosystems in biodiversity areas and applicable processes along corridors, rivers, wetlands and important topographical features. The Ecological Impact Assessment in included in **Annexure E**. The summary below includes findings and recommendations of the specialist.

[18] EIA's are typically carried out on specific developments, whereas cumulative impacts result from broader biophysical, social and economic considerations, which typically cannot be addressed at the project level.

a) Description of the environment

The mean annual rainfall is approximately 200 mm per year. Rainfall occurs from November to March, but peaks in mid- to late summer (February / March). All areas with less than 400 mm rainfall are considered to be arid and therefore the study area can be considered to be arid.

The study site is located on the high-lying plateau to the north-east of De Aar. The topography of the site varies from steep to flat and is relatively rugged in places. The plateau escarpment faces De Aar and is steep to very steep.

There are three land types in the study area, namely the Fb, Ae and Ib land types (Land Type Survey Staff, 1987). The A-group of land types refer to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly . A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. The F-group of land types refer to landscapes that are not predominantly rock and nor predominantly alluvial or aeolian and in which the dominant soil-forming processes have been rock weathering, clay illuviation[19], giving rise typically to lithocutanic[20] horizons (MacVicar *et al*. 1974). The I-group of land types refer to soil patterns difficult to accommodate elsewhere, at least 60% of which comprises pedologically youthful, deep (more than 1 000 mm to underlying rock) unconsolidated deposits (MacVicar *et al*. 1974).

The study area falls within the Nama-Karoo Biome (Mucina and Rutherford, 2006). There are two main vegetation types occurring within the study site, namely Northern Upper Karoo and Besemkaree Koppies Shrubland. Both vegetation types are classified nationally as Least Threatened. The Northern Upper Karoo vegetation type occurs across an extensive area (covers an area of almost 42 000 km^2). Besemkaree Koppies Shrubland is less extensive in extent (covers an area of approximately 3 600 km^2). There are no threatened, near threatened or rare plant species that occur on site.

The only tree species protected under the National Forest Act that has a geographical distribution within the proposed study area is *Boscia albitrunca* (Shepherd's Tree/ Witgatboom /! Xhi). However, this species is unlikely to occur on site.

There are two plant species that are protected according to National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that are known to occur in the general geographical area that includes the sites. The species that have a geographic distribution that includes the study area are *Hoodia gordonii* (Hoodia) and *Harpagophytum procumbens* (Devil's Claw). No individuals of these species were found during the field survey and it is considered unlikely that they occur on site.

The shrub, *Prosopis glandulosa* (Mesquite), is potentially the most problematic invasive alien in the Northern Cape and is widely distributed in the Northern Upper Karoo vegetation type.

[19] The process by which a material (illuvium), which includes colloids and mineral salts, is washed down from one layer of soil to a lower layer.
[20] Soils which have weathered rock beneath the A-horizon (the uppermost layer).

However, it was found at a relatively low frequency on site and in immediately adjacent areas.

A landcover map of the study area (Fairbanks *et al*. 2000) indicates that the entire site consists of natural vegetation, classified as “shrubland and low fynbos”. The site is currently used as grazing for domestic livestock and cattle, sheep and/or goats were found in various parts of the study area.

There are no red-listed mammal species (excluding bats) that could occur in available habitats in the study area. However, there are two small mammal species that could potentially occur on site that are protected under the National Environmental Management: Biodiversity Act. These are the Black-footed Cat and the Cape Fox. The Black-footed Cat occurs throughout the dryer parts of the country, although at low densities. Individuals travel between 10-20 km at night hunting and frequently move dens. The Cape Fox has a wider distribution than the Black-footed Cat and is only absent from the eastern seaboard and most of Mpumalanga and Limpopo Provinces. Their presence was not confirmed on the sites although it is possible they may occur there. The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on site but based on a field evaluation of the site and surrounding areas, is not likely to be found on site.

The National Parks Area Expansion Strategy (NPAES) has identified a portion of the escarpment of the eastern plateau which is proposed for inclusion in a protected area (reserve). Part of the areas identified falls within the site of the proposed north and south wind energy facilities (see **figure 4-1**). However, it should be noted that no engagement with regards to the identification of the land portions nor with regards to land acquisitions has taken place with the relevant landowners. Representatives from the South African National Parks, South African National Botanical Institute and DEA Chief Directorate: Transfrontier Conservation and Protected Areas have been notified and provided with the opportunity to comment on the proposed projects

b) Impact assessment

The potential impacts most likely to be experienced at the proposed site include:

- Loss or fragmentation of indigenous natural vegetation:
  - Negative change in conservation status of habitat;
  - Increased vulnerability of remaining portions to future disturbance;
  - General loss of habitat for sensitive species;
  - Loss in variation within sensitive habitats due to loss of portions of it;
  - General reduction in biodiversity;
  - Increased fragmentation (depending on location of impact);
  - Disturbance to processes maintaining biodiversity and ecosystem goods and services; and
  - Loss of ecosystem goods and services

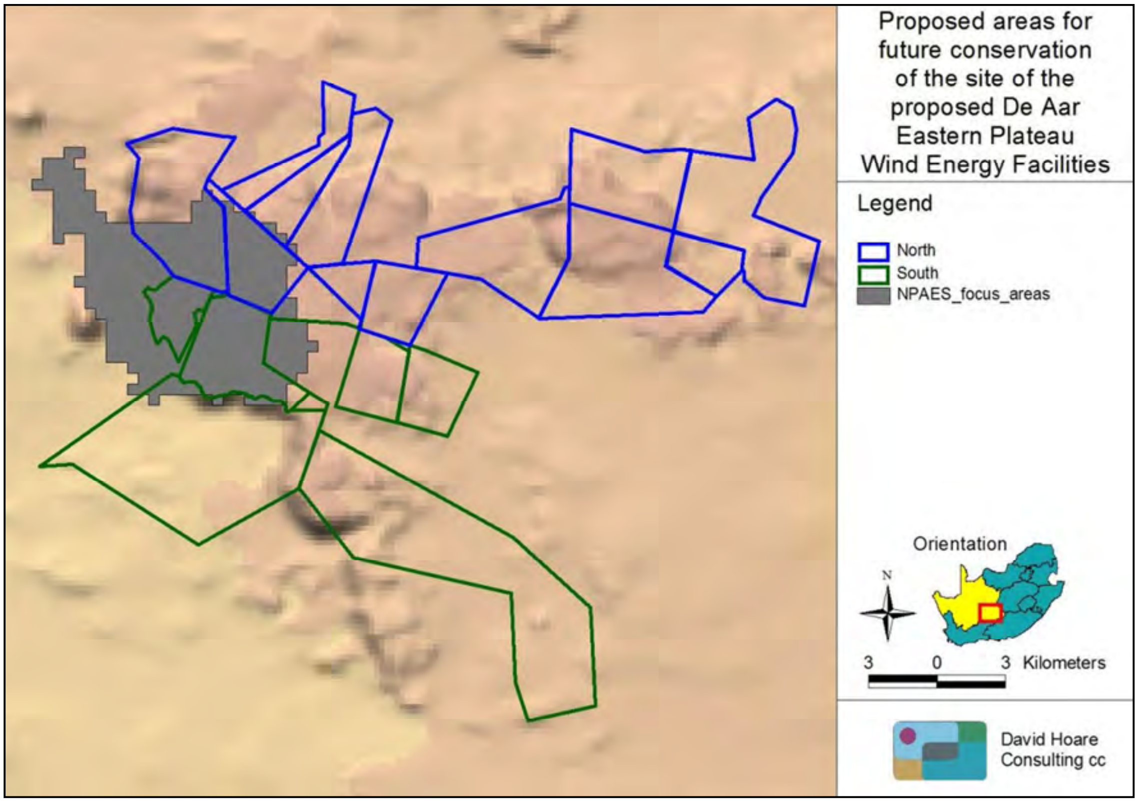


Figure 4-1: Areas included in the National Parks Area Expansion Strategy. (D. Hoare Consulting 2012).

- Loss of individuals of threatened and protected plants and tree species
  - Fragmentation of populations of affected species;
  - Reduction in area of occupancy of affected species; and
  - Loss of genetic variation within affected species.

- Establishment and spread of declared weeds and alien invader plants
  - Loss of indigenous vegetation;
  - Change in vegetation structure leading to change in various habitat characteristics;
  - Change in plant species composition;
  - Change in soil chemical properties;
  - Loss of sensitive habitats;
  - Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
  - Fragmentation of sensitive habitats;
  - Change in flammability of vegetation, depending on alien species;
  - Hydrological impacts due to increased transpiration and runoff; and
  - Impairment of wetland function.

Both vegetation types found on site are classified nationally as Least Threatened. There are no threatened, near threatened or rare plant species that occur on site. The three protected plant species that occur in the general area are unlikely to occur on site.

The majority of potential impacts are considered to be site specific or local, of low to medium magnitude and long term and therefore of **low to medium (-)** significance, without mitigation. With mitigation measures implemented, the impacts would be of **very low to medium (-)** significance. Note that the greatest impact on ecology (**medium (-)**) is as a result of fragmentation by access roads and it is not possible to mitigate this impact. However, the impact is considered to be acceptable based on the low sensitivity of the vegetation and its widespread distribution.

c) Mitigation measures

The following mitigation measures are recommended:

- An on-going monitoring programme should be implemented to detect and quantify any invasive plant species that may become established and to provide management measures for removing invasive species.

d) Cumulative impacts

Due to the fact that two wind energy facilities are proposed adjacent to one another cumulative impacts from both facilities were addressed. The impact on natural vegetation is due primarily to internal access roads. For this infrastructure component the impact was evaluated as being of medium magnitude at a site specific scale and of long-term duration. If the two proposed facilities are taken together then the scale would be elevated to "local", but the remaining measures would stay the same. It is therefore concluded that cumulative impacts would not result in impacts having a significance that is greater than for each of the individual proposed wind energy facilities.

4.2.2 Impact on avifauna (birds)

Based on atlas data from the first South African Bird Atlas (SABAP1) and second (SABAP2) bird atlas projects, up to 221 species can be recorded within a 25 km radius of the development zone. Of the 221 species, 12 are red-list species, 60 are endemics or near endemics and four are red-listed endemics (Ludwig's Bustard, Blue Crane, Blue Korhaan and Black Harrier). Potential avifaunal impacts could arise from disturbance caused by vehicular and people traffic during construction, displacement caused from habitat loss, risk of collision with wind turbine blades and power lines and behavioural displacement (alteration of flight paths). As such Mr Doug Harebottle was appointed to undertake an avifaunal specialist study. A field survey was undertaken from 17 - 20 December 2011 to inform the Avifauna Impact Assessment. The Avifauna Impact Assessment is included in **Annexure F**.

a) Description of the environment

The study area falls within the Nama-Karoo biome and forms part of the 12 000 km^2 Platberg-Karoo Conservancy Important Bird Area. There are no known regionally or nationally critical populations of impact susceptible species within or close to the sites, although there are four red-listed endemic species that occur on site. The natural vegetation present within the study area and impact zone comprises three main vegetation types: Besemkaree Koppies Shrubland, Eastern Upper Karoo and Northern Upper Karoo (Mucina and Rutherford, 2006). Ridges and rocky cliff faces on the plateau are likely to be important sources of lift for soaring species, notably raptors and possibly cranes. These will also support other cliff-nesting and foraging species. Additional avifaunal habitats that are important within the study area would include slopes which are well vegetated with small-medium sized bushes, and the lowland areas which are generally covered by low shrubby vegetation and short grass. The areas around farm dwellings are to some degree degraded mainly due to stock grazing. There are scattered farm dams in the study area with a few larger dams and ephemeral wetlands to the south and east of the plateau. The desktop survey produced a list of 125 species, 17 species were recorded for the top of the plateau including one red-list species (Verreaux's Eagle)(Least Concern) and eight regional endemics (listed below). A total of 16 species were recorded on the plateau and 29 species on the ridge slopes.

The birds of greatest potential relevance and importance in terms of the possible impacts of the wind farms are likely to be (a) resident and breeding raptors, notably Martial Eagle[21] *Polemaetus bellicosus*, Verreaux's Eagle *Aquila verreauxii,* Cape Eagle-Owl *Bubo capensis* and possibly Jackal Buzzard *Buteo rufofuscus*; (b) large terrestrial birds and raptors nesting, foraging on, or moving over, the lowland/plateau interface, including Booted Eagle *Aquila pennatus*, Southern Pale-chanting Goshawk *Melierax canorus*, Black-chested Snake-Eagle *Circaetus pectoralis*, Ludwig's Bustard *Neotis ludwigii*, Blue Crane *Anthropoides paradiseus* and possibly Black Harrier *Circus maurus* (c) endemic passerines that utilise the ridge lines, including Fairy Flycatcher *Stenostira scita* and most likely African Rock Pipit *Anthus crenatus* and (d) flocks of waterbirds moving between the wetlands (farm dams and pans) in and around the development sites, notably Greater Flamingo *Phoenicopterus ruber* and various duck species.

Although no active raptor nests were found during the site survey, a Verreaux's Eagle nest and a disused Martial Eagle nest were noted on a site visit by Aurecon in October 2011.

During the site survey, a preliminary assessment was carried out to determine which species used flight paths across the plateau top, considering ridges and high points especially. A variety of raptors, particularly Southern Pale-chanting Goshawk and Jackal Buzzard, frequent the sites. The Southern Pale-chanting Goshawk is especially significant as it was observed on top of the plateau, while the Jackal Buzzard and Black-chested Snake-eagle tended to prefer the ridgelines and/or cliff lines; however this does not preclude them from

[21] A disused Martial Eagle nest was pointed out by a landowner. Martial Eagles typically return to the same nest every year, so it is likely that the nest will be used at some point in the future.

Chapter 4

using the plateau either as a foraging area or route between the northern and southern portions of the plateau. Other species such as Barn Swallow, Common Swift, Black Swift, White-rumped Swift, Little Swift, and South African Cliff-Swallow were observed flying on top of the plateau at three different locations within the sites. These are all aerial foragers which occur in relatively large flocks (often together) and which could possibly place them at a higher level of collision risk.

b) Impact assessment

The potential impacts on the avifauna of the study area includes displacement and disturbance of large terrestrial birds, resident or breeding species, mortality caused by collision with the wind turbine blades or power lines, habitat loss, electrocution on new power infrastructure as well as behavioural displacement (alteration of flight paths).

Overall the most important species include (i) resident and breeding raptors, especially Martial Eagle (at least one pair in the south site), Verreaux's Eagle (at least one pair in the south site), Southern Pale-chanting Goshawk (use of powerlines on plateau on the north site and numerous breeding pairs on periphery of the entire combined site) and Cape Eagle Owl (at least one breeding pair on periphery of the south site),(ii) large terrestrial bird species, especially Ludwig's Bustard and Blue Crane (which breeds in the surrounding lowlands) (iii) populations of localised/range-restricted or biome-restricted species particularly African Rock Pipit, Sickle-winged Chat and Black-headed and (iv) congregations of wetland species at and around the various dams in the north and south sites.

Collisions with turbines and power lines

The number of collisions of birds with turbines and power lines ranges from low to high across countries and the world. Although collision rates may appear relatively low in many cases, cumulative effects over time, especially when considered for large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable significance.

Many factors influence the number of birds killed at wind energy facilities. These can be classified into three broad groupings: (i) avian variables, (ii) location variables, and (iii) facility-related variables. It is logical to assume that the more birds there are flying through a site, the higher the chances of a collision occurring. The types of birds present in the area are also very important as some species are more vulnerable to collision with turbines and power lines than others. Species-specific variation in behaviour, from general levels of activity to particular foraging or commuting strategies, also affect susceptibility to collision. There may also be seasonal and temporal differences in behaviour, for example breeding males displaying may be particularly at risk.

Landscape features can potentially channel birds towards a certain area, and in the case of raptors, influence their flight and foraging behaviour. Birds fly lower during strong headwinds due to poor visibility so when the turbines are functioning at their maximum speed, birds are likely to be flying at their lowest height, increasing collision risk.

Larger wind energy facilities, with more turbines, are more likely to result in significant numbers of bird casualties, because they are a greater group risk. Turbine size may also be proportional to collision risk, with taller turbines associated with higher mortality rates in some instances. Illumination of turbines and other infrastructure at night is often associated with increased collision risk, either because birds moving long distances at night do so by celestial navigation, and may confuse lights for stars or because lights attract insects, which in turn attract night birds. However, the turbines under consideration would not be lit at night, except with regulation aviation safety lighting (small, flashing red lights).

Some literature suggests that spacing between turbines can change the number of collisions (i.e. wider spacing results in less collisions), but other literature suggests that all attempts by birds to fly between turbines, rather than over or around them, should be discouraged to minimise collision risk.

Collision prone birds are generally either (i) large species and/or species with high ratios of body weight to wing surface area (wing loading), which confers low manoeuvrability (cranes, bustards, vultures, gamebirds, waterfowl, falcons), (ii) species which fly at high speeds (gamebirds, pigeons and sandgrouse, swifts, falcons), (iii) species which are distracted in flight - predators or species with aerial displays (many raptors, aerial insectivores, some open country passerines[22]), (iv) species which habitually fly in low light conditions, and (v) species with narrow fields of forward binocular vision. Exposure is greatest in (i) very aerial species, (ii) species inclined to make regular and/or long distance movements (migrants, any species with widely separated resource areas - food, water, roost and nest sites), (iii) species that regularly fly in flocks (increasing the chances of incurring multiple fatalities in a single collision incident).

Soaring species may be particularly prone to colliding with turbines where the turbines are placed along ridges to exploit the same updrafts favoured by such birds for cross-country flying. Large soaring birds such as many raptors and storks depend heavily on external sources of energy for sustainable flight. In terrestrial situations, this generally requires that they locate and exploit pockets or waves of rising air, either in the form of bubbles of vertically rising, differentially heated air (thermal soaring) or in the form of wind forced up over rises in the landscape, creating waves of rising turbulence (slope soaring).

Habitat loss – destruction, disturbance and displacement

Birds in the proposed study area are likely to be disturbed, especially shy and/or ground-nesting species. Some studies have shown that specific bird species avoid wind energy facilities due to noise or movement of the turbines or avoidance of the collision impact zone Power line service roads or servitudes would need to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, and to prevent vegetation from intruding into the legally prescribed clearance gaps between the ground and the conductors. These activities have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude, and retaining cleared servitudes can alter the bird

[22] Perching birds and songbirds.

community structure at the site. Due to the low level of the shrub at the site it is unlikely that much maintenance would be required below any overhead power lines.

Electrocution on power infrastructure

Avian electrocutions occur when a bird perches or attempts to perch on an electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. Electrocution risk is strongly influenced by the voltage and design of the hardware installed (generally occurring on lower voltage infrastructure where air gaps are relatively small), and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energised components.

Figures 4-2 and 4-3 show the locations of a few of the species of concern, and flight paths noted, on the sites.

Based on the above, the potential impacts most likely to be experienced at the proposed site include:

- Disturbance and displacement of resident or breeding Karoo species (notably Eastern Clapper Lark and Rufous-eared Warbler) from foraging/breeding areas by operation of the facility;
- Disturbance and displacement of large terrestrial birds (notably Northern Black Korhaan and possibly Ludwig's Bustard) from nesting or foraging areas by operation of the facility and/or mortality of these species in collisions with new power lines.
- Disturbance and displacement of resident/migrant raptor species (notably Lesser Kestrel) from foraging/breeding areas by operation of the facility, and/or mortality of these species in collisions with new power lines, or electrocution when perched on powerlines

The extent of the potential impacts on avifauna would be regional if Martial Eagles, Verreaux's Eagles, Jackal Buzzards or Booted Eagles are killed or displaced, or local should only other priority species be affected, such as Ludwig's Bustard and Blue Crane. The duration would be long-term as the ecology of the area would remain affected for as long as the proposed facilities are operational. Some priority species may be displaced for the duration of the project. Based on the above, the potential impact on birds is considered to be of medium-high magnitude for both the north and south sites, local extent and long term and therefore of **medium - high (-)** significance, without mitigation for the north site and south site, respectively.

The significance of this impact, with mitigation, is considered to be **medium (-)**, for both sites.

