Report No: 5748/106563

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS:
PROPOSED WIND ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE

DEA REF. NO. 12/12/20/2099

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

January 2012

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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

ACRM	Agency for Cultural Resource Management
BID	Background Information Document
CH	Methane
CO_2	Carbon Dioxide
CFC	Chlorofluorocarbons
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
DEAT	Department of Environmental Affairs and Tourism
DM	District Municipality
DME	Department of Minerals and Energy
DoE	Department of Energy
DSR	Draft Scoping Report
EAP	Environmental Assessment Practitioner
EAPSA	Environmental Assessment Practitioner of South Africa
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Environmental Management Framework
EMP	Environmental Management Programme
FSR	Final Scoping Report
GHG	Greenhouse Gas
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
LM	Local Municipality
MW	Megawatts
NEMA	National Environmental Management Act (No. 107 of 1998) (as amended)
NEP	National Electricity Plan
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (No. 25 of 1999)
NRTA	National Road Traffic Act
NWA	National Water Act

NIRP	National Integrated Resource Plan
PAN	Peroxyacylnitrate
REFIT	Renewable Energy Feed-In Tariffs
RFP	Request for Qualification and Proposals
SAHRA	South African Heritage Resources Agency
SACNASP	South African Council for Natural Scientific Professions
SDF	Spatial Development Framework
SKA	Square Kilometre Array
ToR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change
VIA	Visual Impact Assessment
WMA	Waste Management Area

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

Plan 8 Infinite Energy (Pty) Ltd (Plan 8) proposes to construct a wind energy facility to generate approximately 140[1] Megawatts (MW) on a farm, near Copperton in the 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 Plan 8.

This Environmental Impact Assessment (EIA) is for the proposed wind energy facility near Copperton, Northern Cape. The associated infrastructure would include a power line to connect into the existing grid and roads between the turbines as well as roads and cabling between turbines.

The proposed project would take place on Struisbult Farm (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5), near Copperton in the Northern Cape (see **Figure 1.1**). An existing airstrip would also be relocated as part of the proposed project, to Portions 1 and 2 of Farm No. 105. Struisbult Farm is located approximately 5 km east of Copperton and the two main portions (excluding the transmission line portion) cover approximately 3 130 ha. The airstrip would be relocated to a 385 ha area within Portions 1 and 2 of Farm No. 105 which covers an area of 7 578 ha).

In terms of the National Environmental Management Act (No. 107 of 1998) (as amended) (NEMA), the proposed development triggers a suite of activities, which require authorisation from the competent environmental authority before they can be undertaken. As this proposed project triggers a number of listed activities in terms of NEMA, it accordingly requires environmental authorisation. Since the project is 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.

[1] Originally a three phased, 200 MW wind energy facility was proposed, however in terms of the Independent Power Producer procurement process wind energy projects are limited to 140 MW and as such the project has been changed to a single phase 140 MW project.

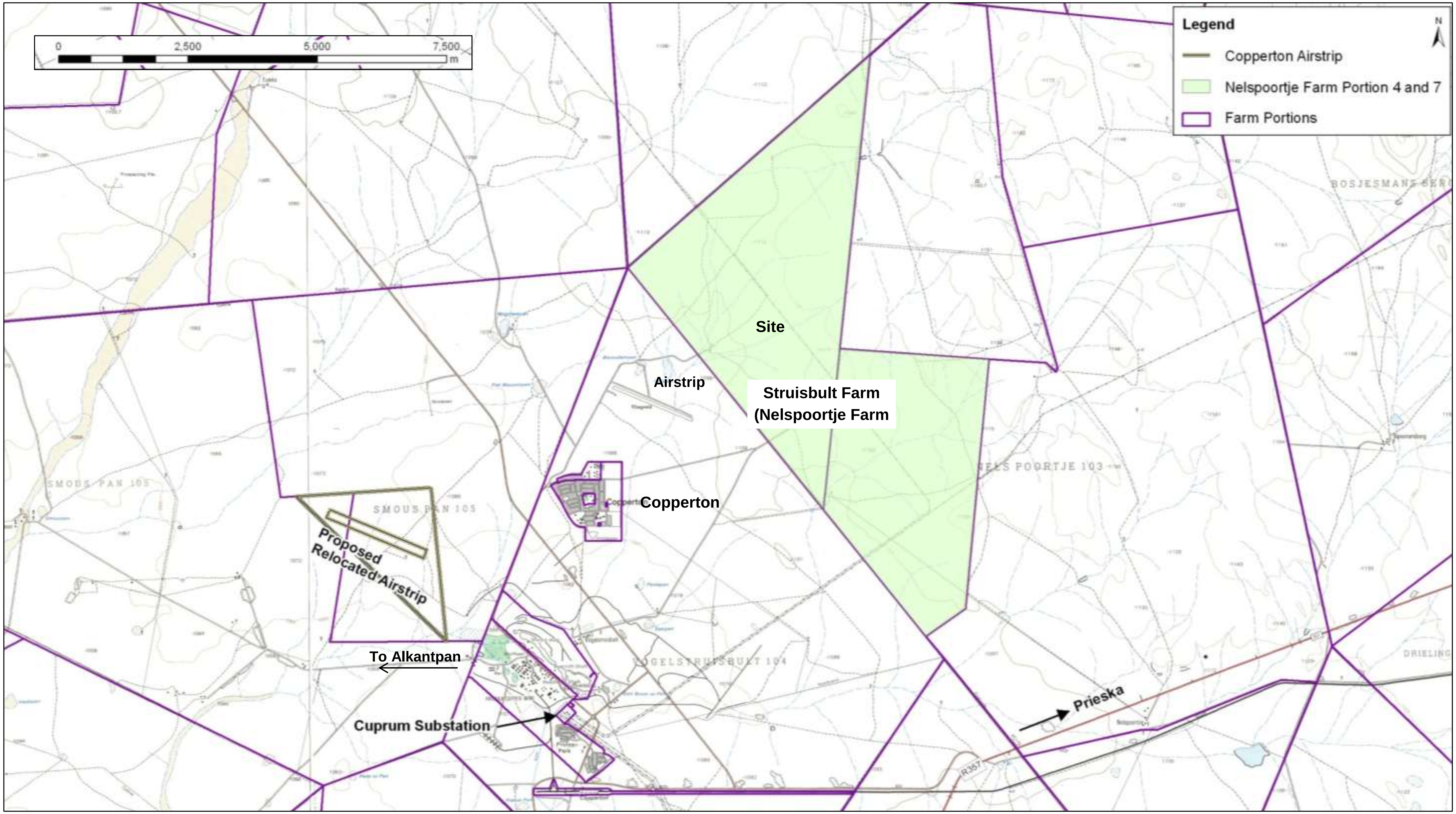

Figure 1.1 Location of the proposed wind energy facility near Copperton, Northern Cape (2922 CD)

The EIA Phase is the last phase in the EIA process. Accordingly, this EIA Report (EIAR) [2] 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 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.