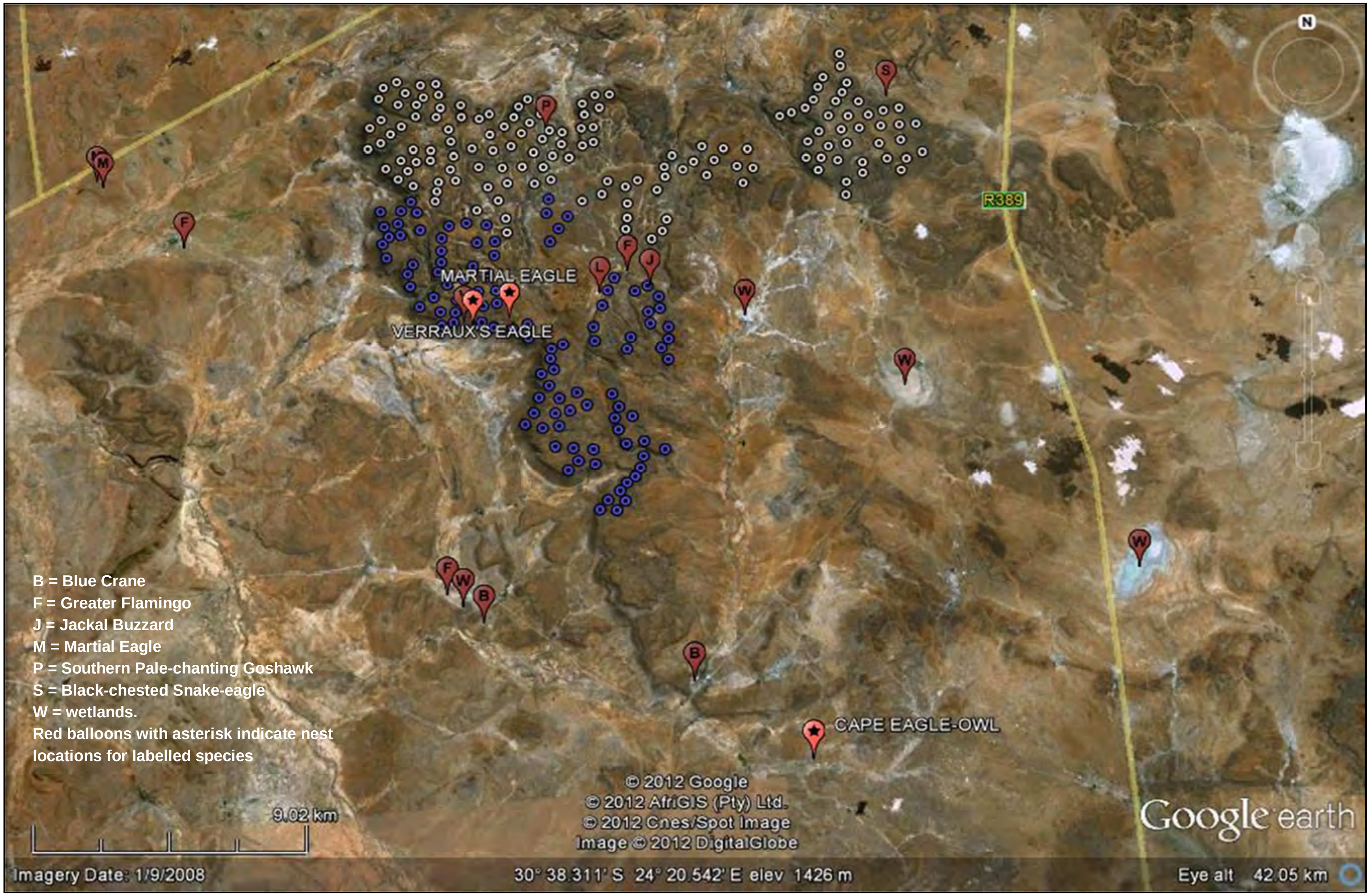


Figure 4-2: Locations of important bird species at the proposed eastern plateau north and south wind energy facilities sites (Source: D. Harebottle 2012)

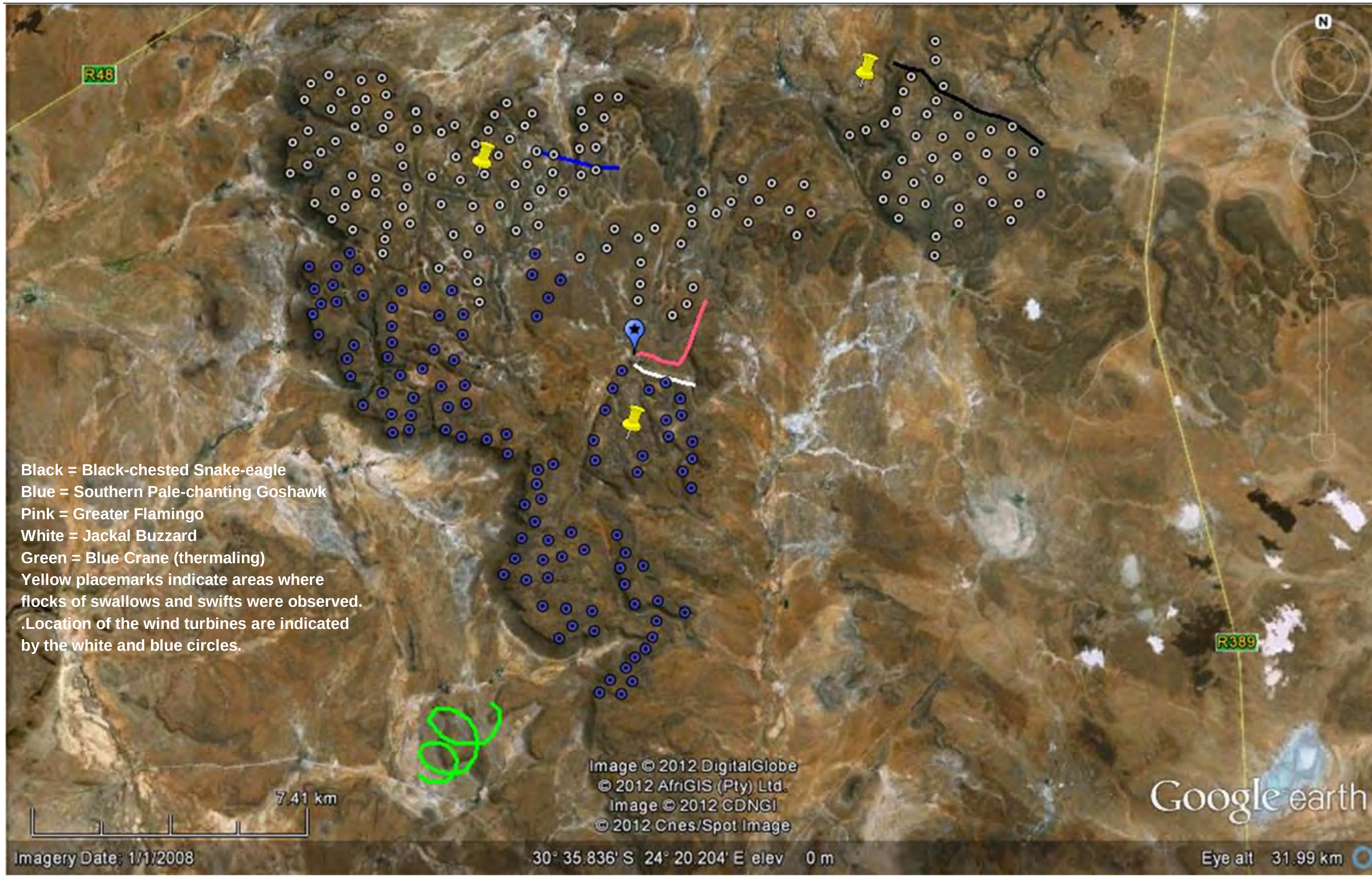


Figure 4-3: Observed flight paths of five priority bird species at the proposed eastern plateau north and south wind energy facilities sites as observed during a field survey from 17-20 December 2011 (Source: D. Harebottle 2012).

c) Mitigation measures

The following mitigation measures are recommended:

- Carefully monitor the local avifauna pre- and post-construction and implement appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in the Avifaunal Impact Assessment, or when collision or electrocution mortalities are recorded for any of the priority species listed in the assessment; and
- Minimize the disturbance associated with maintenance activities by scheduling maintenance activities to avoid and/or reduce disturbance in sensitive areas at sensitive times (identified during the monitoring programme);
- Restricting the construction footprint to a bare minimum;
- Demarcation of ‘no-go’ areas identified during the pre-construction monitoring phase to minimise disturbance impacts associated with the construction of the facility;
- Reducing and maintaining noise disturbance to a minimum particularly with regards to blasting on the ridge-top associated with excavations for foundations. Blasting should not take place during the breeding seasons of the resident avifaunal community and in particular for priority species (June-September). Blasting should be kept to a minimum and, where possible, synchronized with neighbouring blasts;

d) Cumulative impacts

The nearest wind energy development to the eastern plateau development is the approved (but not constructed) 100 MW Mulilo wind energy facility located about 100 km north of De Aar on the Maanhaarberg mountain range. There are at least six proposed solar energy facilities planned for the De Aar surrounds (Aurecon, 2011). These projects, when viewed in isolation, may pose a limited threat to the avifauna of the area. However, in combination with a number of renewable energy facilities in the region, significant barriers to birds either in the form of displacement from foraging areas or reducing energy-efficient travel between resource areas may result. Cumulative impacts from the approved Maanhaarberg wind energy facility may be negligible based on distance from the Eastern Plateau site but migrant raptors, swallows and swifts and long-distance flyers such as ducks, might be at risk from collisions should their flight paths traverse the locations of the wind energy facilities. It is not possible to assess these cumulative impacts in a project specific EIA, not least because not all the proposed projects may be approved or constructed. As such it would be necessary for DEA, or a similar body, to undertake a strategic assessment in this regard.

4.2.3 Impact on bats

Urban development and agricultural practices have contributed to a decline in bat numbers globally, as well as in South Africa. Bats can consume large numbers of insects nightly and are therefore the only major predators of nocturnal flying insects in South Africa and contribute greatly in the control of their numbers. Their prey also includes agricultural insect pests, such as moths and vectors for diseases. Wind energy facilities are known to impact on bats and as such the proposed project could have an impact on any bats found on site. A study of bats was undertaken by Mr Werner Marais of Animalia Zoological & Ecological Consultation cc. The study area was visited from the 12 - 16 December 2011. Bat activity was observed at dusk and at night. Bat echolocation calls were recorded on a continuous basis, during night and day time, while traversing the study area with a vehicle. The bat study is included in **Annexure F**. The findings and recommendations of the bat study are summarised below.

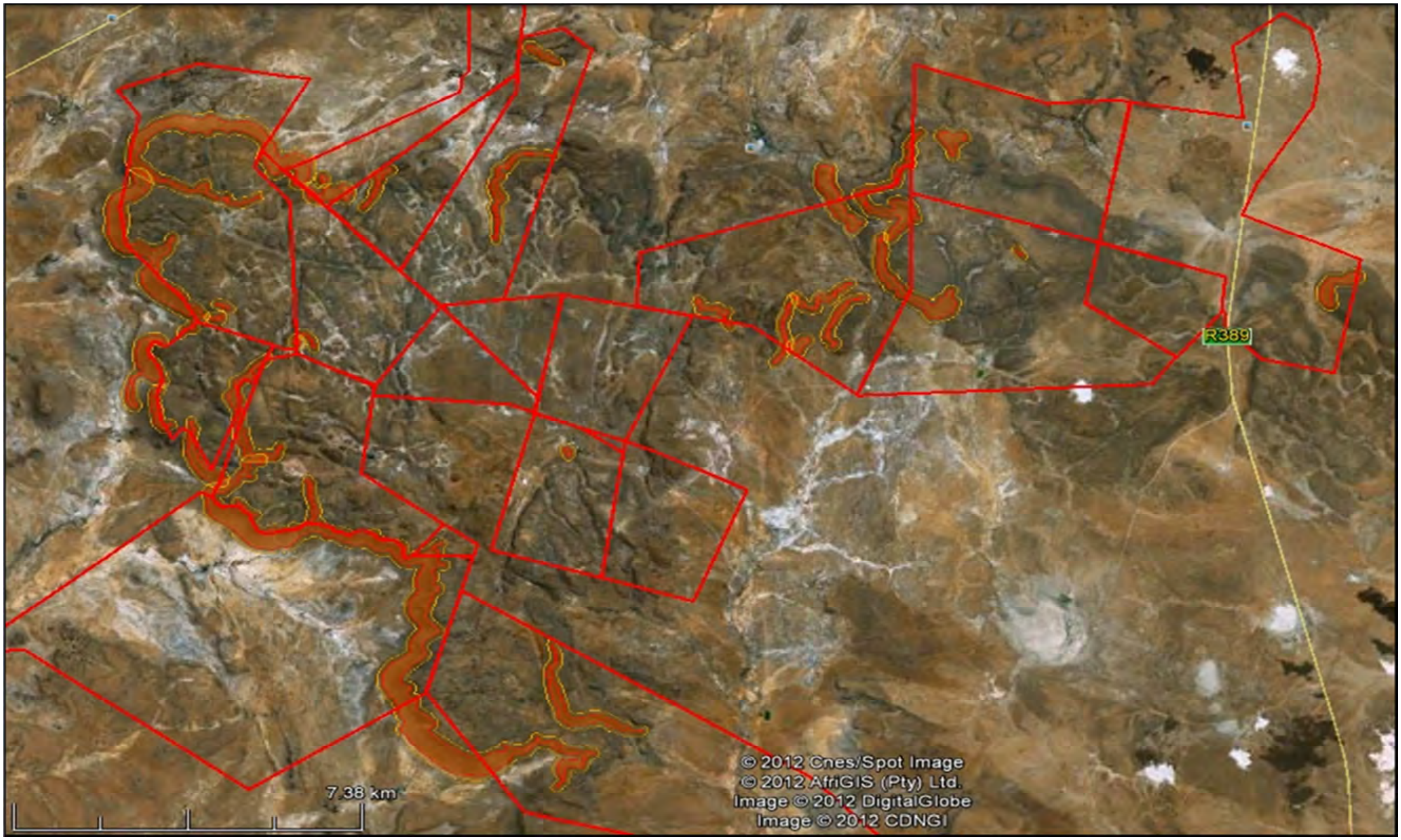
a) Description of the environment

The bat detector device is capable of recording ultrasonic bat calls not always audible to the human ear for computer analysis afterwards. Although advanced technology, it is not necessarily possible to identify bat species by their echolocation calls. Bat activity was detected primarily at the rocky outcrop parts of the sites, while open and windier areas did not have significant bat activity. A number of species were identified and their occurrence confirmed in the study area, including Geoffroy's horseshoe bat (*Rhinolophus clivosus*), Egyptian free-tailed bat (*Tadarida aegyptiaca*), Natal long-fingered bat (*Miniopterus natalensis*) and the Long-tailed and Cape serotine (*Eptesicus hottentotus* and *Neoromicia capensis*).

Geoffroy's horseshoe bat roosts gregariously in caves, but may also utilise any other cavities. The Egyptian free-tailed bat is a very common bat and can typically be found roosting in crevices and buildings. Both species have a conservation status of "Least Concern". The Natal long-fingered bat is a Near Threatened species, which roost gregariously in caves, but there are no known caves close to the study site. The Long-tailed serotine, considered to be least concern is a crevice dweller and prefers rock crevices in rocky outcrops or buildings. Another very common species, the Cape serotine, is a red-listed species considered to be Least Concern, and can also be found in crevices and the roofs of buildings. Temmink's myotis (*Myotis tricolor*), also considered to be Least Concern, may possibly be confirmed to be present in the study area. The cliffs and rocky outcrops on site offer a multitude of crevice roosting space for bats and are therefore regarded as areas of high bat sensitivity. Water bodies, small seasonal streams and drainage gulleys on site offer valuable foraging terrain for bats in the area and are also considered to be sensitive.

b) Impact assessment

Many bat species roost in large aggregations and concentrate in small areas. Furthermore, the reproductive rates of bats are also much lower than those of most other small mammals- usually only 1-2 pups per female annually. Therefore any major disturbance to a small area within which a bat population resides would impact on the whole population and the recovery of the population would be very slow.



Site boundary **High sensitivity** **100m buffer zone**

Figure 4-4: Bat sensitivity map, indicating the cliffs and rocky outcrops with a high sensitivity and therefore a 100 m buffer. (Source: Animalia 2012)

Since bats have highly sophisticated navigation by echolocation, it is not understood why they are hit by rotating turbine blades. A number of theories exist, one theorizing that under natural circumstances bats' echolocation is designed to track down and pursue smaller insect prey or avoid stationary objects, not focus on unnatural objects moving sideways across the flight path. Another is 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 turbines and subsequently attracts bats. Whatever the reasons, it has been found internationally that wind turbines can have a negative impact on bats either through physical injury or through barotrauma, the leading cause of bat mortality. 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.

These potential impacts are particularly relevant to migrating bats. The migration paths of South African bats in the Northern Cape Province are not well studied and are virtually unknown. Cave dwelling species undertake annual migrations between caves. However, no caves are known to be in close proximity to the study area, and it is not located within any known direct line of path between major caves. As such the threat to migrating bats is considered to be low.

Considering the number of species bats confirmed on site, as well as the potential impacts described above, the potential impact of the proposed project on bats during operational phase is considered to be of a high magnitude, regional extent and long term, and thus of a **medium (-)** significance without mitigation, at both sites. With the implementation of mitigation measures, the significance would reduce too **low to medium (-)** at both sites.

c) Mitigation measures

The following mitigation measures are recommended:

- No turbines may be placed in the area indicated as having a High Bat Sensitivity (**Figure 4-4**). A 100 meter buffer should apply to cliffs and rocky outcrops and water bodies designated as areas of high sensitivity;
- Where required by long-term bat monitoring, curtail selected turbines to a preliminary cut-in speed of 5 - 5.5 m/s, or as recommended by the monitoring, as a mitigation measure to lessen bat mortalities. Curtailment is where the turbine cut-in speed is raised to a higher wind speed based on the principle that bats will be less active in strong winds due to the fact that their insect food cannot fly in strong wind speeds, and the small insectivorous bat species need to use more energy to fly in strong winds. Curtailment should be informed by long term bat monitoring which will indicate at which turbines, seasons, time of night and in which weather curtailment is required.
- Consider implementing an ultrasonic deterrent device so as to repel bats from wind turbines if any turbines are placed in moderate sensitivity areas. Should this measure prove effective it may be implemented in place of curtailment, should this be agreed to by a bat specialist, based on long term monitoring; and

- Undertake affordable long term monitoring of bats and the potential impacts of turbines on them to effectively fine tune mitigation. This should include 12 month long term monitoring (preferably prior to construction) where bat detectors are deployed on the site and passively recording bat activity every night. Additionally the site should be visited by a bat specialist quarterly to assess and compare the bat activity on a seasonal basis. The wind speed data gathered by meteorological masts can then be correlated with bat activity to determine the most feasible cut-in speed and fine tune other mitigation measures. Monitoring should also take place for 12 months during operation to evaluate the effectiveness of mitigation measures such as curtailment or ultrasonic deterrent devices; and
- Research from long term monitoring should be shared with academic institutions to aid in research of the potential impacts of wind energy facilities on bats.

d) Cumulative impacts

Bat populations are slow to recover to equilibrium numbers once major mortalities take place due to low reproductive rates. If any mortalities due to blade collisions are allowed to continue without mitigation for a long period of time across the two proposed wind energy facilities as well as the third wind energy facility proposed in the Maanhaarberg mountain range 100 km north of De Aar, the mortality rate is highly likely to exceed the reproductive rates of local bat populations, causing a cumulative impact of high (-) significance.

Migrating bats have been recorded to migrate several hundred kilometres in South Africa, such that the cumulative impact of several wind farms along migration routes operating without mitigation would be catastrophic to the population sizes of these migrating bats. It would be beneficial to collaborate with academic institutions to research any bat migration routes in relation to location of the sites and determine the season of the year migration take place.

4.2.4 Impact on climate change

The establishment of a wind energy facility would reduce South Africa's future reliance on energy from coal-fired power stations which could in turn reduce the future volume of greenhouse gases emitted to the atmosphere, reducing the greenhouse effect on a regional, national and international scale.

a) Description of the environment

Gases which contribute to the greenhouse effect are known to include carbon dioxide (CO_2), methane (CH_4), water vapour, nitrous oxide, chloroflurocarbons (CFCs), halons and peroxyacylnitrate (PAN). All of these gases are transparent to shortwave radiation reaching the earth's surface, but trap long-wave radiation leaving the earth's surface, acting like a greenhouse. This action leads to a warming of the earth's lower atmosphere, with changes in the global and regional climates, rising sea levels and extended desertification. This is turn is expected to have severe ecological consequences and a suite of implications for humans. Total greenhouse gas emissions reported to be emitted within South Africa for the 2008 year was approximately 435 million metric tons of CO_2 equivalent (UN Statistical division, 2011).

b) Impact assessment

Greenhouse gases released from a new coal-fired power station are primarily CO_2 with minor amounts of nitrous oxide (N_2O). The Medupi Power Station (4 788 MW), currently under construction near Lephalale in Limpopo, is expected to produce 29.9 million metric tons of CO_2 per annum. The emissions from Medupi Power Station would increase South Africa's CO_2 equivalent emissions (2008) by some 7 %. This is a significant increase in greenhouse gas emissions, given the aims of the Kyoto Protocol, which are to reduce overall emission levels of the six major greenhouse gases to 5 % below the 1990 levels, between 2008 and 2012 in developed countries. While South Africa, as a developing country, is not obliged to make such reductions, the increase in greenhouse gas emissions must be viewed in light of global trends to reduce these emissions significantly.

No greenhouse gases are produced by wind energy facilities during operation, as wind drives the turbines that generate the electricity. Although wind energy facilities would not completely replace coal-fired power stations within South Africa, since these would still be required to provide base-load, they would reduce South Africa's reliance on them. This would assist in reducing future volumes of greenhouse gas emissions.

A life-cycle analysis looks at the entire chain of activities needed for electricity production and distribution, such as fuel extraction and transport, processing and transformation, construction and installation of the plant and equipment, waste disposal, as well as the eventual decommissioning. Every energy technology (wind, hydro, coal, gas, etc) has its own very distinct fuel cycle. A comparative life-cycle analysis for the current energy technologies used in Europe was conducted by AUMA (2000). The study focused mainly on emissions from the various energy technologies. Although the results of the analysis are not necessarily entirely accurate in the South African context, they offer a good proxy for a comparative assessment of coal-fired and wind energy facilities in South Africa. The results of the analysis are illustrated graphically in **Figure 4-5** below.

It is evident from **Figure 4-5** above that small to almost negligible environmental impacts are associated with renewables, particularly wind, relative to fossil fuels such as coal, over the entire life-cycle.

While the proposed wind energy facility would not provide an equivalent amount of energy as a typical new coal-fired power station (140 MW compared to 4 788 MW), when considered with regards to climate change and given the spirit of the Kyoto Protocol, the impact is deemed to be of regional extent, very low magnitude and long term and therefore of ***low (+)*** significance, without mitigation.

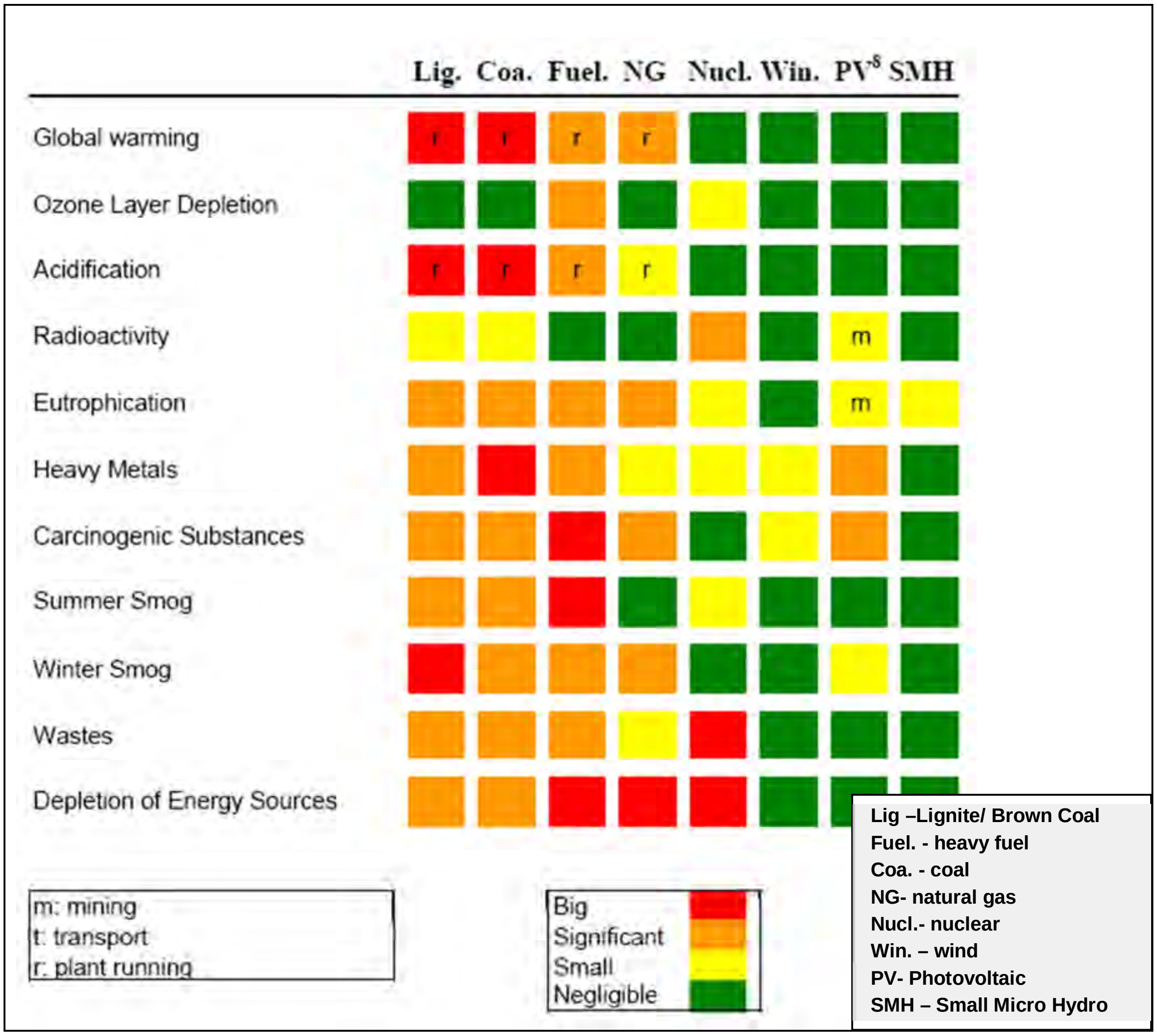


Figure 4-5: Matrix of environmental impacts by categories (AUMA, 2000)

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

As shown in **Figure 4-5**, five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. Furthermore, many more wind energy facilities are proposed throughout South Africa. Given the number of wind energy facilities proposed across the country, the potential reduction in future greenhouse gas emissions is considered to be of regional extent, low magnitude and long term, and therefore of *medium (+)* significance.

4.2.5 Impact on freshwater

A number of wetland and seeps, as well as numerous drainage lines, are found in the vicinity of the sites. The potential exists for the proposed wind energy facilities to impact on the natural vegetation adjacent to and within the freshwater features, modify water quality, cause erosion and/or invasive plant growth. As such a freshwater study was undertaken Mrs Antonia Belcher. A desktop review was undertaken as well as a more detailed assessment of the freshwater features at the sites. Furthermore, aquatic ecosystem health assessments were carried out. A site visit was conducted on 24 and 25 January 2012. in order to inform the Freshwater Impact Assessment. During this study, the characterisation, mapping and integrity assessments of the freshwater features were undertaken. The Freshwater Impact Assessment is included in **Annexure J.** The findings and recommendations of the study are summarised below.

a) Description of the environment

The main aquatic features within the study area are the Brak and Hondeblaf Rivers which are seasonal tributaries within the Orange River System. The Brak River (see Figure 4.5) flows in a north westerly direction along the southern boundary of the study area with a number of its tributaries crossing the site as they flow in a southerly direction. Most of the smaller tributaries within the study area are ephemeral with no clear associated vegetation and slightly clayey soils.

Small, shallow in stream dams have been constructed within many of the drainage channels on site. Associated with these dams are small wetland areas with a significant series of pans within the study area located at Slingershoek, (**Figure 4.6**).

Geology and soil
The geology of the study area can be described as being underlain by flat-lying sedimentary rocks of the Karoo Supergroup, which have been intruded by innumerable sills and dykes of dolerite. The overlying soils of the plateau are primarily red soils of a restricted soil depth, excessive drainage, high erodibility and low fertility. The higher lying areas of the plateau are shallow rock. These areas are water recharge areas. Both the Brak and Hondeblaf Rivers have predominantly sandy/silty substrate with outcrops of bedrock. The rivers drain shrubland vegetation in an area with a very low rainfall. As a result, the water flowing in these rivers is saline, turbid and seasonal.

Vegetation
Portions of the proposed sites are in a disturbed condition, mostly as a result of livestock grazing. There is however little presence of invasive alien plants. Along the Brak and Hondeblaf Rivers much of the associated vegetation occurs instream (dominated by the common reed *Phragmites australis* with some sedge).

Figure 4-6: Water features in the study area (Source: A. Belcher 2012).

There is very little discernible riparian vegetation. The instream habitat of the Brak River is still largely natural to moderately modified while the riparian habitat is more impacted (moderately to largely modified) as a result of surrounding farming activities. Both the riparian and instream habitat integrity of the Hondeblaf River are considered to be in a moderately modified state. The ephemeral streams (tributaries of these two rivers) have no visible aquatic vegetation and are largely natural to moderately modified, with the modification of the habitat occurring as a result of the surrounding farming activities (livestock grazing).

Freshwater Biodiversity and Conservation

The Brak River system is deemed to have a moderate[23] to low[24] Ecological Importance and Sensitivity, while the Hondeblaf River provides refuge for juvenile Vaal-Orange Largemouth Yellowfish in the lower reaches of the river and as such has a high[25] Ecological Importance and Sensitivity. According to the Freshwater Ecosystem Protected Areas (FEPA) map for the study area, a portion of the Brak River system has been identified as having conservation importance. FEPAs are strategic spatial priorities for conserving freshwater ecosystems and associated biodiversity. The series of pans, located at Slingershoek, have also been identified as a FEPA wetland.

The wetlands on site are considered to be depression wetlands or pans with small contributions of surface water runoff and possibly a minor contribution of groundwater. The pans are still in a largely natural condition with the only impacts being from upstream rural and agricultural activities (flow and water modification as well as the impact of livestock grazing). The key services, which should be maintained, provided by the pans relate to flow regulation/flood attenuation and sediment trapping (see **Figure 4-7**).

b) Impact assessment

The potential impacts on the freshwater systems on the sites include increased runoff, erosion (in particular on surfaces with a steeper gradient) and sedimentation of downslope areas due to hard surfaces created during development.

None of the locations proposed for the wind turbines would be within an identified drainage line/stream or wetland/pan as they are placed on higher areas. Some of the proposed wind turbines are however near to pans. Overhead transmission lines would cross drainage lines

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[23] Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.

[24] Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.

[25] Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.

in a number of places. The proposed access routes (some of which are existing roads only requiring widening and upgrade) would also cross a number of the identified freshwater features and go past a number of pans.

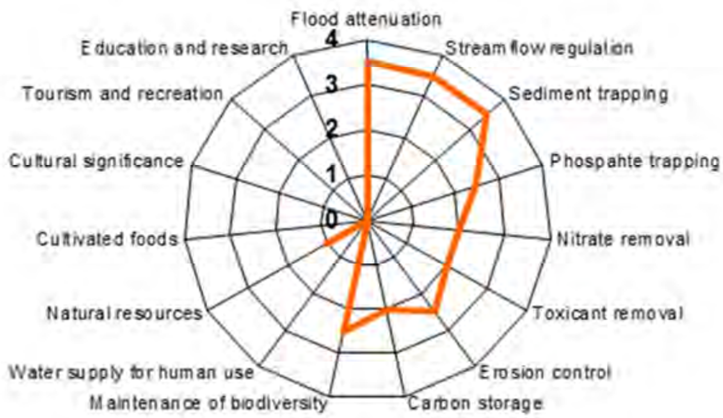

Figure 4-7: Ecosystem services provided by the wetland/pan areas

Based on the above, the potential impact on freshwater is considered to be of local extent, low magnitude and long term, and therefore of **low (-)** significance, without mitigation for both projects. With the implementation of mitigation measures the significance would reduce to **very low (-)** significance for both sites.

c) Mitigation measures

The following mitigation measures are recommended:

- Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants.
- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible.
- Where transmission lines need to be constructed over/through the drainage channel, disturbance of the channel should be limited. All crossings over drainage channels or stream beds after the construction phase should be rehabilitated such that the flow within the drainage channel is not impeded.

d) Cumulative impacts

Erosion and sedimentation from the project activities, together with invasive alien plant growth and the possible modification of surface water runoff and water quality may lead to additional impacts on the freshwater habitats within the study area. These impacts can however be monitored and easily mitigated.

4.3 OPERATIONAL PHASE IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

4.3.1 Impact on heritage resources

Heritage resources include archaeological material (e.g. rock paintings, stone tools), palaeontological material (e.g. fossilised materials) and cultural heritage material (e.g. old graveyards, fences or ruins of buildings). Since some potential heritage material is buried, it is often only found during the construction phase of a project.

Due to the relatively undisturbed nature of the site, and the findings from an inception site visit, it was likely that archaeological or cultural material would be found on site. A large scale development such as the proposed project could have a negative impact on the archaeological and cultural heritage resources (including visual, landscape and sense of place impacts) by damaging or destroying such material or by requiring the material to be removed and stored *in situ*. As such a Heritage Impact Assessment (HIA) was conducted by Lita Webley and Jayson Orton of the Archaeology Contracts Office (ACO) to assess the impacts of the proposed project. Information for the study was sourced from published and unpublished archaeological reports, and a site visit was undertaken in November 2011.

a) Description of the environment

"Archaeology" pertains to the remains resulting from human activity in disuse and older than 100 years such as artefacts, human and hominid remains, artificial features and structures. "History" refers more to the activities of 19^{th} century seasonal Trekboers, their shepherds and farmers from the colonial era.

During the site visit extensive pre-colonial and colonial scatters of material were found, which include Middle and Late Stone Age (MSA and LSA) archaeological material, historic period ruins and stone kraal complexes and scatters of historic material. The historic building environment comprises a number of late 19^{th} century and early 20^{th} century farm houses and sheds.

Pre-colonial archaeology

No Early Stone Age (ESA) material was identified on either the north or south sites. MSA material was found scattered throughout the North and South sites and represents the dominant Stone Age archaeological material found. Artefacts include cores, flakes, and blades and snapped blades of which some show signs of damage from utilisation.

Archaeological site boundaries were not clearly defined as material was generally widely spread over the project area, referred to as "ancient litter" of material in archaeological terms. No MSA sites with fossil bone or other organic material were identified. A few dense scatters were identified on the South site, most significantly a “factory” site (where tools are made) on Knapdaar where both MSA and LSA material were found on site (see **Figure 4-8** and **Figure 4-9**). Later Stone Age (LSA) findings were relatively uncommon on the plateau top and only a few discreet sites were recorded.

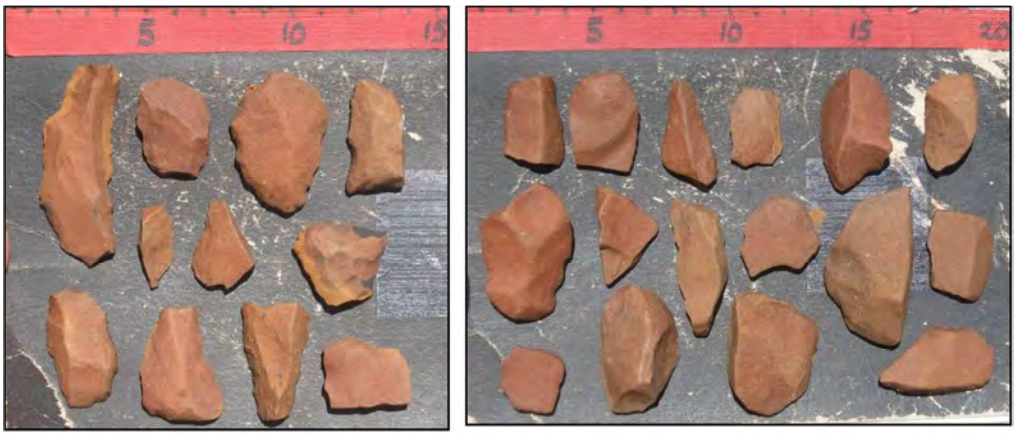

Figure 4-8: Typical weathered and patinated MSA stone artefacts found widely distributed in the area

Engravings

On the North site engravings on dolerite boulders were recorded on the farm Zwagershoek and consist of an engraving of an ostrich and unknown animal. Engravings in the form of 19th century historic graffiti by Boer soldiers were recorded on the South site on the farm Slingershoek, located on a little koppie behind the main farmhouse.

Historical Archaeology

A large number of stone kraal complexes were documented during the survey and were found on both the North and South sites on farms Enkeldebult, Pienaarskloof, Matjiesfontein, Meyersfontein, Vendussie Kuil and Knapdaar. The majority of kraals were rectangular or square suggesting they date back to the historical period, possibly seasonal outposts of the 19th century Trekboers and/or their shepherds.

A few circular or oblong kraals were recorded at Enkeldebult (North site) and Knapdaar (South site) and they may date to the pre-colonial period, although little substantive evidence (in the form of associated artefacts) were found (see **Figure 4-9** and Figure 4-10).

Cemeteries and Graves

A number of graves were recorded on the farm Zwagershoek, on the North site. The landowners were questioned about possible graves in the study area, but apart from Zwagershoek, none were reported and recorded

General Built Environment

On both sites old farm houses and buildings, potentially of greater than 60 years of age were found, which would then have protection under NHRA. Some of these buildings older than

60 years had medium heritage significance (see **Figure 4-9**). The majority of permanent farm dwellings are located below the plateau.

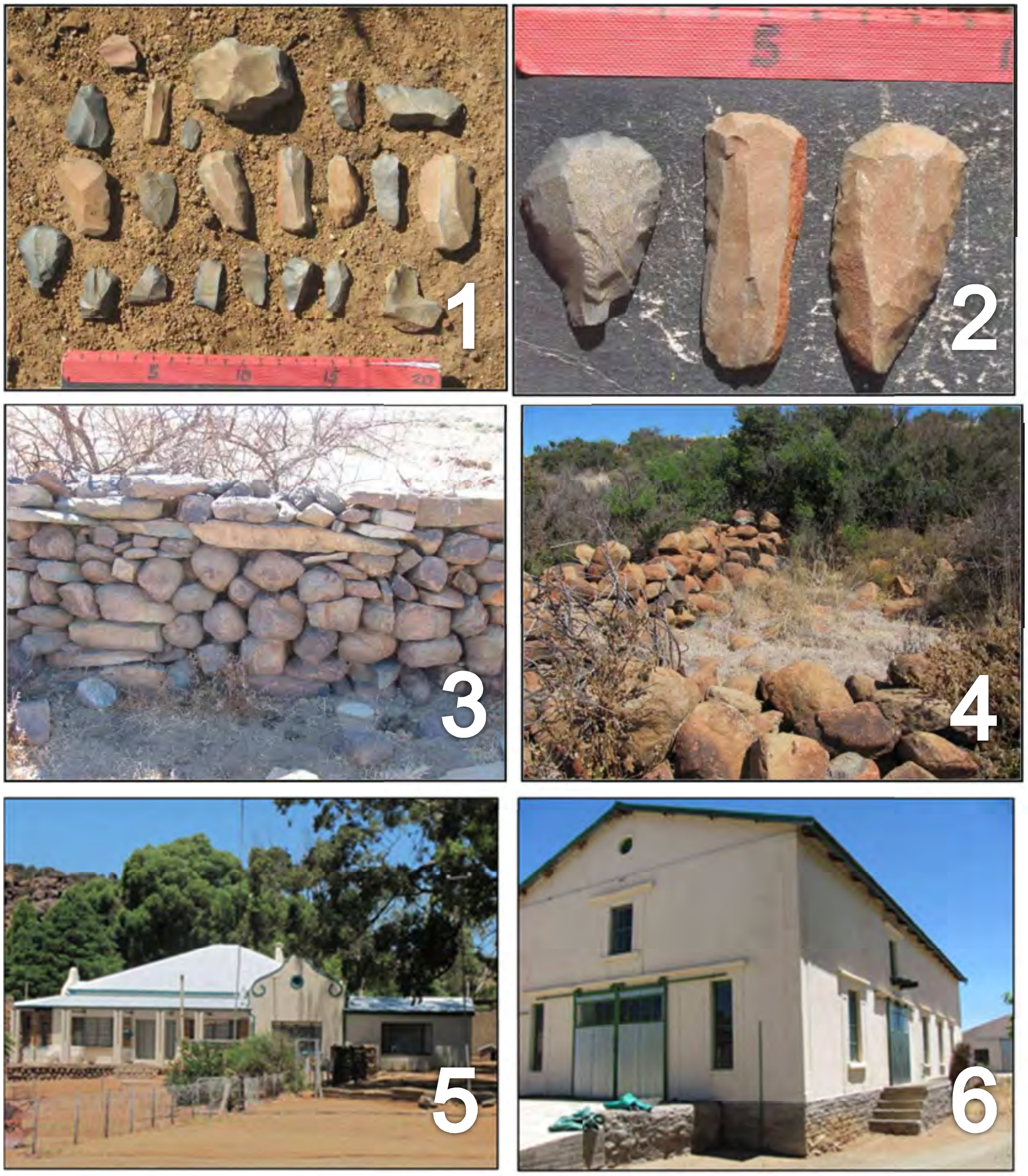

Figure 4-9:LSA artefacts from the site on Enkeldebult (1&2). Section of stone walling from Knapdaar and on Matjiesfontein (3&4). Cape Dutch homestead of Kranskop on Vendussie Kuil and a 1942 barn on Knapdaar (5&6).

Cultural landscape

The cultural landscape is typical Karoo landscape with vast open plains covered in low scrub and grasses, low ridges and small hills. Although maybe not desirable as a tourist destination, the landscape does have archaeological and historic significance because of the activities of prehistoric people and colonial Trekboers in the area. The potential impact on the cultural landscape is assessed within visual impacts in Section 4.3.2. Construction phase impacts on archaeology are assessed under Section 4.4.5

Figure 4-10: A stone feature on Enkeldebult.

4.3.2 Visual impacts

The overall landscape is defined as Karoo plain, with extensive grasslands, scrublands, and isolated uplands, with tree groups mostly associated with farmsteads, and long open views over the plains. The proposed location of the projects is on a plateau which rises about 200 – 250 m above the plain. Wind turbines and their associated infrastructure make a strong visual statement, because of their semi-industrial character and the potential to be visible from many kilometres away. As such, Mrs Karen Hansen, a private consultant, was appointed to undertake a Visual Impact Assessment (VIA) to determine potential visual impacts of the proposed projects. The receiving site was assessed, and also surrounding areas from where the site appeared to be likely to be visible on 17 and 18 November 2011. The VIA, and comments on the updated site layout, is contained in **Annexure I**. The VIA included a desktop survey of various maps and aerial photography. Terrain analysis software, Global Mapper, was also used to start the visual envelope definition process. Based on professional experience, as well as the experience of other specialists in visual impact a study area with a radius of 25 km was considered in the VIA. The findings and recommendations of the study are provided below.

a) Description of the environment

The character of the landscape is defined as open, flat, remote and sparsely populated lands, typical of the rural open plains of the Karoo. Emerging from the sedimentary rocks of the plain, are conical and ridge shaped hills and a larger flatter plateau that is comprised of intrusions of dolerite rock, and form the vertical relief. The hills are about 100 m above the plain, and the plateau about 200-250 m above the plain. Existing vertical elements in the landscape are the lines of transmission pylons leading to and from existing substations, and telegraph poles. These bring some industrial character into this rural area.