Plan 8 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[3].

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 **Table 1.1**
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[2] Section 31 of EIA Regulation No. 543 of NEMA lists the content required in an EIAR.
[3] GN No. R 543, 544, 545, 546 and 547 in Government Gazette No. 33306 of 18 June 2010.

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 facility

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.	Relevancy: A transmission line of approximately 8.6 km length could be required to connect into the Eskom 132 kvA grid. The site is in a rural area. Alternatively an onsite connection is being considered.
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.	Relevancy: A number of roads, greater than 50 m^2, would cross drainage lines or within 32 m of drainage lines.
18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock 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-	Relevancy: A number of roads, comprising more than 5 m^3, would cross drainage lines.

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.	Relevancy: The proposed wind energy facility would generate approximately 140 MW.
7	The construction of (i) airports, or (ii) runways or aircraft landing strips longer than 1,4 kilometres.	Relevancy: An airstrip of approximately 1 700 x 60 m would be constructed to replace a nearby airstrip.
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.	Relevancy: Up to 35 ha of indigenous vegetation would be cleared for the proposed wind energy facility, in a rural area.

Since the proposed project is 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 1.4**.

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 Plan 8 obtains authorisation and makes the decision to pursue the proposed project 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.

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 proposed core planned Square Kilometre Array (SKA) radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. South Africa, along with Australia, has been shortlisted to host the world's largest telescope, the SKA. A final decision on the location is expected to be made in early 2012 by the SKA Board of Directors.

The proposed wind energy facility falls outside of the Karoo Core Astronomy Advantage Area, but inside the general 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. While the Minister has not yet prohibited these activities it is important that the relevant astronomical bodies are notified of the proposed project and provided with the opportunity to comment on the proposed project.

Plan 8 has met with SKA and will be undertaking modelling together with SKA to determine potential impacts of the proposed wind energy facility and potential solutions.

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 facility, Plan 8 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 site, a small airstrip is located approximately 1 km south west of the site. It is proposed that this airstrip is moved so that aircraft can continue to make use of the strip. Plan 8 has secured permission from CAA to move the airstrip and construct a wind energy facility as proposed. Note it is proposed that the airstrip be moved onto Armscor (Alkantpan) test range. Armscor has indicated to Plan 8 that this is acceptable.

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, Plan 8 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. A small pan of approximately 4.9 ha, named Modderpan, is located in the centre of the site, and a number of pans are located on land adjacent to the site. Should the proposed development occur within 500 m radius of a wetland (Modderpan) it may be necessary to submit a water use license application to the Department of Water Affairs (DWA). If a water use licence application is required it would fall outside of the scope of this EIA and would be addressed by Plan 8 as part of their broader project planning. Comment will be sought from DWA as part of the EIA process.

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

1.2.1 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. Plan 8 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 project.

1.3 TERMS OF REFERENCE AND SCOPE OF THE EIA

In October 2010, Plan 8 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 facility near Copperton 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

[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.

- 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).

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 second phase, *viz.* the Scoping Report Phase.

1.4.1 Initial Application Phase

The Initial Application Phase entailed the submission of the EIA Application Form to notify DEA of the project, submitted on 20 October 2010. Acknowledgement of receipt of the EIA Application Form was received from DEA on 2 December 2010. 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).

To date the Scoping Phase has 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 Integrated Environmental Management Program (IEMP)(African EPA, 2007)