A landscape may be valued for many reasons, which may include landscape quality, scenic quality, tranquillity, wilderness value, or consensus about its importance either nationally or locally, and other conservation interests and cultural associations. The site landscape appears to have some value for its wilderness value; however the site does not have a strong or identifiable sense of place.

The 25 km viewsheds for the proposed projects include Phillipstown, the R48 De Aar-Philipstown Road, R48 Philipstown-Petrusville road, R389 Philipstown-Hanover road, Burgerville road between hydra and R389, R388 from the R48 to Hopetown, the local, gravel and farm roads within this area, and rail lines north to Kimberley and south east to Middelburg and a number of farmsteads and places of work. The viewshed envelope is therefore defined partly by views from existing settlements, transport corridors and by topography, and within extensive but under-populated areas.

b) Impact assessment

Turbines on the north site would be positioned mainly on the highest ground at a distances of between 450 m and 1 000 m apart and with elevations ranging from 1 480 m to 1 680 m above sea level (asl). Turbines on the south site would be situated at elevations from 1 440 m to 1 630 m above sea level (asl).

The degree to which the proposed project would be visible is determined by the height of the turbines and rotors. Visibility is moderated by the distance over which this would be seen, the weather and season conditions and some back-grounding effect from the environment. Factors affecting visibility are the open quality of the site and the surrounding land uses and land cover.

Visual exposure refers to the visibility of the site in terms of the capacity of the surrounding landscape to offer screening. This is determined by the topography, tree cover, built form, etc. In the case of both the proposed sites the visual exposure is high i.e. there is little screening offered by the landscape.

The Zones of Visual Influence or Theoretical Visibility (i.e. affected area) for the proposed project is considered to be high as the proposed projects would strongly influence the view and act as a visual focus over significantly large areas (see **Figure 4.11** and **4.12** for the zones of visual influence of a few turbines on the north and south site, for turbine alternative 2).

Parts of the northern edge of Philipstown would lie within the zone of visual influence of the North site, with the nearest turbine just over 9 km away. Shielding would be provided by buildings and trees in the town.

A number of inhabited farmsteads are located on the sites or adjacent to the boundaries of the sites. For some there are significant elevation differences and a few of the farmsteads are located within 3 km of the nearest turbine (see **Figure 4.15**). The magnitude of the impact is considered to be high for a total number of eight of these farmsteads. Almost all the farmsteads have surrounding tree planting for shelter and this would offer some screening.

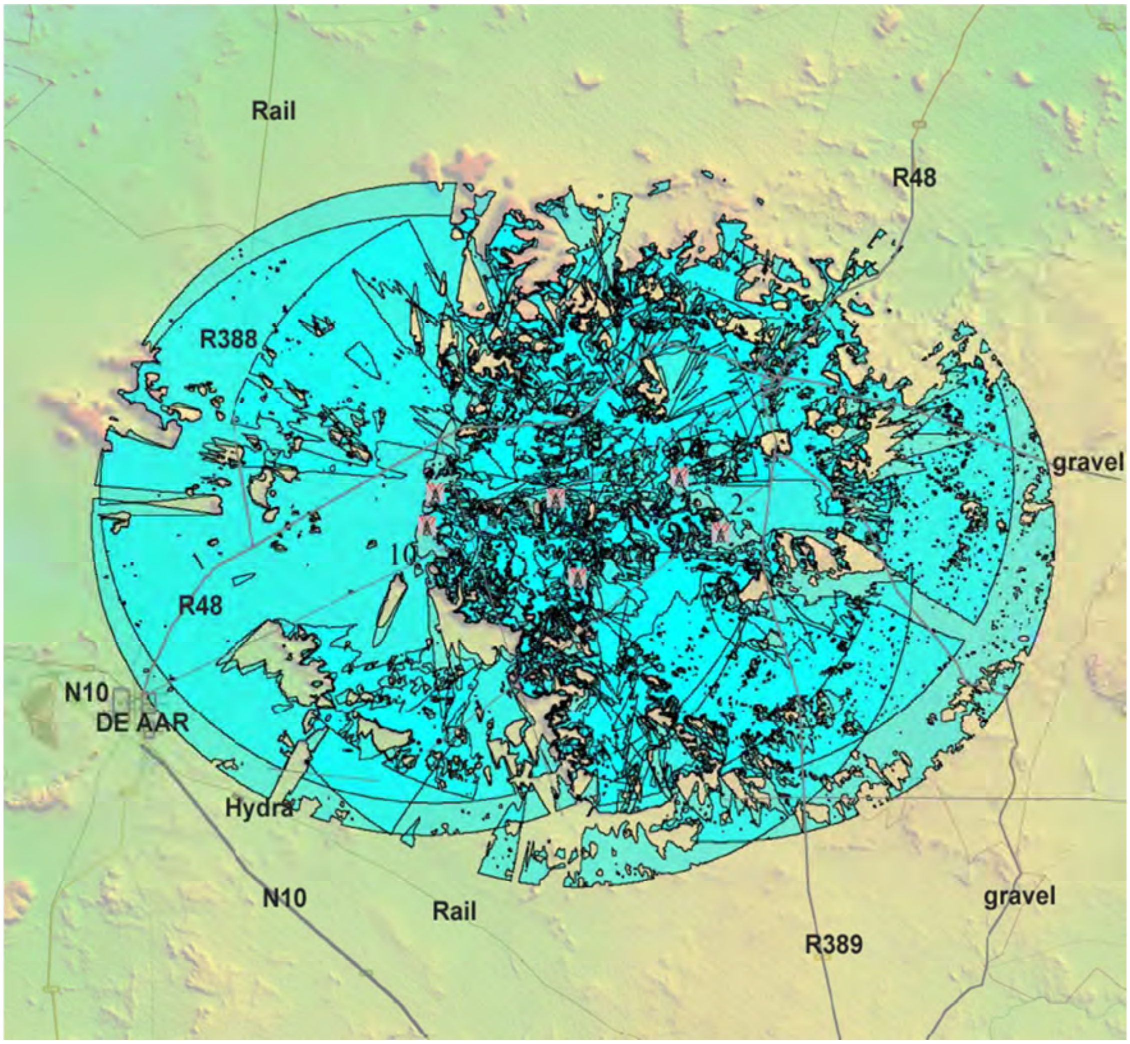

Figure 4-11: Visual envelope of turbines N23, N28, N29, N115, N141, N56 for the proposed North site for turbine alternative 2 (100 m mast, 60 m rotors). (Source: K. Hansen 2012)

The R48 De Aar-Philipstown Road carries a moderate amount of local farm and regional commercial traffic. The nearest turbines would be those on the west side of the north project and range from 3 – 6 km in distance, while the nearest turbine within the south site would be 8 km away.

The R48 Philipstown-Petrusville road also experiences moderate traffic volumes, however the visual impact is reduced by its distance to the closest turbine on the eastern side of the north site (9 km away).

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The R389 Philipstown-Hanover Road is moderately used by local and regional traffic and the nearest turbines would be those on the east side of the north project and would be about 3.5 to 4 km away. For drivers travelling north of Philipstown the turbines would be visible for approximately 32 km. The closest turbine on the South site would be 12 km away and visible for approximately 14 – 17 km.

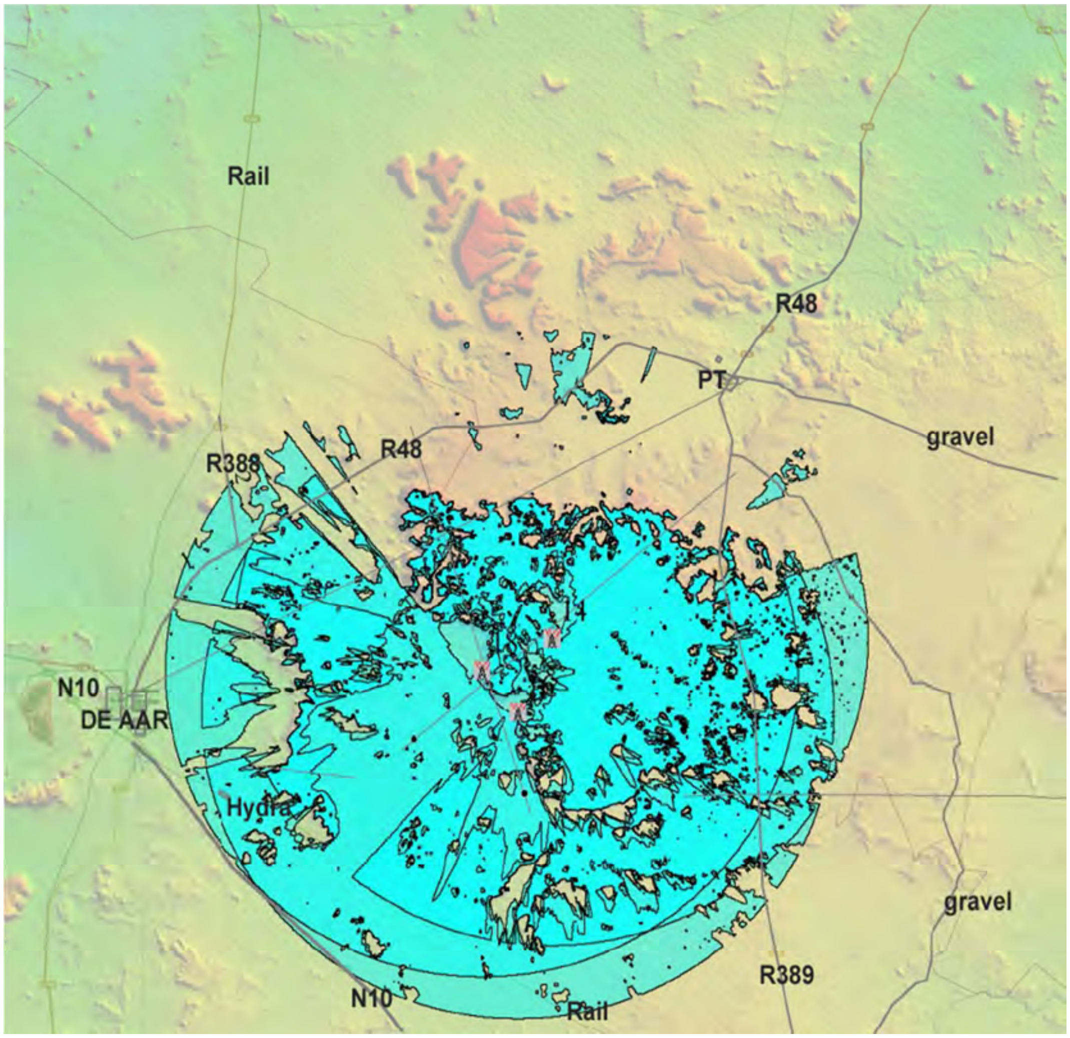

Figure 4-12: Visual envelope of turbines S83, S67, S33 on the east side of the proposed South site for turbine alternative 2 (100m mast, 60m rotors). (Source: K. Hansen 2012)

The Burgerville Road between Hydra and the R389 is a gravel road and serves a few local farms. The nearest turbines would be on the South site, about 5 km away. One of the substations may be located 2 km from the road. Road users would obtain glimpsed views of the western and eastern side of the north project, and short glimpses of the western side of the south project would be visible from the west section of the road closest to Hydra. Road users travelling in each direction and looking both ahead and to the side, would view the east side of the South site for most of the length of the road (31 km).

The R388 from the R48 to Hopetown is a well maintained gravel road which follows the rail line and carries local and commercial traffic and serves local farms in the area. Although both proposed projects would be visible to users of this road, the nearest turbines would be those of the North site, 12 km away.

A number of other local, gravel and farm roads runs within the project area and their landscape setting and the zone of visual influence would be low due to the few receptors in the area.

The zones of visual influence on the rail lines running north to Kimberley and south east to Middelburg would be low due to the shielding effect created by the distance. The Kimberley rail line mainly carries passengers and both the north and south projects are equally close at about 18 km. The rail line to Middelburg carries freight and would not be impacted on by the North site. The rail is approximately 20 km from the nearest turbine groups in the South site and would be visible.

Figure 4-13: View from the R48, 6.5 km north of the Hopetown Road, (R388), and looking at the North project turbines about 6 km away.

Figure 4-14: View from the R389 looking south and about 6 km south of Philipstown, looking at the North Project turbines which are about 4 km away and appear to be the same height as the hill

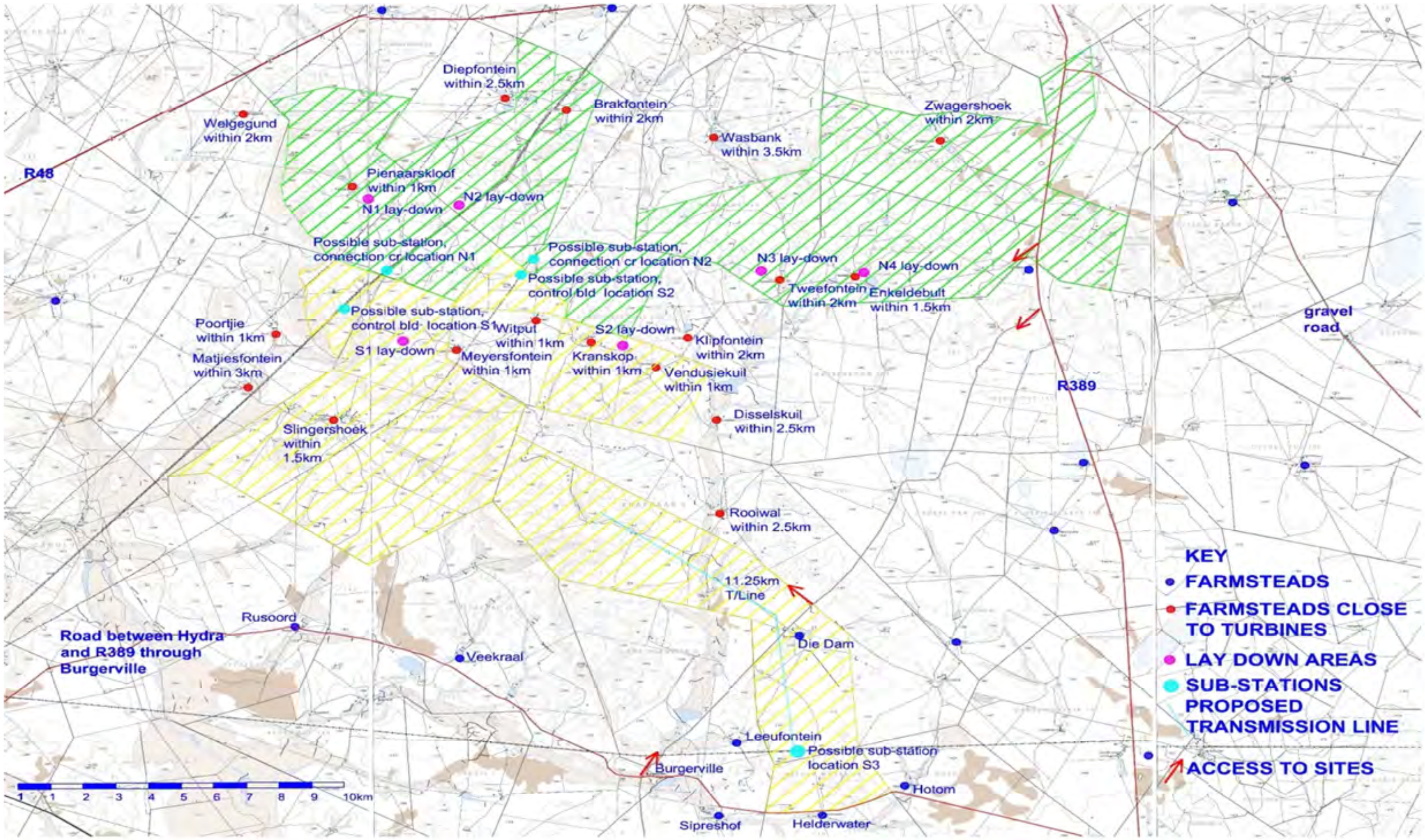

Figure 4-15 :Farmsteads on or near the sites. Farmsteads which would be within 3 km of a turbine location and deemed to be visually impacted upon by the proposed developments are shown in red. (Source: K. Hansen 2012)

Figure 4-16: View from 6 km west of the road junction at Burgerville on the gravel road between Hydra and the R389; the development would be 5 km away. This section of road presents a clear view of the South Project turbines but further to the west, the view is more broken up.

The visual influence is determined by the distance from which turbines would be visible, as well as the length of road and travelling time over which the turbines would be visible. The general zone of visual influence is assessed as moderate to low (see **Figure 4.17**).

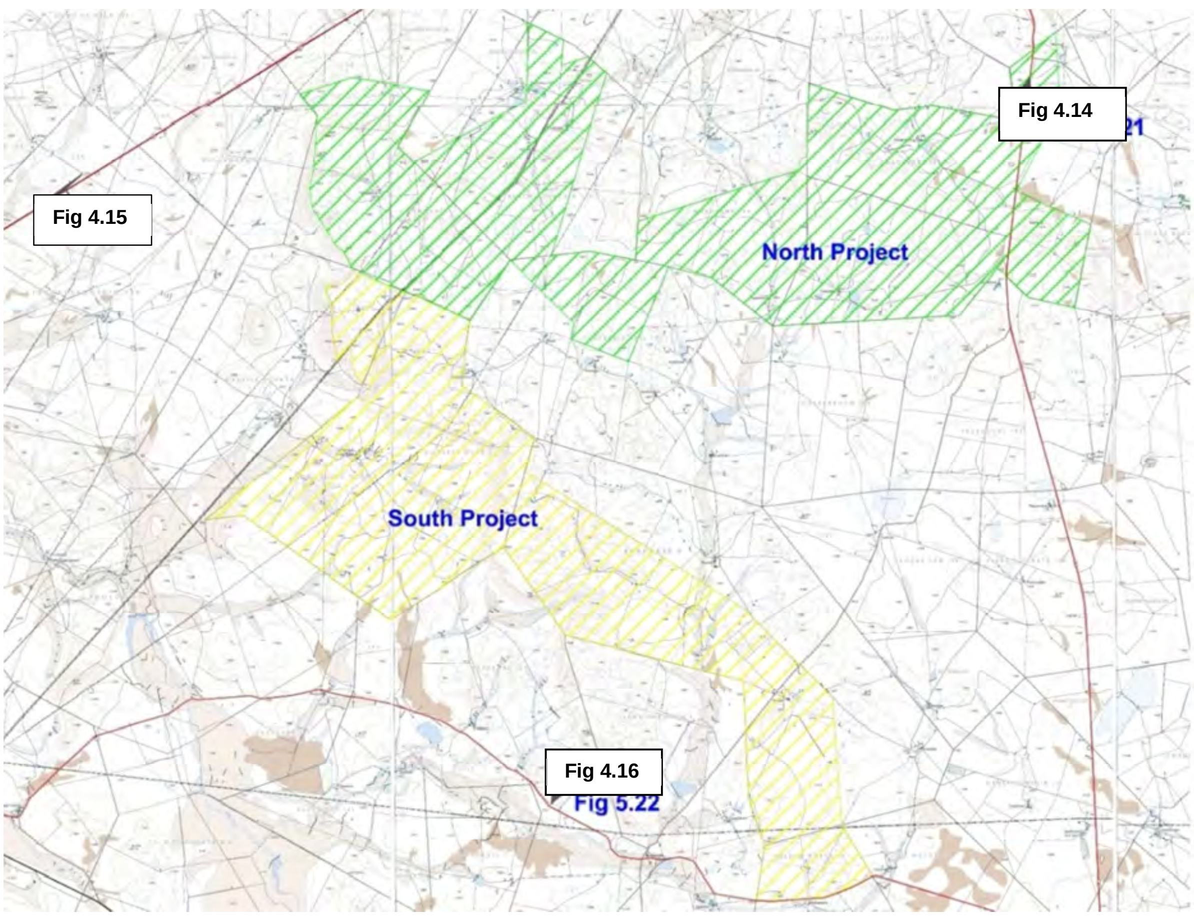

Figure 4-17: Locations of the illustrated view points. (Source: K. Hansen 2012)

The land has a rural character and the project structures would look somewhat out of place in an open upland landscape (see **Figure 4.14, 4.15 and 4.16**). There are few vertical elements in the local landscape, apart from electricity pylons. The proposed projects would change the use of rural, exposed and windswept hill lands to a semi-industrial use. The visual absorption capacity, the ability of the surrounding area to visually absorb the project, is considered to be medium. Based on these considerations, the overall potential visual impact is considered to be of high magnitude, regional extent and long term and therefore of **high (-)** significance, without or with mitigation for both sites. This potential impact remains the same for both technology alternatives as the 55 m height difference is not considered to be significant when the scale of the proposed projects are considered. Where it is at its most significant however is in proximity to farm dwellings where mast height and rotor length would be seen closely.

The potential visual impact is assessed in optimum weather conditions, when there is good visibility i.e. non – rain days from sunrise to sunset. The extent of the impact would be reduced in poor light, induced by time of day, (dusk and dawn) haze or dust in the air, and rain.

c) Mitigation measures

The following mitigation measures are recommended:

- Power lines should run underground where possible.
- The ratio between the height of the turbines and relative height of their sites should be about two thirds : one third (example 100m turbine on the summit of a 200m hill should be more acceptable).
- Paint nacelles and towers in matte white or off-white. Where it does not conflict with other specialist recommendations (e.g. avifauna) rotors should be painted in the same colour as the remainder of the turbine structure.
- Do not display brand names on turbines. Stripes of contrasting colour on the blades are similarly discouraged, where they are not as a result of mitigation of other specialist concerns, as they interfere with visual clarity.
- Fit aircraft warning lights with shields so that they are only visible to aircraft, not to receptors on the ground.
- Provide information on the proposed project to local people through a small education centre or office.
- Maintain turbines in operational condition.

d) Cumulative impacts

A number of other renewable energy projects are proposed for the area. Should these be approved it would mean additional infrastructure (such as roads and powerlines) as well as solar panels and turbines. The local landscape character would be made more industrial. In the context of the De Aar-Phillipstown area, with its long views, exposed sites, roads with little traffic and small to medium sized towns, the cumulative impact is considered to be of medium (-) significance.