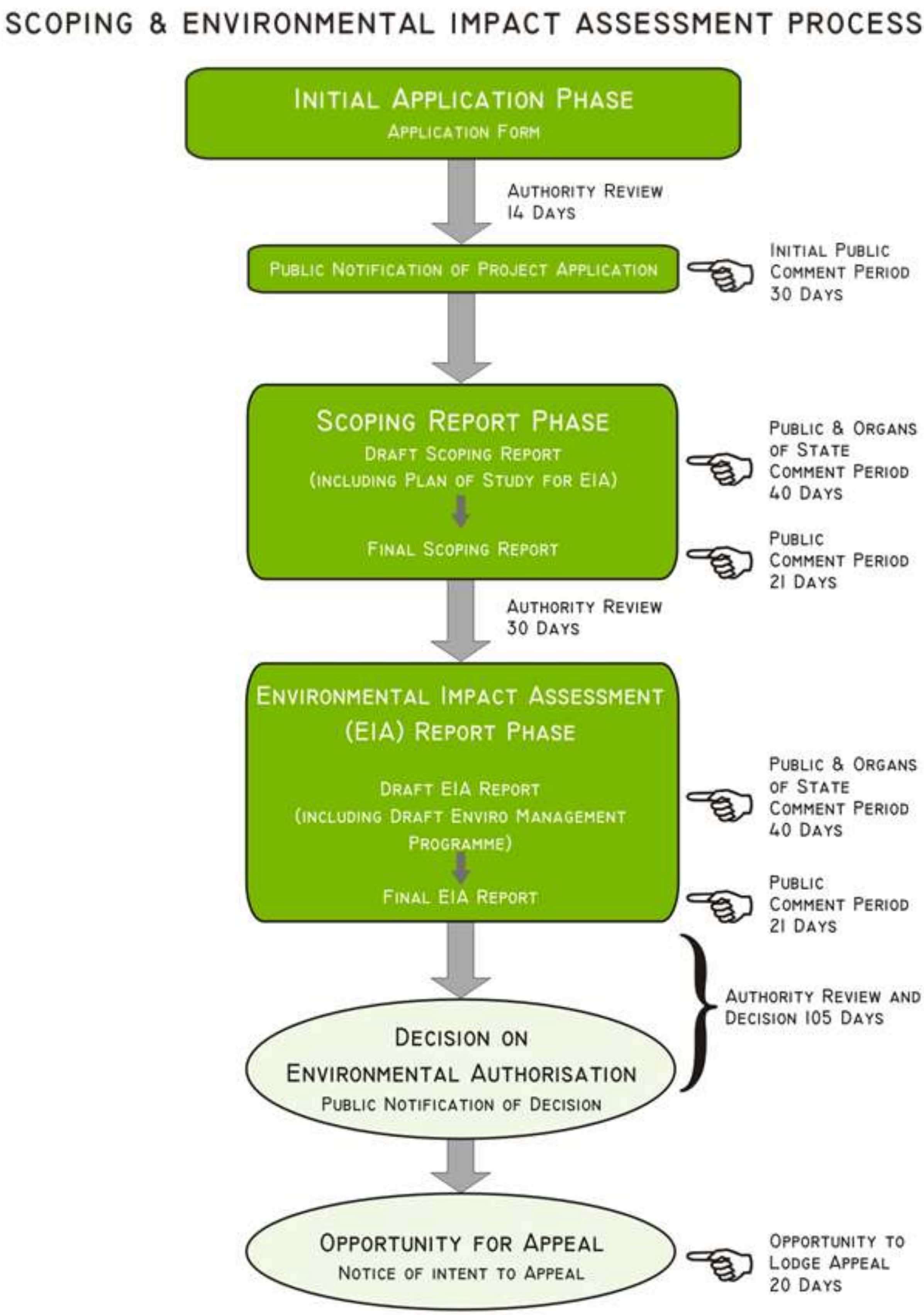

Figure 1.2 The EIA process in terms of NEMA

- Pixley ka Seme District Municipality Spatial Development Framework (SDF) (2007)
- Siyathemba IEMP (African EPA, 2007)
- Vegetation Map of South Africa (Mucina & Rutherford, 2006); and
- Proposed Solar Farm, Prieska. Draft Environmental Impact Assessment Report (EIAR) (DJ Environmental Consultants, 2010).

Other tasks undertaken included:

- Distribution of the Background Information Document (BID) on 24 November 2010 to inform Interested and Affected Parties (I&APs) of the project and to invite I&APs to register on the database;
- Placement of advertisements in a local newspaper, the Gemsbok, notifying the broader public of the initiation of the EIA and inviting them to register as I&APs from 24 November 2010;
- Erection of a site notice at the entrance to Struisbult Farm on 24 November 2010;
- Lodging the Draft Scoping Report (DSR) at Prieska (Elizabeth Vermeulen) Public Library, Ietznietz in Copperton and on the Aurecon website from 17 February 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 17 February 2011. The notification letters also included a copy of the Executive Summary of the DSR in English and Afrikaans.
- Holding a public meeting on Thursday, 10 March 2011 to present and discuss the findings of the DSR at the Ietznietz Conference Room, Copperton from 18h00-20h00. Notes of the public meeting were sent to all those who attended on 30 March 2011;
- I&APs had until 40 days, until 30 March 2011, to submit their written comments on the DSR. 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 1 June 2011 at the same locations as the DSR from 10 May 2011. All registered I&APs were informed of the lodging of the FSR by means of a letter posted on 10 May 2010. 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 10 May 2010 and accepted on 15 June 2011 (see **Annexure A** for a copy of the acceptance letter). DEA required that, in addition to the proposed specialist studies, a study must be done to determine the land use potential of the area especially with regard to the agricultural potential of the site and the impact of the proposed project on this potential; and
- One comment was received on the FSR and has been included and responded to in **Annexure B**.

An inception field trip was held on 1 October 2010 with the EIA team and the Applicant. 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 occur, 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.

Registered I&APs were invited to a public meeting being held on 22 February 2011 at Ietznietz Conference Room in Copperton from 17h00 – 19h00 to discuss the findings of the EIAR. Due to low attendance of the public meeting held at the Scoping Phase (three I&APs) I&APs have been requested to RSVP by 15 February 2012, and should the number of RSVP's be insufficient the meeting will be cancelled and I&APs will instead be contacted telephonically/electronically to discuss any issues and concerns they may have.

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 project. A summary of the public participation process is provided in **Annexure B**.

Currently there are 49 I&APs are registered on the project database (see **Annexure B** for a list of current I&APs).

Key issues raised by the public during the Scoping Phase are recorded in CRR 1 and 2 which are included in Annexure E of the FSR. The major issues raised by I&APs can briefly be summarised as follows:

- Aerodrome and aviation;
- Astronomy;
- Biophysical resources;
- Cultural and heritage resources;
- Infrastructure;
- Public participation;
- Project alternatives; and
- Socio-economic aspects.

One comment was received on the Final Scoping Report (see **Annexure B**), noting a correction with regards to the airstrip at Copperton, and this has been responded to in CRR 3 (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 Form and issued a reference number 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:

- Northern Cape DEANC;
- Department of Agriculture, Forestry and Fisheries;
- Department of Water Affairs (DWA);
- South African Heritage Resources Agency;
- Northern Cape Heritage Authorities;
- Pixley ka Seme District Municipality;
- SiyaThemba Local Municipality;
- Department of Science and Technology;

- Department of Agriculture (Northern Cape); and
- Department of Land Reform.

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 and specialists is accurate and unbiased.
- The scope of this investigation is limited to assessing the environmental impacts associated with the proposed wind energy facility and connection to the grid. The project does not include any infrastructure upgrades which may be required from Eskom to allow capacity in the local grid for the proposed project.

1.5.2 Gaps in knowledge

This EIA Report has identified the potential environmental impacts associated with the proposed activities. However, Plan 8 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

The requirement for independence of the environmental consultant is aimed at reducing the potential for bias in the environmental process. Neither Aurecon nor any of its sub-consultants are subsidiaries of Plan 8 nor is Plan 8 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 project.

The Project Director, Mr Brett Lawson, Project Manager, Miss Louise Corbett, are appropriately qualified and registered with the relevant professional bodies. Mr Lawson is a certified Environmental Assessment Practitioner of South Africa (EAPSA), and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). Miss Corbett is registered as a Professional Natural Scientist with the SACNASP. Aurecon is bound by the codes of conduct for EAPSA and SACNASP.

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

As noted above, the Project Director, Mr Brett Lawson is appropriately qualified and registered with the relevant professional bodies. Mr Lawson is a certified EAPSA, and is registered as a Professional Natural Scientist with SACNASP. Mr Lawson has an MA degree in Environmental and Geographical Science, and has over 15 years in the field of impact assessment, as well as many years' experience in Nature Conservation. Miss Louise Corbett is an Environmental Practitioner with five years' experience in the field. Miss Corbett has a BSc Honours degree in Environmental and Geographical Science and is also a Professional Natural Scientist with SACNASP. Aurecon and the above environmental assessment practitioners (EAPs) are bound by the codes of conduct for EAPSA and SACNASP. The CV summaries of the key Aurecon staff were included in the Plan of Study for EIA in Chapter 5 of the Scoping Report, should further detail be required.

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 1.7 (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 the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;	Chapter 4
(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 1.4 and **Annexure B**

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
(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- (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;	Section 5.5.2
(p)	a draft environmental management programme containing the aspects contemplated in regulation 33;	Annexure K
(q)	copies of any specialist reports and reports on specialized processes complying with regulation 32;	Annexures E-J
(r)	any specific information that may be required by the competent authority; and	Annexure L
(s)	any other matters required in terms of sections 24(4)(a) and (b) of the Act.	

	SECTION 31 OF REGULATION 543	CHAPTER OR SECTION
	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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Chapter 2

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].

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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 2.2**.

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.

3 THE PROPOSED ACTIVITY

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

Chapter 3

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, Plan 8 has identified a number of projects for wind energy generation and this proposed project is the first to initiate the necessary environmental studies.

3.2 DESCRIPTION OF THE PROPOSED ACTIVITY

Plan 8 proposes to construct a 140 MW wind energy facility, consisting of 56 turbines of 2.5 MW each, on the farm Struisbult (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5) near Copperton in the Northern Cape. Originally a three phased, 200 MW wind energy facility was proposed, however in terms of the IPP process wind energy projects are limited to 140 MW and as such the project has been changed to a single phase 140 MW project. It would also be necessary to rebuild the airstrip adjacent to the site. This would be moved to Portions 1 and 2 of Farm No. 105, approximately 7 km east of the site onto Armscor (Alkantpan) test range. Armscor has indicated to Plan 8 that this is acceptable. See **Figure 3.1** for the proposed project layout. The airstrip would be approximately 1 700 x 60 m in size. Note that CAA has given permission to move the airstrip and construct a wind energy facility as proposed.

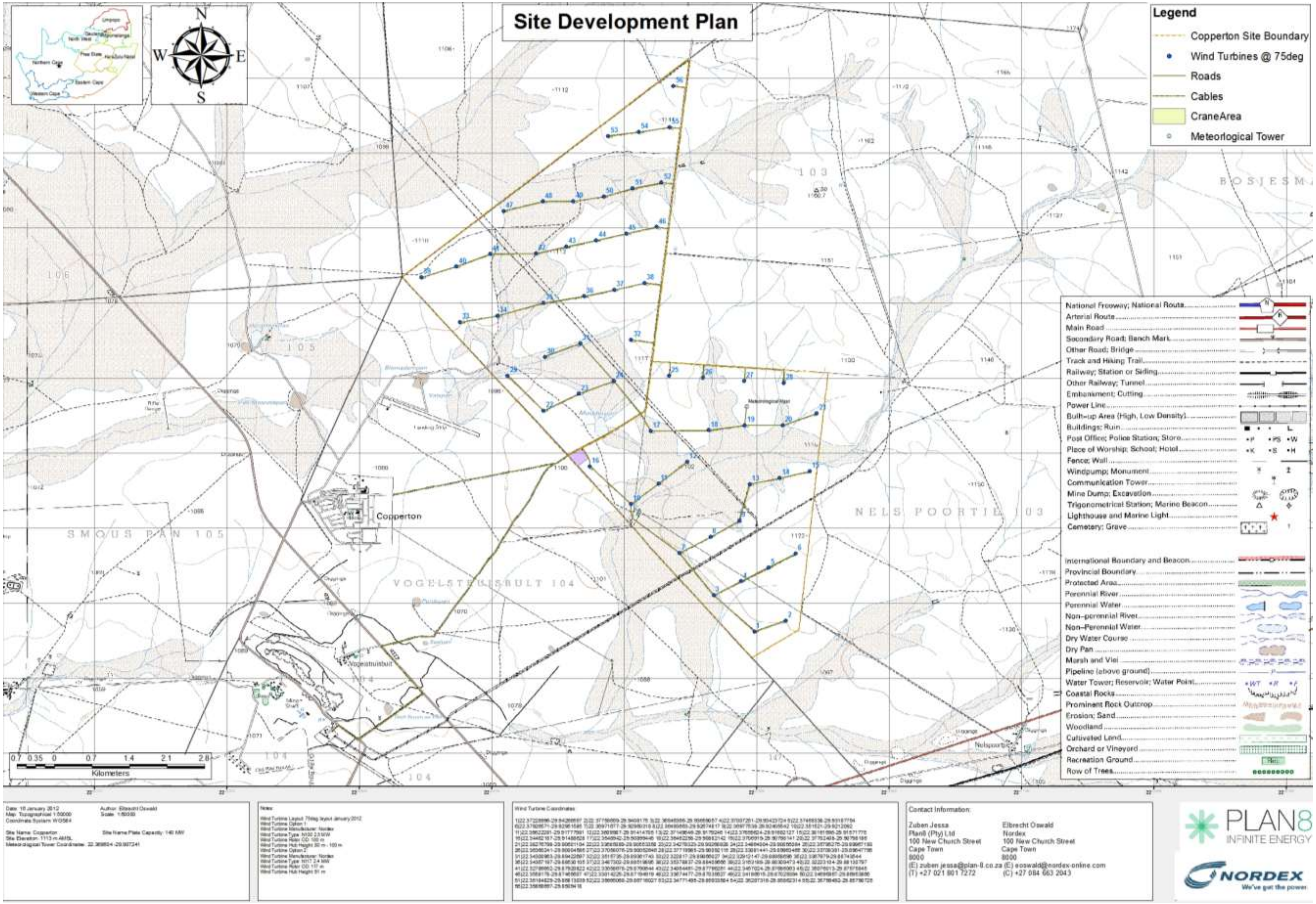

Figure 3.1 Preferred layout, dated October 2011, for the proposed wind energy facility (Source: Plan 8, Nordex)

Struisbult (Farm No. 103 Portions 4 and 7 and Farm No. 104 Portion 5) is owned by Request Trust, who has entered into a long term agreement with Plan 8 for the proposed project. Struisbult Farm is zoned Agriculture and is currently used for grazing sheep, goats and cattle. Smouspan Farm (Farm No. 105 Portions 1 and 2), owned by Alkantpan Test Range, is used for testing weapons.