4.3.3 Impact on energy production

South Africa has experienced a shortfall in electricity supply in the past few years and continues to experience constrained electricity supply. The proposed projects could impact on the ability of Eskom to provide electricity.

a) Description of the environment

Historical trends in electricity demand in South Africa have shown a consistent increase in demand. There are some years where the demand levels off or decreases but over the long term there is still an increase. Such a decrease in demand was seen in 2009 in line with the global recession, demand growth has since resumed. As a result, the reserve margin still remains low and Eskom is still short of capacity, a situation that is expected to continue until new base load capacity can be brought online from 2012 onwards. The reserve margin will again be constrained after 2018 should no new base load power stations be constructed. The proposed wind energy facilities would be able to provide power to assist in meeting the energy demand within South Africa.

In Eskom's Medium Term Adequacy Report (Week 44 of 2011) it is anticipated that the reserve margin would vary between 6.8 % (2013) and 12.7 % (2011) of Eskom's capacity and it would be necessary to import 1 500 MW of electricity annually up til 2014[26].

As noted in **Section 2.5** South Africa aims to procure 3 725 MW capacity of renewable energy by 2016 (the first round of procurement). The proposed projects could each provide 155-360 MW, or 4.0-5.4 %, of this figure.

b) Impact assessment

Given the need for increased production capacity in South Africa, as well as the targeted renewable energy figure, the potential impact of the proposed projects on energy production is considered to be of low magnitude, regional and long term and therefore of ***low (+)*** significance, without or with mitigation measures.

No difference in significance would result from the proposed alternatives.

c) Mitigation measures

No mitigation measures are recommended.

[26] http://www.eskom.co.za/c/article/803/adequacy-report-week-44/ (accessed 15/11/11)

d) Cumulative impacts

As noted previously a number of other renewable energy projects are proposed for the area, with a combined capacity of over 1 000 MW. The potential cumulative impact of these proposed projects on South Africa's energy production would remain of *low (+)* significance.

4.3.4 Impact on local economy (employment) and social conditions

The establishment of the proposed wind energy facilities would provide a number of direct, indirect and induced jobs. Direct jobs are created during manufacturing, construction and installation, operation and maintenance. The proposed projects would also result in a large amount of expenditure in South Africa, both to procure services (e.g. transportation services) and materials (e.g. road building materials).

a) Description of the environment

De Aar is located within the Emthanjeni Local Municipality (LM) of the Pixley ka Seme District of the Northern Cape. The Emthanjeni LM had a total population of 38 612 in 2010 and an average annual population growth rate of -0.7 % (1996-2008) (Urban-Econ, 2010 in DJ Environmental Consultants, 2010). Although the unemployment rate is only 26 %, the economically inactive population amounts to 46.9 %. The skills levels in the municipality is generally low (32 % of labour force are unskilled workers) as is annual household income (79.8 % of households earn low-income annual salaries). The four main languages spoken in the Northern Cape is Afrikaans, English, IsiXhosa and Tswana.

According to a Socio-economic Impact Assessment (Urban-Econ, 2010 in DJEC, 2010), the local area has a diverse economy, while the main sectors contributing to the Gross Geographic Product (GGP) in 2008 included the financial and business services sector(21.6 %), the general government sector (21.1 %) and the trade sector (15.5 %). The general government sector employs more than 24 % of the share of total labour, while the agricultural sector employs 21.5 % of the labour and a total of 19 % of the labour is employed in the trade sector.

De Aar has the largest abattoir in the southern hemisphere and supplies all the major centres throughout the country with the famous "Karoo" lamb and mutton. Sheep farms around De Aar are also major suppliers of wool (Emthanjeni Local Municipality, 2009).

De Aar is a declared industrial growth point and is trying to position itself as an attractive location for industry in the Northern Cape[27]. Industrial sites are reasonably priced and De Aar is centrally located with excellent rail and road links. De Aar is the second most important railway junction in the country as its central to Gauteng, Cape Town, Port Elizabeth and Namibia (Macroplan, 2007).

[27] http://www.deaar.co.za/, accessed 29/10/11

Philipstown is located within the Renosterberg Local Municipality (LM) of the Pixley ka Seme District of the Northern Cape. Phillipstown falls primarily in a farming region comprising of mostly wool industries and hunting lodges.

The site is located in a rural area and as such the population density is very low, with neighbouring farms located great distances from each other. The De Aar area has large areas of land which are very dry and the farmers struggle to earn a living from the land. Employment opportunities in the immediate area predominately stem from farming.

b) Impact assessment

The establishment of the proposed wind energy facilities would provide a number of direct, indirect and induced jobs. Direct jobs are created during manufacturing, construction and installation, operation and maintenance.

The proposed projects would have workforce comprising at least 50 % local labour. Approximately 420 and 320 jobs during the pre-construction and construction phases for the proposed northern and southern facilities, respectively and 35 and 30 jobs during the operational phase for the proposed northern and southern facilities, respectively, would be created. Indirect and induced jobs would also result from the proposed projects. It is important to note that the number of jobs does not equate to the number of people employed. This is expressed in job years. A job year is equivalent to one year of work e.g. a person who works from age 20 to 65 has worked 45 job years.

Increased employment opportunities (direct and indirect) would allow for an improvement in social conditions for those who obtain employment. The proposed projects would also result in an increase in the revenue of the Local Municipality through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes. Increased spending (procurement of goods and services) in South Africa would indirectly result in more employment opportunities.

Based on the number of employment opportunities during the operational phase the potential impact on the local economy (employment) and social conditions is considered to be medium magnitude, regional and long term and therefore of ***medium (+)*** significance, with or without mitigation.

No difference in significance would result from the proposed alternatives.

c) Mitigation measures

The following mitigation measures are recommended:

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities.
- Give preference to local communities for employment opportunities.

- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.
- Base recruitment on sound labour practices and with gender equality in mind.

d) Cumulative impacts

As noted previously, many other renewable energy projects are proposed for the area. The potential cumulative impact of these proposed projects on employment and socio-economic conditions in the local area would remain of *medium (+)* significance.

4.3.5 Impact on agricultural land

The site is used for agricultural purposes, consisting mostly of sheep grazing. The foundations of the wind turbines would cover an area of approximately 15 m x 15 m, which could be recovered with top soil to allow vegetation growth around the 6 m diameter steel tower. Furthermore, hardstandings of 20 x 40m are required to erect turbines, access roads and powerlines all add to the footprint of the proposed projects. The footprint of the proposed development would reduce the area available for agriculture. As such Mr Kurt Barichievy of SiVEST (Pty) Ltd was appointed to undertake a desktop Agricultural Impact Assessment. A desktop review was undertaken and due to the size of the projects two separate site visits were undertaken by Mr Barichievy on 21 – 25 November 2011 and 10 – 14 December 2011 in order to inform the Agricultural Impact Assessment. The study considered climate, soils, terrain, land capability, geology, current agricultural practices and agricultural potential. The Agricultural Impact Assessment is included in **Annexure L.** The findings and recommendations of the study are summarised below.

a) Description of the environment

In terms of this study, agricultural potential is described as an area's suitability and capacity to sustainably accommodate an agricultural land use. A study of local agricultural practices was also carried out.

Climate
The study area has a semi-arid to arid continental climate with a summer rainfall regime i.e. most of the rainfall is confined to summer and early autumn. Mean Annual Precipitation (MAP) is approximately 300 mm per year. An MAP of 300 mm is deemed low as 500 mm is considered to be the minimum amount of rain required for sustainable dry land farming. Without some form of supplementary irrigation natural rainfall for the study area is insufficient to produce sustainable harvests. This is reflected in the lack of dry land crop production within the study area.

De Aar typically experiences hot days and cold nights with the highest maximum temperature of approximately 40^{o}C and the lowest minimum temperature of approximately - 8^{o}C. Evaporation is estimated to be in the region of 2 000 mm per annum and the area is subjected to very severe moisture availability restrictions Agricultural Geo-Referenced Information System (AGIS, 2012). In summary the climate for the study area is severely restrictive to arable agriculture which is primarily due to the lack of rainfall and severe moisture availability restrictions.

Geology

The study area is underlain by a variety of parent materials including dolerite, mudstone, shale and tillite. Dolerite, a basic igneous rock dominates the central regions of both the North and South sites. These areas coincide with the top of the plateau which comprises most of the sites. Shale and mudstone geologic materials are found on the plains which surround the plateau. Shale, a clastic sedimentary rock, is formed by the settling and accumulation of clay rich minerals and other sediments. Due to the settling process this parent material usually takes the form of parallel rock layers which lithify[28] over time.

Like shale, mudstone is also clastic sedimentary rock which is formed from the lithification of deposited mud and clay. Mudstone consists of a very fine grain size of less than 0.005 mm but unlike shale it is mostly devoid of bedding. Pockets of tillite, consisting of consolidated masses of unweathered blocks and unsorted glacial till, also dot the study area.

Slope

The plateau terrain influences climate and soil characteristics and thus plays a dominant role in determining whether land is suitable for agriculture. The steep cliffs which form an arrow head shape towards the north western corner of the study area are the most prominent topographical feature. These cliffs divide the flat lower plains with the more undulating plateau. Away from these cliffs the study area is generally flat with an average gradient of less than 10 %.

Land use

The proposed site consists of a mix of natural veld and unimproved shrubland which is used as general grazing land for sheep, goats and cattle. Grazing land is interspersed with incised river channels which flow intermittently and seasonal pans occur through the landscape. According to the spatial databases there are no cultivated fields or irrigated lands.

Soils

The Environmental Potential Atlas for South Africa (ENPAT) for the Northern Cape Province shows the majority of the study area is dominated by shallow Red Apedal (structureless) soils with a high base status. The southern portion of the site is underlain by Glenrosa and Mispah soil forms. These forms are associated with shallow soils, where parent rock is found close to the land surface. The entire study area is classified as having an effective soil depth (depth to which roots can penetrate the soil) of less than 0.45 m deep, which is a limiting factor in terms of sustainable crop production.

Agricultural potential

Climate is the overriding and major limiting factor for agricultural potential at both sites. The combination of low rainfall and an extreme moisture deficit means that sustainable arable

[28] The process whereby loose mineral fragments and/or particles of sand are solidified into rock.

agriculture cannot take place without some form of irrigation. The sites do not contain nor are they bounded by a reliable surface water irrigation resource and the use of borehole water for this purpose does not seem agriculturally and economically feasible.

The majority of the sites contain soils which are not suitable for arable agriculture but remain suitable to grazing and forestry (only where climate permits). A restrictive climate rating, due to low rainfall and moisture/heat stress dramatically reduces the agricultural potential of the projects area. The ENPAT Database provides a summary of the study area's agricultural potential based on its soil characteristics. It should be noted this spatial dataset does not take the prevailing climate into account.

Taking all the site characteristics (climate, geology, land use, slope and soils) into account, the actual agricultural potential for the majority of the study area is classified as being extremely low for crop production and moderate to moderately low for grazing. The poor agricultural potential rating is primarily due to climatic characteristics and soil depth limitations. The site is not classified as high potential nor is it a unique dry land agricultural resource.

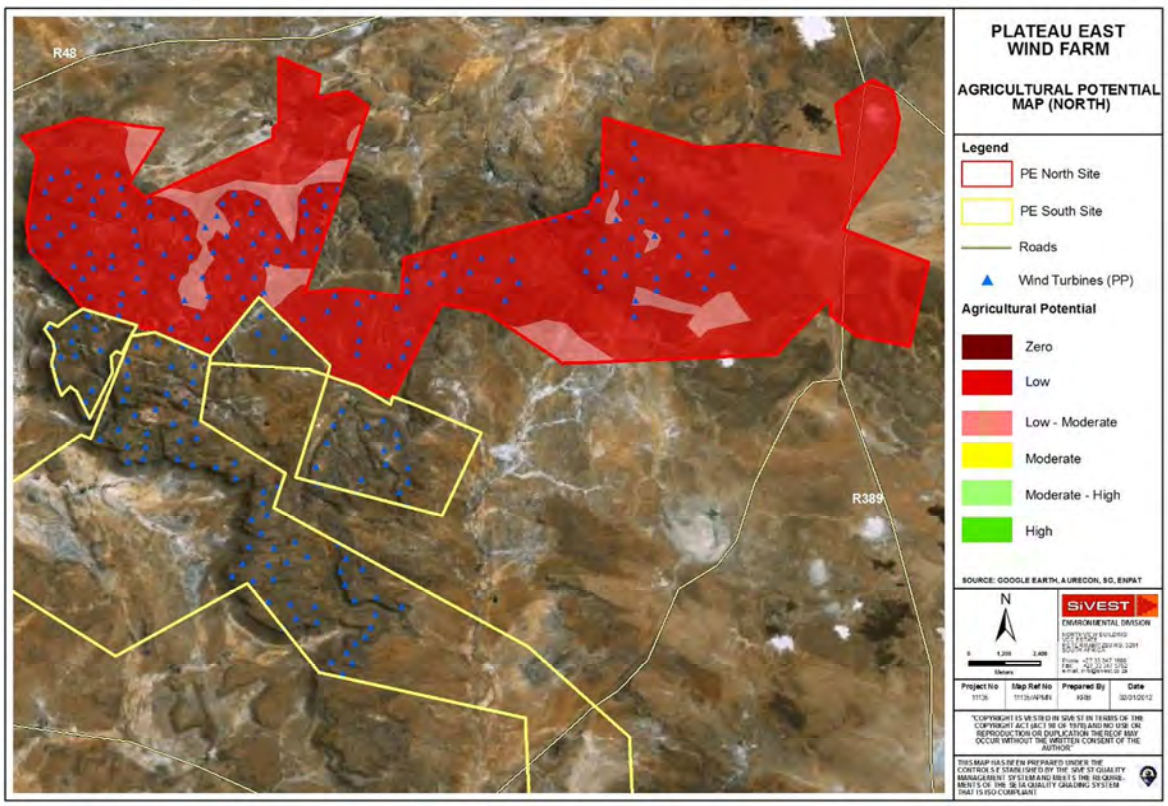

Figure 4-18: Agricultural potential map for the north site. (Source: SIVEST 2012)

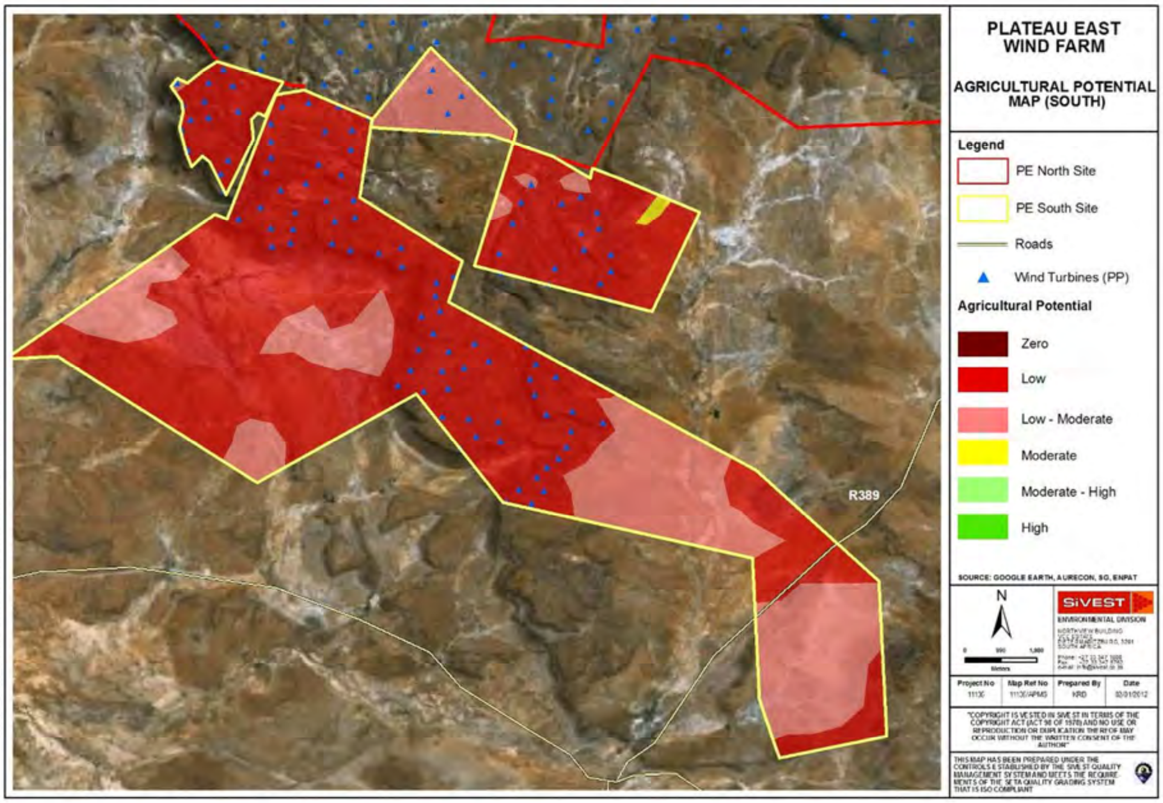

Figure 4-19: Agricultural potential map for the south site. (Source: SIVEST 2012)

b) Impact assessment

The proposed developments' primary impact on agricultural activities would involve the construction of the wind turbines and associated infrastructure. The construction of these turbines would only influence a small area of the total farm portion. The total loss of grazing land would be less than 1 %. Normal grazing (the dominant agricultural activity) would be permitted around the turbines. Both the North and South sites are dominated by grazing land and this activity is considered non-sensitive when assessed within the context of the proposed projects. There are no centre pivots, irrigation schemes or active agricultural fields which would be influenced by the proposed projects.

Furthermore, due to minimum wind speed requirements and to optimise power generation, the various wind turbines have been positioned on top of the plateau and kopjes. The onsite soil survey indicated that these areas are dominated by rocky and shallow soils with an inherently low agricultural potential. Thus the direct impact of the wind turbines on soil resources would be of local extent, very low magnitude and long term and therefore of **very low (-)** significance, without mitigation for both sites.

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

The potential cumulative impact of the two proposed projects is considered to be very low (-) due to minor loss of agricultural land.

4.3.6 Impact of noise

Currently the study area has a rural character in terms of the background sound levels. The potential exists for noise from the proposed wind turbines to affect surrounding landowners and the ambient noise environment. As such Mr Morné de Jager of M^2 Environmental Connections was appointed to undertake a specialist study and a site visit was undertaken on the 29 and 30 December 2011 to inform the Noise Impact Assessment (NIA). The study considered the current ambient sound character and undertook noise propagation modelling for both the construction and operational phases. Potentially sensitive receptors were initially identified using Google Earth®, supported by the site visit to confirm the status of the identified dwellings. The area studied in terms of the noise impact of the proposed projects is approximately 600 km^2 and includes an area up to a radius of 2 000 m beyond the proposed wind turbines. The Noise Impact Assessment is included in **Annexure K**. The findings and recommendations of this study are summarised below.

a) Description of the environment

The proposed projects would be developed in a rural area that is mountainous. The R399 crosses the North site in the east, although this road is more than 6 km from the top of the plateau. This provincial road carries significant traffic during the day yet is relatively quiet during the night. There are a number of gravel roads traversing the proposed sites, mainly used by the farmers in the area. Currently traffic on these roads is insufficient to significantly impact on the ambient sound levels in the area.

b) Impact assessment

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are: intensity, loudness, annoyance and offensiveness.

Noise emitted by wind turbines can be associated with two types of noise sources. These are aerodynamic sources due to the passage of air over the wind turbine blades and mechanical sources that are associated with components within the turbine, such as the gearbox and generator. Mechanical noise from wind turbines is generally perceived as audible tones that are associated with components of the power train within the turbine. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise emitted from the proposed projects.

The exact make and model of wind turbine to be used is not yet known. It was decided that the Vestas V90 2.0MW VCS wind turbine would be used to illustrate, identify and model potential noise impacts. The final turbine selection would be dependent on wind data (different turbines are better suited to different wind conditions) as well as financial considerations.

It should be noted that wind-induced noises are usually seen as unwanted noises, and samples reflecting significant background interference due to wind-induced noises are normally discarded. However, for the purpose of this study, it was opted to include all measurements taken because the typical operating noise of the proposed facilities would only be emitted during times when wind-induced noise levels are relevant.

The day time period (working day) was not considered in the NIA as noise generated during the day by the proposed projects would generally be masked by other noises from a variety of sources surrounding potentially noise-sensitive developments.

Projected noise levels in the area due to the operation of the proposed facilities are illustrated in **Figure 4-20** illustrating the cumulative impact from the proposed facilities with all the wind turbines operating.

The operation of the proposed wind energy facilities would alter the existing ambient sound levels. The changes in ambient sound levels are important as noise-sensitive receptors would become aware of the increased noise levels and may result in noise complaints. Excluding Potential Sensitive Receptor (PSR) 1, the homestead on Vendussiekuil (see **Figure 4.20)**, the operation of the proposed projects would not have any noise impact on any other identified potential noise-sensitive development

The proposed facilities would be situated in an area dominated by agricultural use with the only significant towns in the area being relatively far away. The potential exists for noise from the proposed wind turbines to affect surrounding landowners and one landowner in particular, PSR1, was identified who would most likely be impacted by the noise. However, the layout was revised to allow for a minimum 1 000 m buffer around this receptor.