The corner point co-ordinates of the two sites, moving in a clockwise manner, starting at the bottom corner, are given in **Table 3.1**.

Table 3.1 Co-ordinates of corner points of the site

Latitude	Longitude
Struisbult	
29°56'50.31"S	22°22'18.29"E
29°56'32.73"S	22°22'47.28"E
29°53'57.53"S	22°23'5.02"E
29°53'49.98"S	22°21'18.90"E
29°50'47.27"S	22°21'41.32"E
29°52'59.09"S	22°18'46.97"E
Smouspan	
29°58'23.03"S	22°15'8.90"E
29°55'19.46"S	22° 8'14.16"E
29°53'40.74"S	22° 9'0.15"E
29°53'21.27"S	22°14'19.23"E
29°55'21.56"S	22°14'38.61"E
29°55'16.73"S	22°16'24.95"E
29°56'53.11"S	22°16'36.44"E
29°56'52.43"S	22°17'3.92"E
29°57'54.14"S	22°16'35.39"E

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/h, high efficiency, and low torque ripple, which contribute to good reliability. The turbine proposed are pitch controlled, fixed speed, third generation technology.

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

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

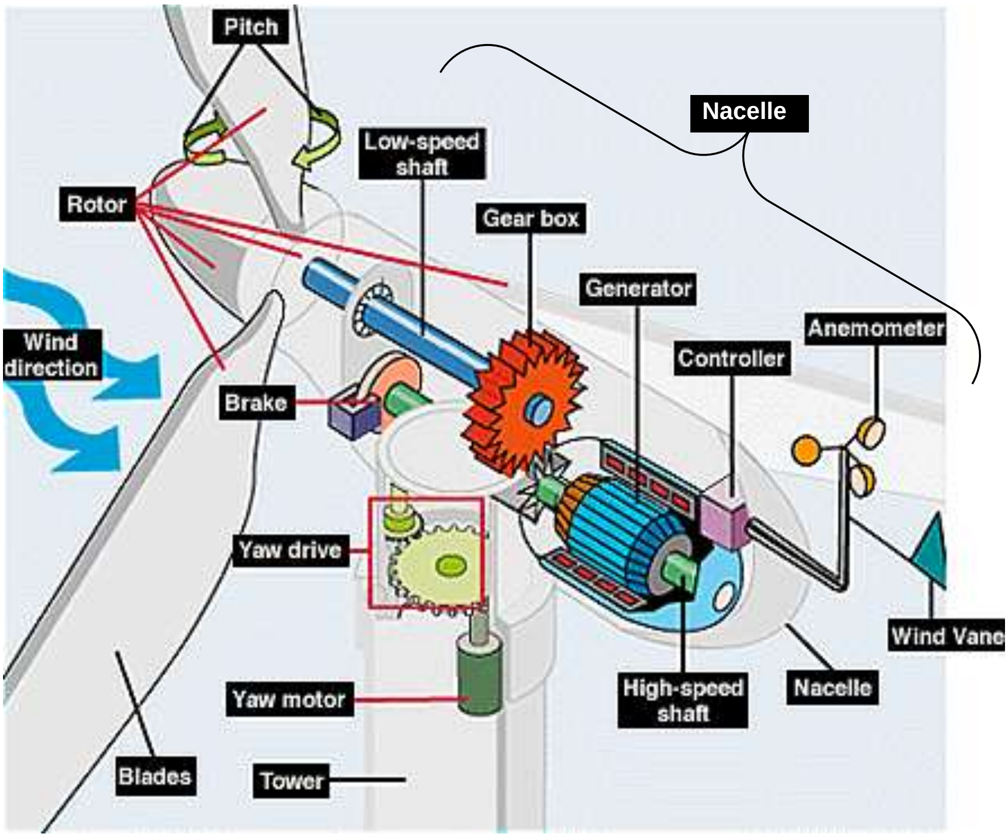

Figure 3.2 Typical components of a horizontal axis wind turbine[15]

a) Rotor and blades

The rotor converts collected wind energy into rotational energy so as to turn the generator. The rotor has three blades that rotate at a constant speed, approximately 7.5 - 15 revolutions per minute (rpm) in the case of the turbines being considered for Copperton. The rotor is pitch controlled. The blades are usually coloured light grey and, in the case of the proposed project, would approximately 50 – 58.5 m long (100 - 117 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').

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

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

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 located at the base of the turbine (outside) that steps up the voltage, in the case of the proposed project from 660 V to 33 or 22 kV, to match the line frequency and voltage for electricity evacuation/distribution.

d) Tower

The tower is constructed from tubular steel and supports the rotor and nacelle. For the proposed project the tower would be either 91 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 20 m x 20 m and an average of 3 – 6 m deep. The foundation would be cast *in situ* and could be covered with top soil to allow vegetation growth around the 6 m diameter steel tower.

3.2.2 Construction and operation of the proposed wind energy facility

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. A permanent hard standing made of compacted gravel and approximately 20 m x 6 m would be constructed adjacent to each turbine location for the crane. **Figure 3.3** shows turbines in the process of being erected.

Gravel surface access roads of approximately 4.7 m wide would also be required between each turbine. Cables connecting each turbine would be buried beneath the proposed access roads. See **Figure 3.1** for the location of the proposed access roads and cabling.

Figure 3.3 Wind turbines in the process of erection[16]

For each wind turbine approximately 72 - 83 construction vehicles would be required to bring in construction materials and components (Nordex Energy GmbH (Nordex), 2009). The proposed project consists of 56 turbines hence approximately 4 032 – 4 648 construction vehicles would

16 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)

be required. Additionally construction vehicles not required specifically for the turbines would increase this to a preliminary figure of 4 885. This equates to 3.6 - 4.2 construction vehicles per day, assuming an even spread over the three year construction period. It should be noted that an even spread of construction vehicles is unlikely and the number of construction vehicles are likely to peak for approximately 13 months over the middle of the 24 month construction period.

Transporting components to site would require a height clearance of 4.4 - 5.9 m (dependent on method of transportation) and a width clearance of 4.5 m. As such the route to site needs to be carefully plotted to ensure components can fit below all bridges. Where necessary roads may need to be upgraded to allow for the necessary turning circles for trucks transporting long components such as turbine blades. The required radii required for bends in the road are indicated in **Figure 3.4**.

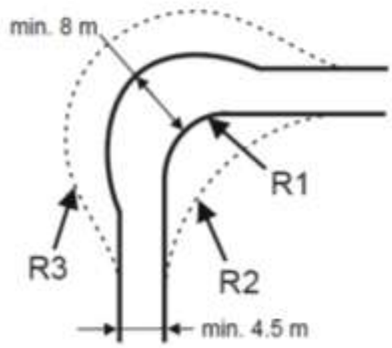	For all hub heights: R1: Inside radius bend 35 m R2: Inside radius of obstacle-free area 50 m R3: Outside radius of obstacle-free area Determined by the protruding length of the rotor blade The marked area (- - -) must be free of all obstacles, that is, trees, buildings, masts, etc.

Figure 3.4 Radii required for bends in access roads (source: Nordex, 2009)

Components would be imported via either Saldanha Bay or Port Elizabeth.

Each turbine would have a transformer that steps up the voltage from 660 V to 33 or 22 kV. This transformer is housed immediately outside the turbine and is approximately 5 m x 5 m. The cabling between the turbines would traverse the site to the sub-station, located near the main access on the eastern side of the site (see **Figure 3.1**), where the power from all the turbines would be metered.

There is electricity distribution infrastructure, which is designed for 132 kilovolt (kV) distribution, adjacent to the site. This is the Eskom Cuprum substation located at the disused copper mine approximately 6.5 km to the south west. The proposed project would connect to the grid via a transmission line from the proposed substation to Cuprum substation, as indicated in **Figure 3.5**. This route is approximately 8.6 km long. An alternative grid connection would be via an onsite connection to the transmission lines traversing the site. The location of the proposed substation for this alternative would also be at the entrance to the site and the power would be stepped up from 33 or 22 kV to 132 kV either onsite or at Cuprum substation. The final connection will be dependent on the technical requirements and cost set out by Eskom.

A preliminary approximation of the water requirements for the construction phase of the proposed project is 30 000 m^3, whilst the operational phase would require 1 000 m^3 per year for 20 years. Plan 8 has indicated that water would be obtained via an existing pipeline to the Orange River. This supply source is currently used by the farmer and Alkantpan Testing Range.

It has also been used to provide emergency supplies to Carnarvon residents when the town's water sources have been depleted. An agreement for the supply of water by Alkantpan Testing Range has been signed.

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 facility would be monitored and controlled remotely, with a mobile team for maintenance, when required. Currently it is proposed to operate the facility for 20 years.

Local labour would be employed during construction. Up to 548 construction, installation and manufacturing direct jobs could be created. Up to 377 operation and maintenance jobs would be created during the operational phase. Indirect and induced jobs would also result from the proposed project. It is important to note that the number of jobs does not equate to the number of people employed.

Unskilled and semi-skilled labour for the proposed project would be sourced via a labour broker and would be local labour as far as possible. As the labour would be from Prieska no onsite labour accommodation would be required. Buses would transport labour from Prieska daily, as is currently the case at the Alkantpan test range.

Accommodation for imported skilled staff such as engineers, project managers, foreman and administrative staff would be accommodated in two to three existing houses in Copperton or in rental stock in Prieska.

As per Section 2.5, Plan 8 is applying for an IPP contract in August 2012 and should this be awarded the proposed project would need to be constructed by 2016. This means that the construction period would last for some three years.

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.

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

When identifying sites to investigate for potential wind energy facilities Plan 8 undertakes a desktop study, which considered various parameters. These parameters are:

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

For each potential site, desktop studies are produced rating the above parameters. The parameters hold equal weight. Parameters are rated according to statutory requirements and documented best practice guidelines. Note that many of the statutory requirements and documented best practice guidelines in South Africa are in a draft state, due to the fact that wind energy is a new technology in the South African context. Where no guidelines exist, German requirements are used by Plan 8, due to the advanced state of the wind industry in Germany, which was driven by a similar feed-in-tariff structure to that proposed for South Africa. Plan 8 requires that each parameter is satisfactory in meeting statutory requirements and documented best practices guidelines and that there are no fatal flaws or significant issues, prior to pursuing a project. Sites are then compared and the most favourable selected.

To date, Plan 8 has investigated a total of 22 wind farm sites. Of these, only three are currently being pursued. As such, only the proposed site at Copperton will be considered in this EIA, as the remaining two sites will undergo separate EIA processes.

With regards to electricity distribution infrastructure, there is existing infrastructure adjacent to Struisbult Farm which is designed for 132 kV distribution. This line could be used by the proposed project to evacuate the power generated and hence new infrastructure, other than a substation, would not be required. However, Eskom may require that the electricity is evacuated via the Cuprum substation, which is located on the site of the disused Copper mine approximately 6.5 km away. The final connection will be dependent on the technical requirements and cost set out by Eskom.

Based on the above, the following location alternatives will be assessed in the EIAR (see **Figure 3.5**):

- Electricity distribution via onsite linkage to the existing grid; or
- Electricity distribution via an 8.6 km 132 kV connection to Cuprum substation.

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 IRP provides 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 Plan 8 has identified a number of projects for wind energy generation.