Based on the above considerations, the significance of the noise impact is considered to be of low intensity, local extent and long term and therefore of **low (-)** significance for the proposed South project, without mitigation. The significance after mitigation is considered to be **very low (-) – no impact**.

a) Mitigation measures

No mitigation is recommended for the proposed North site. A number of alternative mitigation measures are provided below, any one of which could be implemented to reduce the potential noise impact for the proposed South site, should the receptor (PSR1) lodge a reasonable noise complaint:

- Use a quieter wind turbine, possibly with an increased setback from the sensitive receptor, in order to reduce sound levels at the sensitive receptor.

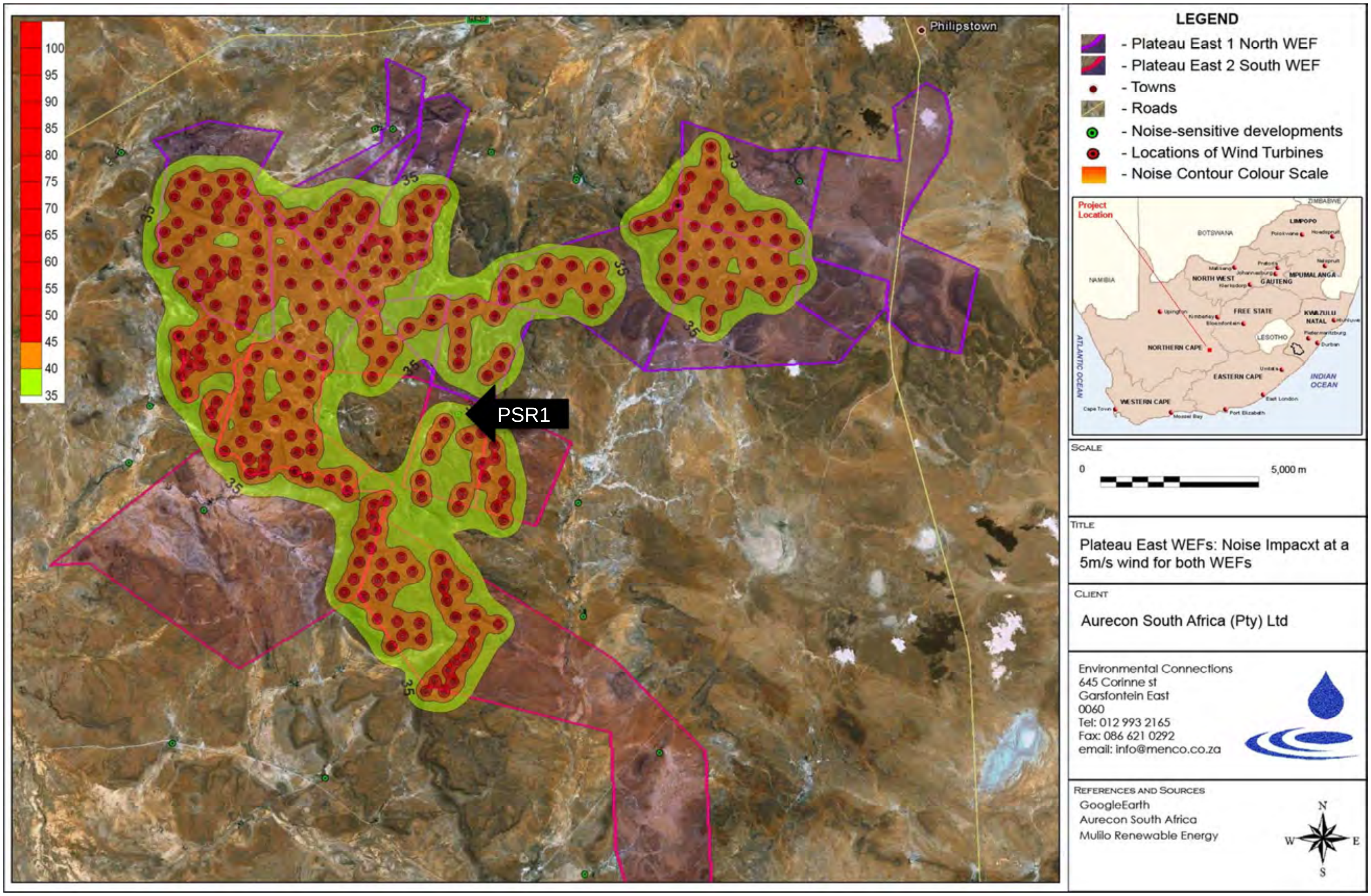

Figure 4-20: Projected noise levels (ISO model) showing contours of constant sound levels for a 5 m/s wind with both proposed projects operating (based on original layouts). (Source: MENCO 2012)

- Operating all, or selected wind turbines in a different mode. Most manufacturers allow the turbines to be operated in a different mode. This allows the wind turbine generator to operate more silently, albeit with a slight reduction of electrical power generation capability;
- Problematic wind turbines could also be disabled, or the rotational speeds significantly decreased during periods when a quieter environment is desired (and reasonable complaints registered).
- Should the receptor be amenable, relocate the receptor to a location agreed to with the receptor, outside of the projects footprint.

b) Cumulative impacts

The impacts of the two proposed projects considered cumulatively are no higher than each of the individual impacts, namely low (-) significance. As no other wind energy facilities are proposed in the vicinity it is not anticipated that any further cumulative noise impacts would result.

4.4 CONSTRUCTION PHASE IMPACTS ON THE BIOPHYSICAL AND SOCIAL ENVIRONMENTS

The construction phase is likely to result in a number of negative impacts on the biophysical and the social environment. The following potential impacts have been identified as relevant to the construction of the proposed projects:

- Disturbance of flora, avifauna, bats and fauna;
- Sedimentation and erosion of water ways;
- Impact on heritage resources including palaeontology;
- Visual impacts;
- Impact on local economy (employment) and social conditions;
- Impact on transport;
- Noise pollution;
- Storage of hazardous substances on site; and
- Dust impact.

The significance of construction phase impacts is likely to be limited by their relatively short duration, since the construction phase should last approximately 18 months. Many of the construction phase impacts could be mitigated through the implementation of an appropriate EMP. A life-cycle EMP is contained in **Annexure M** of this report, which specifies the mitigation measures that could be implemented to mitigate construction phase impacts, amongst others.

4.4.1 Impact on ecology

The primary potential ecological impacts from the proposed projects would arise from (a) impacts on indigenous natural vegetation and (b) establishment and spread of declared weeds and alien invader plants and animals.

As noted in Section 4.2.1, there are no threatened, near threatened, declining or rare plant species that occur in the area. There are three protected plant species that have a geographical distribution that includes the sites, but they were not found on site and, based on a field evaluation of the site, they are unlikely to occur there.

The Black-footed Cat and Cape Fox, both protected species that could be found on site, are both highly mobile animals and would move out of the path of any construction activities. If either of these species occur in the area, they are likely to return to site after construction of the facilities.

There is the potential for invasive alien plants, such as Mesquite, to spread or invade the area following disturbance on site.

The greatest impact during construction is as a result of roads, which would cover an area of approximately 28 ha (approximately 70 km x 4 m) for the north site and approximately 20 ha (approximately 50 km x4 m) for the south site.

Based on the above, the potential impact on ecology is considered to be of local extent, medium magnitude and long term and therefore of **medium (-)** significance, without mitigation, for both sites. With mitigation this potential impact would remain **medium (-)** significance for both sites. However, the impact is considered to be acceptable based on the low sensitivity of the vegetation and its widespread distribution. No difference in significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbines and laydown area.
- Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible, using site-appropriate indigenous species.
- Any invasive alien plants within the control zone of the applicant must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.
- Existing access roads must be used, where possible, as the location for new roads; Steep slopes must be avoided when routing roads, where possible.
- Service roads for the projects' powerlines must be properly maintained to avoid erosion impacts.

4.4.2 Disturbance of avifauna

The primary potential avifaunal impacts would arise from (a) disturbance caused by vehicular and people traffic during construction, (b) displacement caused from habitat loss, disturbance during the construction phase and from maintenance activities. The construction phase would result in temporary damage or permanent destruction of habitat large than this area. This could have a lasting impact in cases where the site coincides with critical areas for restricted range, endemic and/or threatened species. Furthermore, construction activities could disturb breeding, foraging or migrating birds. Bird species of particular concern, which may be affected, include the Southern Pale-chanting Goshawk, Black-chested Snake-eagle, Greater Flamingo Verreaux's Eagle, Martial Eagle, Greater Flamingo, Ludwig's Bustard and Blue Crane.

The construction of the proposed projects are envisaged to have a potential impact on avifauna of medium magnitude, site specific extent and short to long term and therefore a **medium (-)** significance, without mitigation, for both sites. With implementation of mitigation measures this impact would reduce to **low - medium (-)** significance for both sites. No difference in significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Restricting the construction footprint to a bare minimum.
- Demarcation of 'no-go' areas identified during the pre-construction monitoring phase to minimise disturbance impacts associated with the construction of the facility.
- Reducing and maintaining noise disturbance to a minimum particularly with regards to blasting on the ridge-top associated with excavations for foundations. Blasting should not take place during the breeding seasons of the resident avifaunal community and in particular for priority species (June-September). Blasting should be kept to a minimum and, where possible, synchronized with neighbouring blasts.

4.4.3 Disturbance of bats

During the construction phase of the projects, turbine and infrastructure construction activities may result in loss of foraging and roosting habitat. The extent of the impact is site specific and the magnitude regarded as ranging from low to very low, resulting in a significance rating of **low - very low (-)** without mitigation and **very low (-)** with mitigation measures applied for both sites.

The following mitigation measures are recommended:

- Construction of any wind turbines in the areas designated as having a High Bat Sensitivity should be avoided.

4.4.4 Sedimentation and erosion impacts

The study area falls within the arid region of South Africa. Average annual rainfall is low (196 mm). The main aquatic features within the study area are the Brak and Hondeblaf Rivers, seasonal tributaries within the Orange River System and a number of pans.

The sediment loads of any drainage depressions or pans may increase due to the excavations on the site, the laying of linear infrastructure such as roads or power lines across drainage lines and other construction related activities.

The potential impact of sedimentation and erosion from the construction of the proposed projects are considered to be of medium to high magnitude, site specific and short term and therefore of **low (-)** significance, without mitigation for both sites. The potential of this impact would reduce to **very low (-)** significance, after mitigation, for both sites

The following mitigation measures are recommended:

- Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. A buffer of 30 m should be maintained adjacent to the identified freshwater features, and 75 m for the pans at Slingershoek.
- Any of the cleared areas that are not hardened surfaces are rehabilitated after construction is completed by revegetating the areas disturbed by the construction activities with suitable indigenous plants. Invasive alien plants that currently exist within the immediate area of the construction activities should also be removed and the sites.
- To reduce the risk of erosion, the locality of the turbines should preferably not be on any steep slopes. Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines.
- Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100maway from the river system and regularly serviced. These measures should be addressed, implemented and monitored in terms of the EMP for the construction phase.
- Minimise duration and extent of construction activities in the river – construction should also preferably take place in the low flow season.
- Clearing of debris, sediment and hard rubble associated with the construction activities should be undertaken post construction to ensure that flow within the drainage channels are not impeded or diverted.
- Rehabilitate disturbed stream bed and banks and revegetation with suitable indigenous vegetation.
- The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed projects. For new access roads to the turbines, these should rather be along the ridges of the hills than in the drainage/stream beds.
- Where access routes need to be constructed through ephemeral streams, disturbance of the channel should be limited.
- Wetland and pan areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 30m buffer zone as far as possible.
- All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.
- Road infrastructure and cable alignments should coincide as much as possible to minimize the impact.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

4.4.5 Impact on heritage resources

Given the common occurrence of heritage resources on site, as indicated in Section 4.3.1, it is likely that heritage resources would be encountered during construction.

a) Impact Assessment

The proposed wind energy facilities have potential to produce a wide range of impacts that would affect the heritage qualities of an area. During the construction phase of the project, activities such as bulldozing of access roads to turbine sites and excavation of tower foundations and cable trenches may result in the following impacts on the landscape and heritage environment:

- Displacement of pre-colonial and colonial archaeology material at turbine footings, access roads and trenches
- Accidental damage and/or vandalism to the build environment, such as farmsteads, sheds and workers' cottages
- Destruction of cemeteries and graves which are not clearly marked
- Negative visual impact of construction of turbines, substations and overhead transmission lines on the cultural landscape of the Great Karoo.

The volume and widespread distribution of MSA material of relatively low heritage significance over the entire plateau results in an overall impact of relatively small magnitude, except for a single "factory" site on the farm Knapdaar (South site) which may be negatively affected. LSA is of greater significance because the material is relatively sparse on the plateau and may provide valuable information on LSA settlements in the area. Historic kraal complexes represent an unrecorded part of the 19^{th} century farming settlement patterns in this part of the Karoo and their destruction will result in a loss of heritage.

Some of the access roads run in close proximity to farmhouses, historic farm sheds, ruins and engraving sites and so the heritage sites may be vulnerable to destruction and vandalism unless these roads are re-routed or measures taken to conserve the heritage sites. Engravings in the form of 19^{th} century historic graffiti by Boer soldiers were recorded on the South site on the farm Slingershoek, located on a little koppie behind the main farmhouse, but these would not be impacted by the proposed projects as they are on the lowlands.

Although no visible farm cemeteries or graves were identified within the footprint of the development, the excavation of turbine footings and cable trenches and the construction of access roads may result in the destruction of cemeteries and graves which are not clearly marked. A number of graves were recorded on the farm Zwagershoek, on the North site, but these would not be impacted on by the proposed project as they are located on the lowlands.
The wind energy facilities are planned to be constructed a plateau which rises about 100 m above the plains and visible from a number of local roads. The potential visual impacts of the proposed projects are assessed in **Section 4.3.2**. The cultural landscape around De Aar is representative of the great Karoo and the potential visual intrusion caused by the facility would not result in the loss of a significant portion of the Karoo cultural landscape.

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Based on the above considerations the potential impact on the archaeological and historical resources found on both the North and South sites is considered to be of local to national extent, medium magnitude and permanent nature and therefore of **medium to high (-)** significance, without mitigation for all alternatives. With the implementation of mitigation measures the potential impact is likely to be local and of **low (-)** significance, for both sites, as little to no impact is foreseen. No difference in significance would result from the proposed alternatives.

b) MITIGATION MEASURES

The following mitigation measures are recommended:

- Areas known to have sensitive archaeological sites should be avoided. An archaeologist should be involved in the placement of the turbines and associated infrastructure in these sensitive areas.
- If mitigation by avoiding sensitive archaeological sites is not feasible, sampling and recording of the archaeological site before its destruction must be undertaken.
- In the case of unexpected exposure of below-ground archaeological material during excavations, SAHRA must be consulted immediately to ensure timeous implementation of appropriate mitigation measures.
- At least one LSA site on the North site and one MSA “factory” site and two LSA sites on the South site will require targeted sampling and excavation to allow for more accurate characterization of the archaeological finding.
- Old buildings should be fenced off during construction to avoid vandalism of the buildings, kraal complexes must be avoided and access roads re-routed to avoid damage to the buildings.
- A 500 m buffer should be implemented around farmsteads, buildings, sheds, kraals etc.
- In the event of accidental uncovering of graves, work must stop immediately and the SAHRA Burials Unit should be notified. An archaeologist should be involved to assist with the investigation and procedures to address the situation.

c) Cumulative Impacts

Generally the cumulative impact of the two proposed wind energy facilities on the plateau may result in significant loss of archaeological knowledge if no mitigation occurs. Considering the number of renewable energy applications in the area it is likely that there will be further cumulative impacts. However, should each of these sites be adequately mitigated it is likely that cumulative impacts would be of low (-) significance.

4.4.6 Impact on palaeontology

The project sites are situated in an area of the Northern Cape and Karoo known for the presence of potentially fossiliferous Palaeozoic rocks of the Karoo Supergroup, consisting of Ecca and Beaufort Groups. Due to this underlying geology of the area, there is a possibility of finding palaeontological material during excavations on site. A large scale development such as the proposed project could have a negative impact on the palaeontological resources by damaging or destroying such material or by requiring the material to be removed and stored *in situ*.

Palaeontology Impact Assessment (PIA) was therefore undertaken by Dr John Almond. The assessment was based on a desktop review and field-based assessment of the paleontological aspects in the project area and included a site visit on 8 to 12 January 2012. The PIA is included in **Annexure H**. The findings and recommendations of the study is summarised below.

a) Description of the environment

The geology of the project areas near De Aar is mainly the Karoo Supergroup. The region is of special geological and palaeontological interest in that the stratigraphic boundary, between the Ecca Group (largely composed of freshwater inland sea rocks) and the overlying continental sediments of the Beaufort Group, runs between the escarpment edge and De Aar.

The geological map of the region east of De Aar indicates the following rock units within the project area (see **Figure 4.21**):

- Tierberg Formation (Ecca Group);
- Adelaide Subgroup (Lower Beaufort Group);
- Intrusive dykes and sills of the Karoo Dolerite Suite;
- Neogene to Quaternary calcretes;
- Quaternary to Recent superficial deposits (alluvium, colluvium, etc); and
- Kimberlite pipe.

The plateau is fairly rugged, typical dolerite terrain with the escarpment slopes almost entirely mantled in doleritic colluvium, with very little bedrock exposure of Karoo Supergroup country rocks beneath the sill. The terrain surrounding the plateau is less rugged, being underlain by softer-weathering mudrocks and sandstones of the Karoo Supergroup, and extensively mantled with alluvium and soils.

The Ecca and Beaufort Group sediments of the Karoo Supergroup generally have a moderate to high palaeontological sensitivity respectively, while the superficial sediments and dolerite intrusions are of low to zero sensitivity. Rare kimberlite pipes of Createaceous age are unfossiferous and are not associated with preserved crater lake deposits or diamonds.

The upper Ecca Group bedrocks in the De Aar area contain well-preserved, locally abundant fossil wood as well as low diversity trace fossil assemblages typical of the Middle Permian Waterford Formation. The trace fossils include various invertebrate burrows as well as possible tracks and partial body impressions of large crocodile-like amphibians.

Although natural and artificial exposures of Lower Beaufort Group bedrocks (Adelaide Subgroup) are exceedingly sparse in the De Aar region, several of the localities investigated yielded fragmentary to semi-articulated vertebrate remains. The localities of the finds are located on the low ground of the study area and are indicated in **Figure 4.22** and **4.23**.

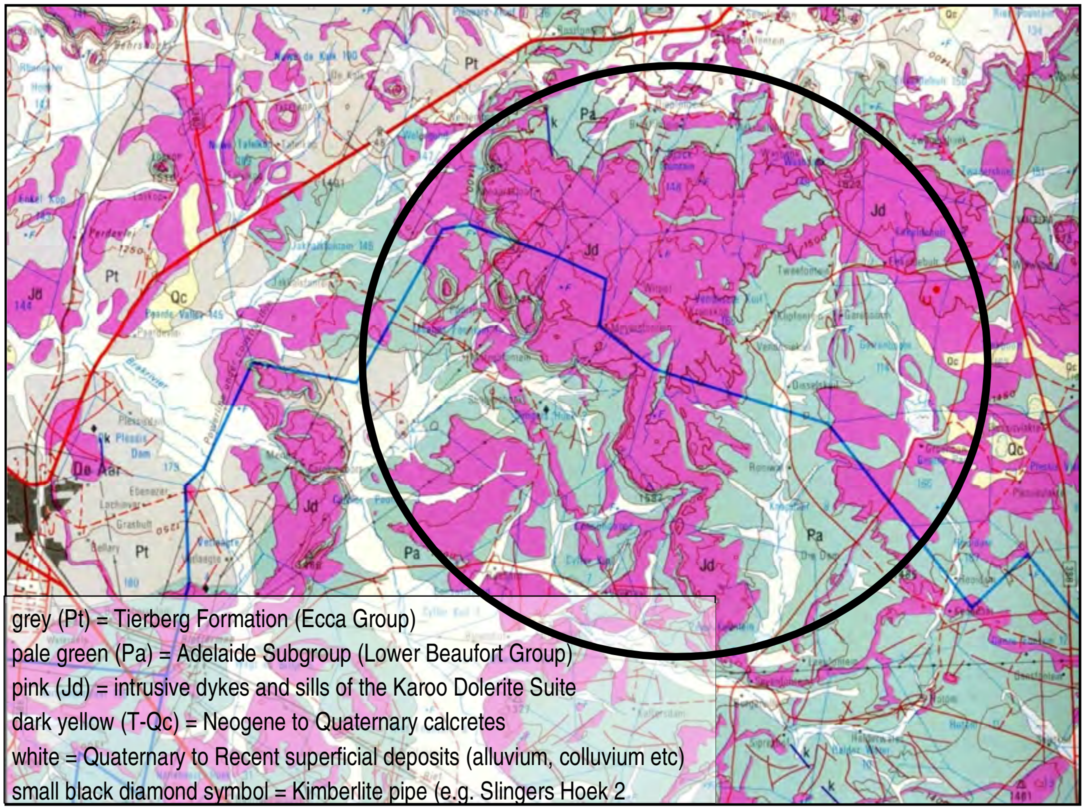

Figure 4-21: Geological map of the region east of De Aar, Northern Cape, showing in very broad outline the location of the proposed projects on the eastern plateau c. 20km east of De Aar (Abstracted from 1: 250 000 geology sheet 3024 Colesberg, Council for Geoscience, Pretoria) (Source: Natura Viva 2012).

The fragments are among the first ever recorded in this part of the Karoo. They include skull and postcranial remains of small therapsids (probably the small dicynodont *Diictodon*) as well as a partial specimen of the rare tortoise-like parareptile *Eunotosaurus*. Other fossil groups recorded from these rocks in the study area include transported plant material (horsetail ferns), **(Figure 4.25)** and well-preserved silicified wood **(Figure 4.24).** These fossil remains probably belong to the *Pristerognathus* Assemblage Zone of late Middle Permian age that is associated to the west with the Poortjie Member of the Teekloof Formation. Fossils are sparsely distributed but *not* very rare within the Lower Beaufort Group near De Aar; the main constraint is lack of bedrock exposure.

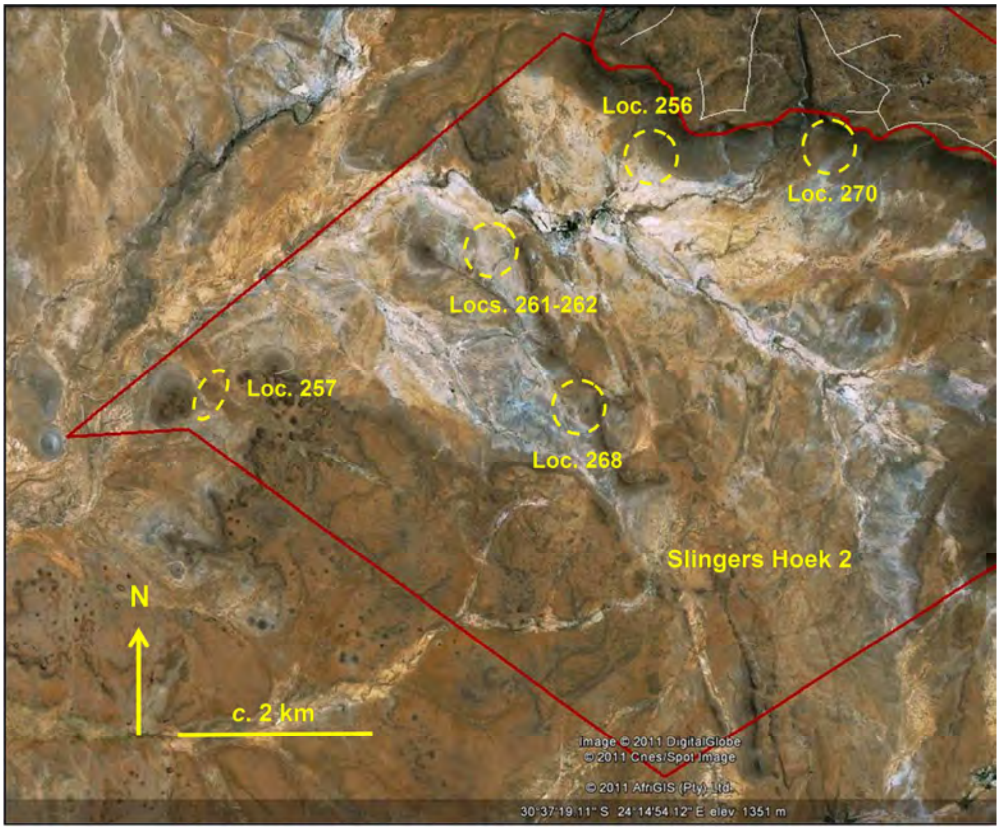

Figure 4-22 Locality of Late Palaeozoic vertebrate, plant and trace fossils found on the southern site. (Source: Natura Viva 2012)

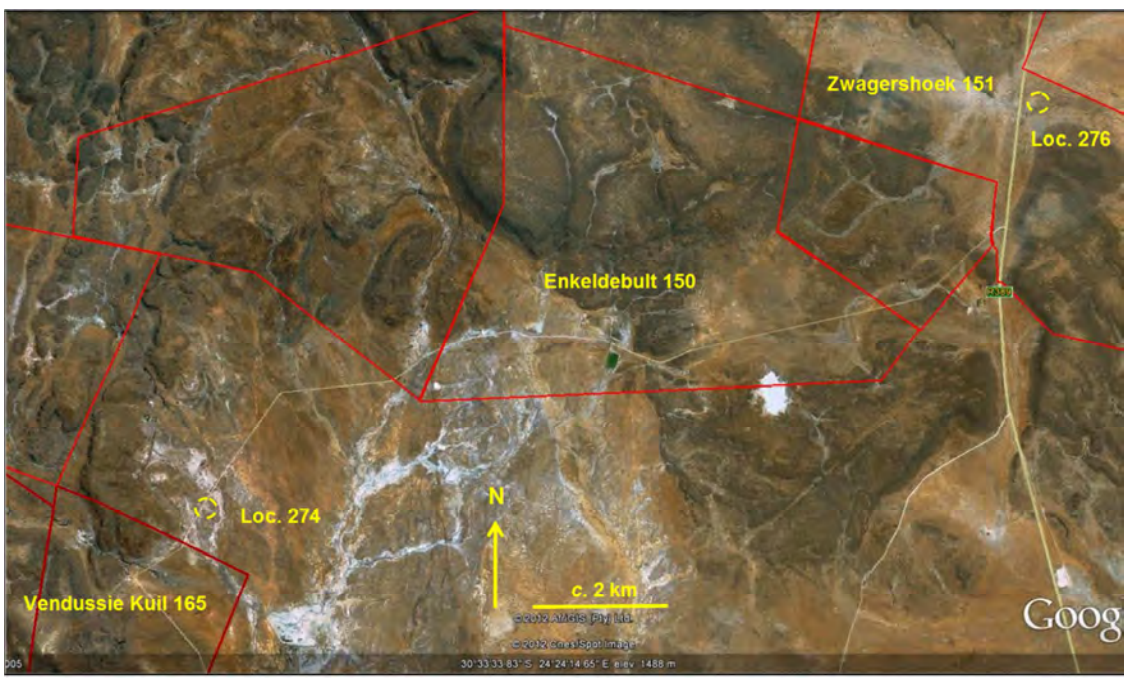

Figure 4-23 Northern site showing the position of two Beaufort Group vertebrate fossil localities within the Lower Beaufort Group. (Source: Natura Viva 2012)

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Figure 4-24: Locally abundant fragments of silicified wood that have been reworked from upper Ecca beds into surface sheetwash gravels near the base of the escarpment on Slingers Hoek 2 (Loc. 256) (Source: Natura Viva 2012).

Figure 4-25: Striated-walled horizontal burrows of Palaeophycus striatus, a typical Carnarvon facies trace fossil, from thin-bedded Ecca sandstones on Slingers Hoek 2 (Loc. 257) (Scale in cm). (Source: Natura Viva 2012).

Figure 4-26: Single track-like impression from the Jakhalsfontein wave-rippled palaeosurface apparently showing five digit impressions (Scale marked in cm). (Source: Natura Viva 2012)

b) Impact assessment

The development footprints are mainly situated in areas underlain by unfossiliferious dolerite or doleritic colluvium (scree, gravels, etc) and is therefore unproblematic in fossil heritage terms. The exception is the flatter-lying areas in the northeast of the North site (on the farm Zwagershoek) where rare fossil vertebrate remains have been recorded from Beaufort Group sediments.

The potentially fossiliferous Karoo Supergroup rocks (Ecca and Beaufort Groups) within the development footprints of the wind turbines, transmission lines, access roads and other infrastructure are generally buried beneath a mantle of fossil-poor superficial sediments such as soils, alluvium, gravels and calcretes. These superficial deposits are probably of Pleistocene to Recent origin and are of low palaeontological sensitivity in the study area as a whole. The Karoo Supergroup rocks are often extensively disrupted by near-surface secondary calcrete formation. Furthermore baking by dolerite intrusion has often further compromised their original fossil heritage.

Potentially fossiliferous bedrocks occur extensively in the western (Slingers Hoek 2) **(Figure 4-22)** and south-eastern (Knapdaar 8/Die Dam) portions of the South site, but these would not be affected by the development footprint. Numerous impressions of large tetrapod tracks were found in the sandstone surface exposed in a stream bed near the homestead on Jakhalsfontein **(Figure 4-26)** outside the project area.

When pits are dug for the turbine foundations fossils could be found and it is possible that these may be damaged. However, the palaeontological sensitivity of all the rock units ranges from zero to low. Therefore it is unlikely that there would be any impacts on fossil heritage. However, if there is any potential impact it would be of low magnitude, local and long term and therefore of **low (-)** significance, for both projects.

c) Mitigation measures

No mitigation is considered to be necessary.

4.4.7 Visual impact

During the construction period activities on site would involve excavations, construction of concrete foundations, installation of above ground infrastructure and erection of new transmission lines along the new access routes linking the turbines. Traffic movements would increase and construction camps would be visible, although it is expected that these would be most visible within a 3 km radius.

The potential construction phase visual impact is considered to be of medium intensity, local and site specific in extent with the duration of the impact limited to the construction period and therefore of **medium (-)** significance, without mitigation. With the implementation of mitigation measures this would reduce to **medium - low (-)** significance. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Minimise the construction period, where possible;
- Retain 100-150 mm of topsoil, where there is sufficiently deep topsoil, from any disturbed areas to rehabilitate disturbed areas after construction;
- Use cut material where possible in construction or on site (e.g. in grading gravel roads) or remove cut material from site;
- Where site offices are required, limit these to single storey and use temporary screen fencing to screen offices from the wider landscape; and
- Ensure prompt revegetation of disturbed areas.
- Access roads should be kept tidy and storage of materials and builders' rubble should be screened from public view;
- The use of contaminants, such as diesel, curing compounds, shutter oil and cement, should be controlled on site, litter should be regarded a serious offence and no fires should be allowed on site. All site employees should receive training in awareness of these issues;
- The alignment of access roads should be carefully considered to minimize visible scarring from cut and fill, and gravel should be used as surface material. Roads alignments should lie with the contour as far as possible;
- Consider temporary hard-standings for cranes in place of permanent hard-standings;

- As much as possible, place any new structures where they are least visible to the greatest number of people;

4.4.8 Impact on local economy (employment) and social conditions

The proposed wind energy facilities would employ a medium local content i.e. up to 50% of the procurement would be within South Africa.
Local labour would be employed during construction. Up to 740 construction, installation and manufacturing direct jobs could be created for both facilities. The construction period would last for some 18 Months.

The projects would generate approximately 420 and 320 jobs for the proposed northern and southern facilities, which includes construction, installation and manufacturing direct jobs. Increased employment opportunities would allow for an improvement in social conditions for those who obtain employment. As the majority of labour would be accommodated within De Aar or Phillipstown, an increase in spending would result in these areas thereby stimulating the local economies. The projects would also result in an increase in the revenue of the LM's through increased rates and taxes. This in turn could result in an increase in municipal spending on social programmes.

Based on the number of employment opportunities, as well as the local expenditure, during the construction phase the potential impact on the local economy (employment) and social conditions is considered to be medium magnitude, regional and short term (for the construction period) and therefore of ***medium (+)*** significance, with or without mitigation for both proposed projects.

The following mitigation measures are recommended:

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities;
- Base recruitment on sound labour practices and with gender equality in mind; and
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.

4.4.9 Impact on transport

Construction vehicles are likely to make use of the existing roads, including the R389 and R48, to transport equipment and material to the construction site. For each wind turbine approximately 72 - 83 construction vehicles would be required to bring in construction materials and components (based on the N100 (2.5 MW) turbine transport requirements in Nordex Energy GmbH (Nordex), 2009). The proposed projects consist of 145 turbines in the north hence approximately 10 440– 12 035 construction vehicles would be required, and 105 turbines in the south would equate approximately to 7 560 – 8 715 construction vehicles. This equates to 19 to 22 construction vehicles per day for the north site and 14 to 16 for the south site, assuming an even spread over the 18 months construction period.

Transporting components to site is likely to necessitate the upgrading of sections of road to ensure clearances and bends are negotiable by trucks (see Section 3.2 for more details).

Due to the large size of many of the facility's components (e.g. tower and blades) and the need for them to be transported via "abnormal loads" from either Port Elizabeth or Cape Town harbour, construction related transport could impact negatively on the traffic flow in the vicinity and on the integrity of the affected roads. This may exacerbate the risk of vehicular accidents. The necessary clearances from the respective Roads Authorities would need to be in place prior to the transporting of these loads.

Cumulatively, it is estimated by The GreenCape Initiative (2011) that some 13 abnormal loads would be on roads daily in the Western Cape until 2015. Most of these loads would use on the N1 or the N7 and many would extend to the Northern Cape.

The potential impact of the projects on transport is considered to be of medium magnitude, regional extent and short term and therefore of **medium (-)** significance, with or without mitigation for both proposed projects. The cumulative potential impact of wind energy projects on transport is considered to be of high magnitude, regional extent and short term and therefore of **high (-)** significance, with or without mitigation. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Ensure that road junctions have good sightlines;
- Implement traffic control measures where necessary;
- Transport components overnight as far as possible; and
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc are scheduled.

4.4.10 Noise pollution

Projected noise levels for the construction of the proposed wind energy facilities were modelled using the methods as proposed by SANS 10357:2004. The resulting noise projections indicated that the construction activities, as modelled for the worst case scenario, would comply with the Noise Control Regulations (GN R154) as well as the acceptable day rating levels as per the SANS 10103:2008 guidelines.Therefore this potential impact is considered to be of low magnitude, local extent and short term and therefore of **very low (-)** significance, with and without mitigation.

The following mitigation measures are recommended:

- Route construction traffic as far as practically possible from potentially sensitive receptors;
- Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include:

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   - Proposed working times;
   - how long the activity is anticipated to take place;
   - what is being done, or why the activity is taking place;
   - contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
- When working within 500 m of a potential sensitive receptor, limit the number of simultaneous activities (e.g. construction of access roads, trenches, etc) to the minimum as far as possible;
- When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. An example would be to work within the 08:00 to 14:00 time-slot to minimize the significance of the impact because:
   - Potential receptors are most likely at school or at work, minimizing the probability of an impact happening;
- Consider using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact;
- Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures.

4.4.11 Storage of hazardous substances on site

As at any construction site, various hazardous substances are likely to be used and stored on site. These substances may include amongst other things, diesel, curing compounds, shutter oil and cement. Utilisation of such substances in close proximity to the aquatic environment such as pans is of greater concern than when used in a terrestrial environment.

This potential impact is considered to be of high magnitude, local extent and short to medium term and therefore of **low to medium (-)** significance, with and without mitigation for both sites. With the implementation of mitigation the likelihood of this impact occurring would reduce. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Implement measures as provided in the EMP, which *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage; and
- Comply with the various pieces of legislation controlling the use of hazardous substances at a construction site.

4.4.12 Dust impacts

Construction vehicles are likely to make use of the existing farm roads to transport equipment and material to the construction site. Earthworks would also be undertaken. These activities would exacerbate dust especially in the dry winter months.

This potential impact is considered to be of medium magnitude, local extent and short term and therefore of **low (-)** significance, without mitigation and **very low (-)** significance with mitigation for both sites.

The following mitigation measures are recommended:

- Implement measures as provided in the EMP, which includes procedures for dealing with dust pollution events including watering of roads, etc.

4.5 SUMMARY OF POTENTIAL IMPACTS

A summary of all the potential impacts from the proposed projects assessed above is included in **Table 4-1** and **Table 4-2** . While some difference in magnitude of the potential impacts would result from the proposed alternatives this difference was not considered to be significant for any of the potential impacts. As such, the tables below applies to all proposed alternatives.

Table 4-1: Summary of potential impacts of the proposed project (south)

Potential impact	No mit/Mit[29]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[30]	Reversibility
OPERATIONAL PHASE								
Impact on Ecology: Preferred layout	No mit	Local	Low- Medium	Long term	**Low – Medium (-)**	Definite	Sure	Irreversible
	Mit	Local	Low	Long term	**Very Low- Medium (-)**	Probable	Sure	Irreversible
No-go alternative	No mit	Local	Low	Long term	**Low (-)**	Definite	Sure	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Impact on birds	No mit	Local	High	Long term	**Medium - High (-)**	Probable	Sure	Irreversible
	Mit	Local	Low- Medium	Long term	**Medium (-)**	Probable	Sure	Irreversible
Impact on bats	No mit	Local	High	Long term	**Medium (-)**	Probable	Low	Irreversible
	Mit	Local	Low	Long term	**Low - Medium (-)**	Probable	Sure	Reversible
Impact on freshwater	No mit	Local	Low	Long term	**Low (-)**	Probable	Low	Reversible
	Mit	Local	Low	Long term	**Very Low (-)**	Probable	Low	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	***Low (+)***	Probable	Sure	Reversible
Visual aesthetics	No mit	Regional	High	Long term	**High (-)**	Definite	Sure	Reversible
	Mit	Regional	High	Long term	**High (-)**	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
Impact on local economy (employment) and social conditions	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on agricultural land	No mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Reversible
Impact of noise	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
CONSTRUCTION PHASE								
Impacts on flora, avifauna, fauna and bats	No mit	Local	Low-Medium	Medium term	**Low-Medium (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
Sedimentation and erosion	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

[29] Note that this refers to No mitigation and Mitigation.
[30] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[29]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[30]	Reversibility
Impact on heritage resources:	No mit	Local	Medium - High	Long term	**Medium- High (-)**	Definite	Low	Irreversible
Archaeology	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Cultural heritage	No mit	-	-	-	**-**	-	-	-
Palaeontology	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Visual aesthetics	No mit	Local	Medium - High	Short term	**Medium (-)**	Probable	Sure	Reversible
	Mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Impact on local economy	No mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
(employment) and social conditions	Mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
Impact on transport	No mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Noise pollution	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Storage of hazardous substances	No mit	Local	High	Short term	**Low (-)**	Probable	Sure	Irreversible
on site	Mit	Local	High	Short term	**Low (-)**	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

Table 4-2: Summary of potential impacts of the proposed project (north)

Potential impact	No mit/Mit[31]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[32]	Reversibility
OPERATIONAL PHASE								
Impact on Ecology:	No mit	Local	Low- Medium	Long term	**Low – Medium (-)**	Definite	Sure	Irreversible
Preferred layout	Mit	Local	Low	Long term	**Very Low- Medium (-)**	Probable	Sure	Irreversible
No-go alternative	No mit	Local	Low	Long term	**Low (-)**	Definite	Sure	Irreversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Impact on birds	No mit	Local	High	Long term	**Medium - High (-)**	Probable	Sure	Irreversible
	Mit	Local	Low- Medium	Long term	**Medium (-)**	Probable	Sure	Irreversible
Impact on bats	No mit	Local	High	Long term	**Medium (-)**	Probable	Low	Irreversible
	Mit	Local	Low	Long term	**Low - Medium (-)**	Probable	Sure	Reversible

[31] Note that this refers to No mitigation and Mitigation.
[32] Conf.=Confidence in the assessment of the potential impact.

Potential impact	No mit/Mit[31]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[32]	Reversibility
Impact on freshwater	No mit	Local	Low	Long term	**Low (-)**	Probable	Low	Reversible
	Mit	Local	Low	Long term	**Very Low (-)**	Probable	Low	Reversible
Impact on climate change	No mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
	Mit	Regional	Very Low	Long Term	**Low (+)**	Probable	Sure	Reversible
Visual aesthetics	No mit	Regional	High	Long term	**High (-)**	Definite	Sure	Reversible
	Mit	Regional	High	Long term	**High (-)**	Definite	Sure	Reversible
Impact on energy production	No mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
	Mit	Regional	Low	Long term	***Low (+)***	Probable	Sure	Reversible
Impact on local economy	No mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
(employment) and social conditions	Mit	Regional	Medium	Long term	***Medium (+)***	Probable	Sure	Reversible
Impact on agricultural land	No mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Reversible
Impact of noise	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
CONSTRUCTION PHASE								
Impacts on flora, avifauna, fauna	No mit	Local	Low-Medium	Medium term	**Low-Medium (-)**	Probable	Sure	Reversible
and bats	Mit	Local	Low	Medium term	**Low (-)**	Probable	Sure	Reversible
Sedimentation and erosion	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Impact on heritage resources:	No mit	Local	Medium - High	Long term	**Medium- High (-)**	Definite	Low	Irreversible
Archaeology	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Cultural heritage	No mit	-	-	-	**-**	-	-	-
Palaeontology	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Visual aesthetics	No mit	Local	Medium - High	Short term	**Medium (-)**	Probable	Sure	Reversible
	Mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Impact on local economy	No mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
(employment) and social conditions	Mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
Impact on transport	No mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Regional	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
Noise pollution	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible
Storage of hazardous substances	No mit	Local	High	Short term	**Low (-)**	Probable	Sure	Irreversible

Potential impact	No mit/Mit[31]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[32]	Reversibility
on site	Mit	Local	High	Short term	**Low (-)**	Unlikely	Sure	Irreversible
Impact of dust	No mit	Local	Medium	Short term	**Low (-)**	Probable	Sure	Reversible
	Mit	Local	Low	Short term	**Very Low (-)**	Probable	Sure	Reversible

5 CONCLUSIONS AND WAY FORWARD

The purpose of this Chapter is to briefly summarise and conclude the EIAR and describe the way forward.

5.1 CONCLUSIONS

The proposed projects comprises:

- Two wind energy facilities where the northern portion would potentially consist of 144 wind turbines and the southern portion, 103 wind turbines.
- Associated infrastructure including, amongst others:
  - Hardstandings of 20 m x 40 m alongside turbines;
  - Access roads 4 m wide between turbines;
  - Overhead transmission lines connecting turbines; and
  - Two substations for the northern site and three substations for the southern site connecting to the existing grid consisting of three transmission lines traversing the sites.