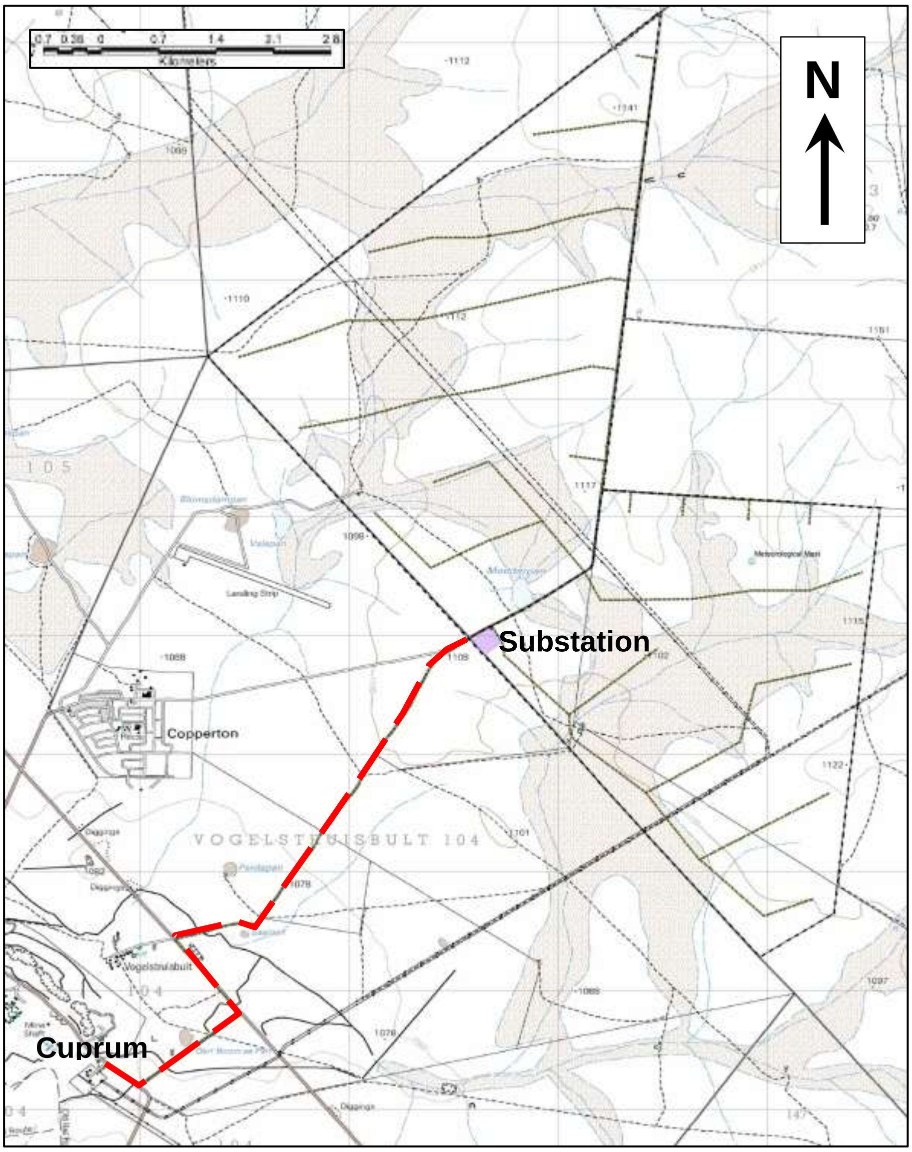

Figure 3.5 Map showing the offsite connection point (dotted line) and cables and onsite substation (adapted from Plan 8)

A project on an adjacent farm, for solar power, is currently at the EIA Phase. This indicates that the proposed site could also be suitable for solar power. However, the selection of the site was based on the requirements for wind energy, and the core business of Plan 8 is wind energy generation. As such the only activity alternative, other than the no-go alternative, which will be 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 will not be 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 as requirements of the IPP process were provided. The layout considered in the Scoping Report, provided in **Figure 3.6**, included 80 turbines and consisted of three phases. This layout 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. This layout was later updated, based on improved wind information, in August 2011, see **Figure 3.7**.

A third layout, with only 56 turbines based on the limitation of a 140 MW project and which did not include phasing, was compiled in September 2011 and was considered by specialists for the EIA Phase. See **Figure 3.8**. The preferred layout, included in **Figure 3.1**, was compiled after specialist reports were received and sensitive botanical, archaeological and bat areas were identified. 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 describe above, only the latest layout, namely the October 2011 layout (see **Figure 3.1**), will be assessed in the EIAR. It should however be noted that specialists assessed the September 2011 layout but also provided comment on the October 2011 layout.

3.3.5 Technology alternatives

The most important factors that need consideration when selecting a turbine for a proposed site, are annual average wind speed, reference wind speed, the return period for extreme wind conditions and wind direction.

Plan 8 analysed four different park designs with turbines of different rotor diameters and different installed capacity. The turbines considered were Nordex N80, N90 and N100 2.5 MW as well as the 1.5 MW Suzlon S82. Based on the modelling of the four alternatives the N100 was the preferred option. However, a new turbine, the N117 (2.5 MW), has been introduced to the market by Nordex since this modelling was undertaken. This turbine shows improved performance for IEC3, which is suitable for the site. Due to the longer rotors (58.5 m) the N117 can yield more power than other turbines in the IEC3 class. The N117 has a tower height of 91 m and a rated power of 2.4 MW. Based on this information, two turbines are assessed in this report, namely the N100 and the N117.