The following feasible alternatives have been identified for further consideration in the EIAR:

- Location alternatives:
  - One location per proposed wind energy facility;
- Activity alternatives:
  - Wind energy generation via wind turbines; and
  - "No-go" alternative to wind energy production.
- Site layout alternatives:
  - One layout alternative per site.
- Technology alternatives:
  - Turbine towers of 65 m and a blade length of 40m; and
  - Turbine towers of 100m with a blade length of 60 m;

Aurecon submits that this Draft EIAR provides a comprehensive assessment of the environmental issues associated with each of the feasible alternatives of the proposed projects outlined in the FSR and the associated Plan of Study for EIA. These impacts and alternatives were derived in response to inputs from consultation with I&APs, provincial and local authorities, and the EIA project team.

Table 5-1 provides a summary of the significance of the environmental impacts associated with this proposed projects.

Table 5-1: Summary of significance of the potential impacts associated with the proposed developments

IMPACT			Preferred Layout south site		Preferred Layout north site	
			No Mit	With Mit	No Mit	With Mit
OPERATIONAL PHASE IMPACTS						
1.1	Impact on Ecology:	Preferred layout	L-M	VL-M	L-M	VL-M
1.2		No-go alternative	L	L	L	L
2	Impact on birds		M-H	M	M-H	M
3	Impact on bats		M	L-M	M	L-M
4	Impact on climate change		L+	L+	L+	L+
5	Visual aesthetics		H	H	H	H
6	Impact on Fresh Water		L	VL	L	VL
7	Impact on energy production		L+	L+	L+	L+
8	Impact on local economy (employment) and social conditions		M+	M+	M+	M+
9	Impact of noise		L	VL	L	VL
10	Impact on agricultural land		VL	VL	VL	VL
CONSTRUCTION PHASE IMPACTS						
11	Impacts on flora, avifauna, fauna and bats		L-M	L	L-M	L
12	Sedimentation and erosion		M	VL	M	VL
13.1	Impact on heritage resources:	Archaeology	M-H	L	M-H	L
13.2		Palaeontology	L	VL	L	VL
13.3		Cultural heritage	M-H	L	M-H	L
14	Visual aesthetics		M	L-M	M	L-M
15	Impact on local economy (employment) and social conditions		M+	M+	M+	M+
16	Impact on transport		L	L	L	L
17	Noise pollution		VL	VL	VL	VL
18	Storage of hazardous substances on site		L	L	L	L
19	Impact of dust		L	VL	L	VL

* This assessment is the same for each of the proposed alternatives.

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KEY				
	H	High Significance	VL	Very Low Significance
	M-H	Medium to High Significance	N	Neutral Significance
	M	Medium Significance	H+	High positive significance
	L-M	Low to Medium Significance	M+	Medium positive significance
	VL-M	Very Low to Medium Significanc	L+	Low positive significance
	L	Low Significance		
	VL-L	Very Low to Low Significance		

5.2 LEVEL OF CONFIDENCE IN ASSESSMENT

With reference to the information available at the feasibility stage of the project planning cycle, the confidence in the environmental assessment undertaken is regarded as being acceptable for the decision-making, specifically in terms of the environmental impacts and risks. The EAP believes that the information contained within the FSR and this EIAR is adequate to inform Mulilo's decision making regarding which alternatives to pursue and will allow DEA to be able to determine the environmental acceptability of the proposed alternatives.

It is acknowledged that the projects details will evolve during the detailed design and construction phases to a limited extent. However, these are unlikely to change the overall environmental acceptability of the proposed projects and any significant deviation from what was assessed in this EIAR should be subject to further assessment. If this was to occur, an amendment to the Environmental Authorisation may be required in which case the prescribed process would be followed.

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5.3 OPERATIONAL PHASE IMPACTS

Table 5-1, the most significant (**high (-)**) operational phase impacts on the biophysical and socio-economic environment, without mitigation was for the potential impacts of the proposed wind energy facility on bats, avifauna, and visual aesthetics. With the implementation of mitigation measures the impact on bats and avifauna would decrease to **low-medium (-) and medium (-)**, however the impact on visual aesthetics would not reduce. This visual impact is considered to be acceptable in the context of the distance to sensitive viewers, generally.

It should be noted that three potential positive impacts on energy production and local economy (employment), climate change and social conditions would result and these would be of ***low-medium (+)*** significance, with and without mitigation measures.

The potential cumulative impacts were also considered, including both proposed projects, as well as any other proposed renewable energy facilities, where applicable. The significance of these were considered to be of low to high (-) significance and *low to medium (+)*, without mitigation. These potential cumulative impacts would decrease, with implementation of mitigation measures for the proposed projects as well as other proposed projects in the area, and are considered to be acceptable. However, it should be noted that it is not possible to assess these cumulative impacts in a project specific EIA, not least because not all the proposed projects in the area may be approved or constructed. As such it would be necessary for DEA, or a similar body, to undertake a strategic assessment in this regard.

There was no difference in the significance of the potential impacts resulting from the feasible alternatives, including the turbine alternatives. As such it is recommended that Mulilo choose their preferred option with consideration to technical and financial considerations.

5.4 CONSTRUCTION PHASE IMPACTS

The most significant construction phase impact was that on heritage and archaeology which was considered to be of **medium-high (-)** and **low (-)** significance with and without mitigation respectively, for both north and south projects. The remaining negative construction phase impacts were not deemed to have a significant impact on the environment, given their duration (approximately 18 months) and localised extent. The remaining construction impacts were assessed to be of **very low to medium (-)** significance, without mitigation measures. With the implementation of the recommended EMP the significance of construction phase impacts is likely to reduce to **very low to low (-)** significance. It should be noted that a potential positive impact on local economy (employment) and social conditions would result and would be of ***medium (+)*** significance, with and without mitigation measures.

5.5 RECOMMENDATIONS

Chapter 4 has outlined mitigation measures which, if implemented, could significantly reduce the negative impacts associated with the projects. Where appropriate, these and any others identified by DEA could be enforced as Conditions of Approval in the Environmental Authorisation, should DEA issue a positive Environmental Authorisation. The mitigation measures are outlined below:

Operation phase impacts:

Ecological impacts

- An on-going monitoring programme should be implemented to detect and quantify any invasive plant species that may become established and to provide management measures for removing invasive species.

Avifaunal (bird) impacts

- Carefully monitor the local avifauna pre- and post-construction and implement appropriate additional mitigation as and when significant changes are recorded in the number, distribution or breeding behaviour of any of the priority species listed in the Avifaunal Impact Assessment, or when collision or electrocution mortalities are recorded for any of the priority species listed in the assessment; and
- Minimize the disturbance associated with maintenance activities by scheduling maintenance activities to avoid and/or reduce disturbance in sensitive areas at sensitive times (identified during the monitoring programme);
- Restricting the construction footprint to a bare minimum;

- Demarcation of 'no-go' areas identified during the pre-construction monitoring phase to minimise disturbance impacts associated with the construction of the facility;
- Reducing and maintaining noise disturbance to a minimum particularly with regards to blasting on the ridge-top associated with excavations for foundations. Blasting should not take place during the breeding seasons of the resident avifaunal community and in particular for priority species (June-September). Blasting should be kept to a minimum and, where possible, synchronized with neighbouring blasts;

Bat impacts

- No turbines may be placed in the area indicated as having a High Bat Sensitivity (**Figure 4-4**). A 100 meter buffer should apply to cliffs and rocky outcrops and water bodies designated as areas of high sensitivity;
- Where required by long-term bat monitoring, curtail selected turbines to a preliminary cut-in speed of 5 - 5.5 m/s, or as recommended by the monitoring, as a mitigation measure to lessen bat mortalities. Curtailment is where the turbine cut-in speed is raised to a higher wind speed based on the principle that bats will be less active in strong winds due to the fact that their insect food cannot fly in strong wind speeds, and the small insectivorous bat species need to use more energy to fly in strong winds. Curtailment should be informed by long term bat monitoring which will indicate at which turbines, seasons, time of night and in which weather curtailment is required.
- Consider implementing an ultrasonic deterrent device so as to repel bats from wind turbines if any turbines are placed in moderate sensitivity areas. Should this measure prove effective it may be implemented in place of curtailment, should this be agreed to by a bat specialist, based on long term monitoring; and
- Undertake affordable long term monitoring of bats and the potential impacts of turbines on them to effectively fine tune mitigation. This should include 12 month long term monitoring (preferably prior to construction) where bat detectors are deployed on the site and passively recording bat activity every night. Additionally the site should be visited by a bat specialist quarterly to assess and compare the bat activity on a seasonal basis. The wind speed data gathered by meteorological masts can then be correlated with bat activity to determine the most feasible cut-in speed and fine tune other mitigation measures. Monitoring should also take place for 12 months during operation to evaluate the effectiveness of mitigation measures such as curtailment or ultrasonic deterrent devices; and
- Research from long term monitoring should be shared with academic institutions to aid in research of the potential impacts of wind energy facilities on bats.

Heritage resources impacts (including palaeontology)

Impacts on archaeology including palaeontology are assessed under the Construction phase.

Visual impacts

- Power lines should run underground where possible.
- The ratio between the height of the turbines and relative height of their sites should be about two thirds : one third (example 100m turbine on the summit of a 200m hill should be more acceptable).
- Paint nacelles and towers in matte white or off-white. Where it does not conflict with other specialist recommendations (e.g. avifauna) rotors should be painted in the same colour as the remainder of the turbine structure.

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- Do not display brand names on turbines. Stripes of contrasting colour on the blades are similarly discouraged, where they are not as a result of mitigation of other specialist concerns, as they interfere with visual clarity.
- Fit aircraft warning lights with shields so that they are only visible to aircraft, not to receptors on the ground.
- Provide information on the proposed project to local people through a small education centre or office.
- Maintain turbines in operational condition.

Impacts on local economy (employment) and social conditions

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities.
- Give preference to local communities for employment opportunities.
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.
- Base recruitment on sound labour practices and with gender equality in mind.

Impacts on noise

- Use a quieter wind turbine, possibly with an increased setback from the sensitive receptor, in order to reduce sound levels at the sensitive receptor.
- Operating all, or selected wind turbines in a different mode. Most manufacturers allow the turbines to be operated in a different mode. This allows the wind turbine generator to operate more silently, albeit with a slight reduction of electrical power generation capability;
- Problematic wind turbines could also be disabled, or the rotational speeds significantly decreased during periods when a quieter environment is desired (and reasonable complaints registered).
- Should the receptor be amenable, relocate the receptor to a location agreed to with the receptor, outside of the projects footprint.

Impacts on freshwater

- Operational activities should as far as possible be limited to the delineated site for the proposed development and the identified access routes. Invasive alien plant growth should be monitored on an ongoing basis to ensure that these disturbed areas do not become infested with invasive alien plants.
- Storm water run-off infrastructure must be maintained to mitigate both the flow and water quality impacts of any storm water leaving the wind energy facilities site. Should any erosion features develop, they should be stabilised as soon as possible.
- Where transmission lines need to be constructed over/through the drainage channel, disturbance of the channel should be limited. All crossings over drainage channels or stream beds after the construction phase should be rehabilitated such that the flow within the drainage channel is not impeded.

Construction phase impacts:

Flora, avifauna, bats and fauna impacts

- Unnecessary impacts on surrounding natural vegetation must be avoided. The construction impacts must be contained to the footprint of the turbines and laydown area.
- Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible, using site-appropriate indigenous species.

- Any invasive alien plants within the control zone of the applicant must be immediately controlled to avoid establishment of a soil seed bank. Control measures must follow established norms and legal limitations in terms of the method to be used and the chemical substances used.
- Existing access roads must be used, where possible, as the location for new roads; Steep slopes must be avoided when routing roads, where possible.
- Service roads for the projects' powerlines must be properly maintained to avoid erosion impacts.
- Restricting the construction footprint to a bare minimum.
- Demarcation of 'no-go' areas identified during the pre-construction monitoring phase to minimise disturbance impacts associated with the construction of the facility.
- Reducing and maintaining noise disturbance to a minimum particularly with regards to blasting on the ridge-top associated with excavations for foundations. Blasting should not take place during the breeding seasons of the resident avifaunal community and in particular for priority species (June-September). Blasting should be kept to a minimum and, where possible, synchronized with neighbouring blasts.
- Construction of any wind turbines in the areas designated as having a High Bat Sensitivity should be avoided.

Sedimentation and erosion impacts

- Construction activities should as far as possible be limited to the identified sites for the proposed wind energy facilities and the identified access routes. A buffer of 30 m should be maintained adjacent to the identified freshwater features, and 75 m for the pans at Slingershoek.
- Any of the cleared areas that are not hardened surfaces are rehabilitated after construction is completed by revegetating the areas disturbed by the construction activities with suitable indigenous plants. Invasive alien plants that currently exist within the immediate area of the construction activities should also be removed and the sites.
- To reduce the risk of erosion, the locality of the turbines should preferably not be on any steep slopes. Run-off over the exposed areas should be mitigated to reduce the rate and volume of run-off and prevent erosion occurring on the site and within the freshwater features and drainage lines.
- Contaminated runoff from the construction site(s) should be prevented from entering the rivers/streams. All materials on the construction sites should be properly stored and contained. Disposal of waste from the sites should also be properly managed. Construction workers should be given ablution facilities at the construction sites that are located at least 100maway from the river system and regularly serviced. These measures should be addressed, implemented and monitored in terms of the EMP for the construction phase.
- Minimise duration and extent of construction activities in the river – construction should also preferably take place in the low flow season.
- Clearing of debris, sediment and hard rubble associated with the construction activities should be undertaken post construction to ensure that flow within the drainage channels are not impeded or diverted.
- Rehabilitate disturbed stream bed and banks and revegetation with suitable indigenous vegetation.

- The existing road infrastructure should be utilized as far as possible to minimize the overall disturbance created by the proposed projects. For new access roads to the turbines, these should rather be along the ridges of the hills than in the drainage/stream beds.
- Where access routes need to be constructed through ephemeral streams, disturbance of the channel should be limited.
- Wetland and pan areas should be avoided and any road adjacent to a wetland feature should also remain outside of the 30m buffer zone as far as possible.
- All crossings over drainage channels or stream beds should be such that the flow within the drainage channel is not impeded.
- Road infrastructure and cable alignments should coincide as much as possible to minimize the impact.
- Any disturbed areas should be rehabilitated and monitored to ensure that these areas do not become subject to erosion or invasive alien plant growth.

Heritage resources impacts(including Palaeontology)

- Areas known to have sensitive archaeological sites should be avoided. An archaeologist should be involved in the placement of the turbines and associated infrastructure in these sensitive areas.
- If mitigation by avoiding sensitive archaeological sites is not feasible, sampling and recording of the archaeological site before its destruction must be undertaken.
- In the case of unexpected exposure of below-ground archaeological material during excavations, SAHRA must be consulted immediately to ensure timeous implementation of appropriate mitigation measures.
- At least one LSA site on the North site and one MSA “factory” site and two LSA sites on the South site will require targeted sampling and excavation to allow for more accurate characterization of the archaeological finding.
- Old buildings should be fenced off during construction to avoid vandalism of the buildings, kraal complexes must be avoided and access roads re-routed to avoid damage to the buildings.
- A 500 m buffer should be implemented around farmsteads, buildings, sheds, kraals etc.
- In the event of accidental uncovering of graves, work must stop immediately and the SAHRA Burials Unit should be notified. An archaeologist should be involved to assist with the investigation and procedures to address the situation.

Visual impacts

- Minimise the construction period, where possible;
- Retain 100-150 mm of topsoil, where there is sufficiently deep topsoil, from any disturbed areas to rehabilitate disturbed areas after construction;
- Use cut material where possible in construction or on site (e.g. in grading gravel roads) or remove cut material from site;
- Where site offices are required, limit these to single storey and use temporary screen fencing to screen offices from the wider landscape; and
- Ensure prompt revegetation of disturbed areas.
- Access roads should be kept tidy and storage of materials and builders’ rubble should be screened from public view;
- The use of contaminants, such as diesel, curing compounds, shutter oil and cement, should be controlled on site, litter should be regarded a serious offence and no fires

should be allowed on site. All site employees should receive training in awareness of these issues;

- The alignment of access roads should be carefully considered to minimize visible scarring from cut and fill, and gravel should be used as surface material. Roads alignments should lie with the contour as far as possible;
- Consider temporary hard-standings for cranes in place of permanent hard-standings;
- As much as possible, place any new structures where they are least visible to the greatest number of people;

Impacts on local economy (employment) and social conditions

- Obtain a list of locally available labour and skills. Give preference to local communities for employment opportunities.
- Base recruitment on sound labour practices and with gender equality in mind; and
- Provide appropriate training, which would enable individuals to apply their skills to other construction and development projects in the region once construction is complete.

Transportation impacts

- Ensure that road junctions have good sightlines.
- Implement traffic control measures where necessary.
- Transport components overnight as far as possible.
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc. are scheduled.

Noise impacts

- Route construction traffic as far as practically possible from potentially sensitive receptors;
- Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include:
  - Proposed working times;
  - how long the activity is anticipated to take place;
  - what is being done, or why the activity is taking place;
  - contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
- When working within 500 m of a potential sensitive receptor, limit the number of simultaneous activities (e.g. construction of access roads, trenches, etc) to the minimum as far as possible;
- When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. An example would be to work within the 08:00 to 14:00 time-slot to minimize the significance of the impact because:
  - Potential receptors are most likely at school or at work, minimizing the probability of an impact happening;
- Consider using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact;

- Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures.

Storage of hazardous substances on site

- Implement measures as provided in the EMP, which *inter alia* specify the storage details of hazardous compounds and the emergency procedures to follow in the event of a spillage.
- Comply with the various pieces of legislation controlling the use of hazardous substances at a construction site.

Dust impacts

- Implement measures as provided in the EMP, which includes procedures for dealing with dust pollution events including watering of roads, etc.

5.5.1 Considerations in identification of preferred alternative

Following the finalisation of the EIAR, the next step in the EIA process is for Mulilo to identify their preferred option, utilising this EIAR together with technical and financial considerations to inform their decision.

Both the proposed wind energy facilities result in ***low to medium (+)*** significance impacts and **low to high (-)** significance impacts on the environment. The layouts have subsequently been revised to further reduce the impacts by incorporating buffers around sensitive features as recommended by specialists. The reduced negative impacts with the revised layouts for the proposed projects are considered to be environmentally acceptable, considering the positive impacts.

With regards to the alternatives considered, including the turbine alternatives, there is no difference in significance of impacts between alternatives. As such there is no preference of alternatives from an environmental perspective.

5.5.2 Opinion with respect to environmental authorisation

Regulation 32(2) (m) of the EIA Regulations requires that the EAP include an opinion as to whether the activity should be authorised or not.

The impacts associated with the proposed projects would result in regional impacts (both biophysical and socio-economic) that would negatively affect the area. The significance of these impacts **without mitigation** are deemed to be of **high or lower** significance. However, with the implementation of the recommended mitigation measures the significance of the negative impacts would be minimized and would be **medium or lower**, for all impacts, apart from visual impacts, which would remain **high (-)**.

Associated with the proposed projects are positive impacts on energy production and local economy (employment), climate change and social conditions of **low to medium (+)** significance.

Based on the above, the EAP is of the opinion that the proposed wind energy facilities and associated infrastructure, including alternatives, being applied for be authorised as the benefits outweigh the negative environmental impacts. The significance of negative impacts can be reduced with effective and appropriate mitigation through a Life-Cycle EMP, as described in this report. If authorised, the implementation of an EMP should be included as a condition of approval.

5.6 WAY FORWARD

The Draft EIAR has been lodged at the Emthanjeni LM (De Aar) and the De Aar and Phillipstown Public Libraries (Station St, De Aar and Kerk St, Phillipstown, respectively) and on the Aurecon website (www.aurecongroup.com/) (change "Current Location" to South Africa and follow the public participation link). All registered I&APs have been notified of the availability of the Draft EIAR by means of a letter, which includes a copy of the Draft EIAR Executive Summary. I&APs will have until 13 April 2012 to submit written comment on the Draft EIAR to Aurecon.

Due to low attendance of the public meeting held at the De Aar Civic Centre for the Scoping Phase (one I&AP), no public meeting will be held at this EIA Phase.

The Final EIAR will be completed via the addition of any I&AP comments and the addition of a letter from Mulilo indicating their preferred alternatives and which mitigation measures they will implement. The Final EIAR will then be submitted to the Northern Cape DEANC and DEA for their review and decision-making, respectively.

The Final EIAR will be made available for review at the same locations as the Draft EIAR. Any comments received on the Final EIAR will not be included in a Comments and Response Report and will instead be collated and forwarded directly to DEA.

Once DEA has reviewed the Final EIAR, they will need to ascertain whether the EIA process undertaken met the legal requirements and whether there is adequate information to make an informed decision. Should the above requirements be met, they will then need to decide on the environmental acceptability of the proposed projects. Their decision will be documented in an Environmental Authorisation, which will detail the decision, the reasons therefore, and any related conditions. Following the issuing of the Environmental Authorisations, DEA's decision will be communicated by means of a letter to all registered I&APs and the appeal process will commence, during which any party concerned will have the opportunity to appeal the decision to the Minister of Environmental Affairs in terms of NEMA.

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6.3 PERSONAL COMMUNICATION

Personal communication between Louise Corbett of Aurecon and Sandile Vilakazi of DEA on 13/09/2011 via e-mail