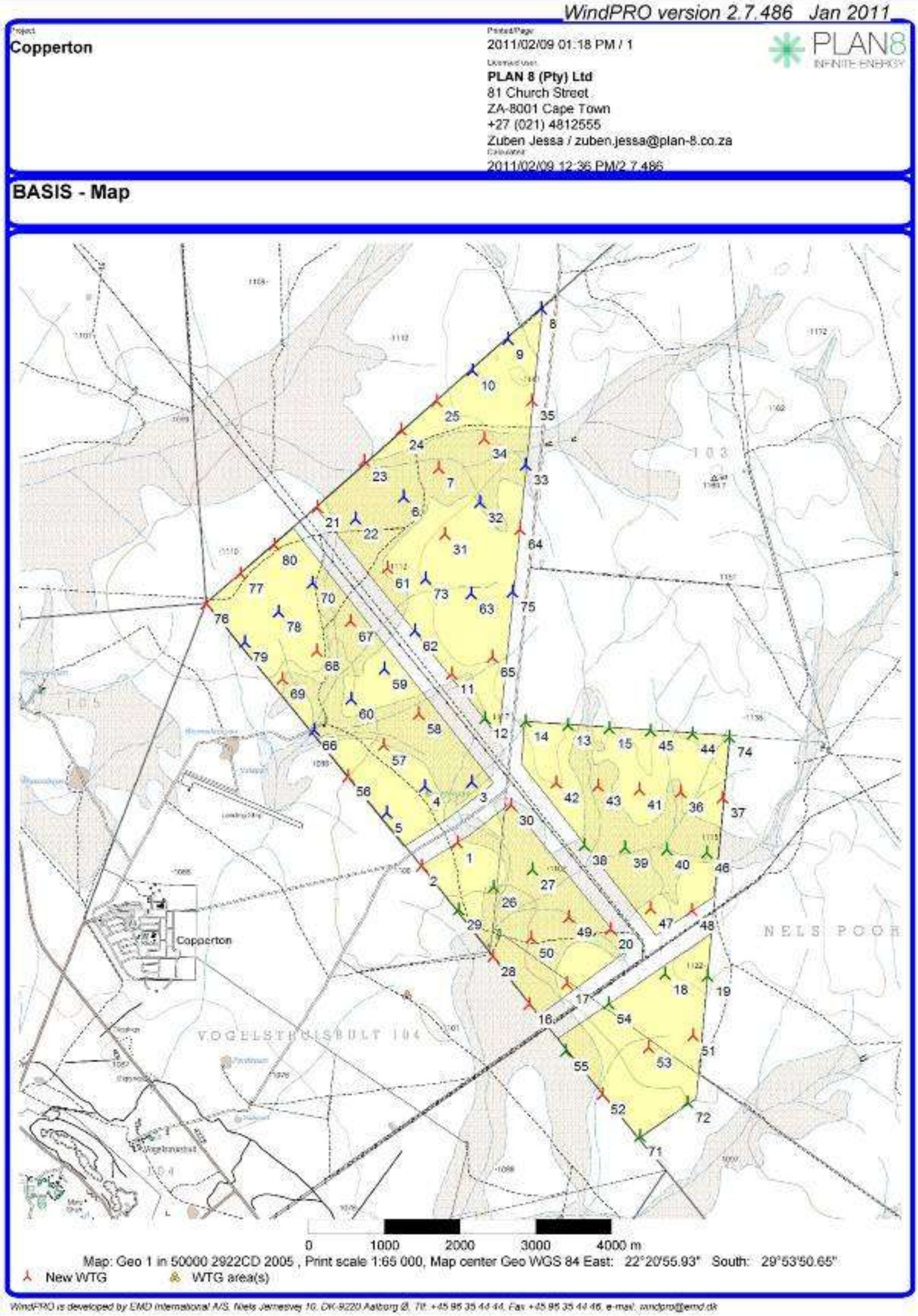

Figure 3.6 Original, phased layout of 80 turbines considered in the Scoping Phase for the proposed wind energy facility

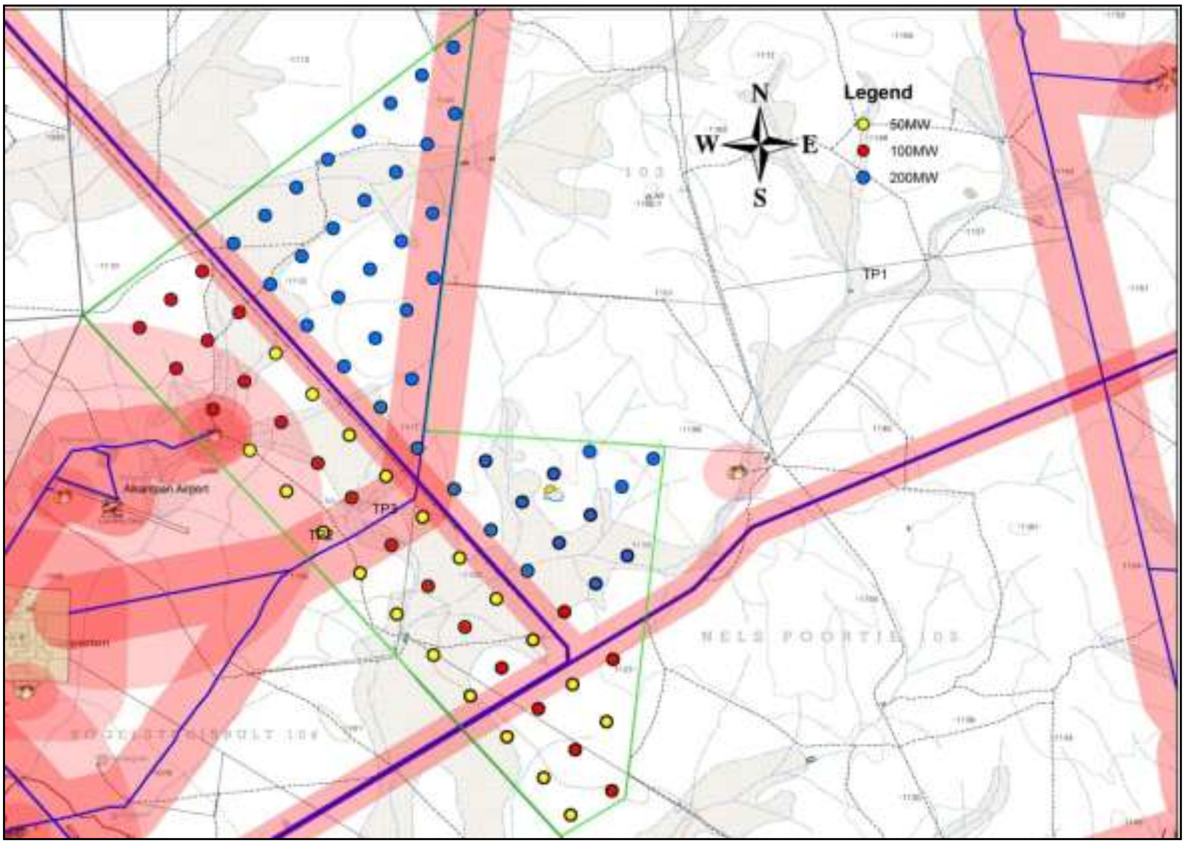

Figure 3.7 Preliminary layout considered in August 2011 for the proposed wind energy facility

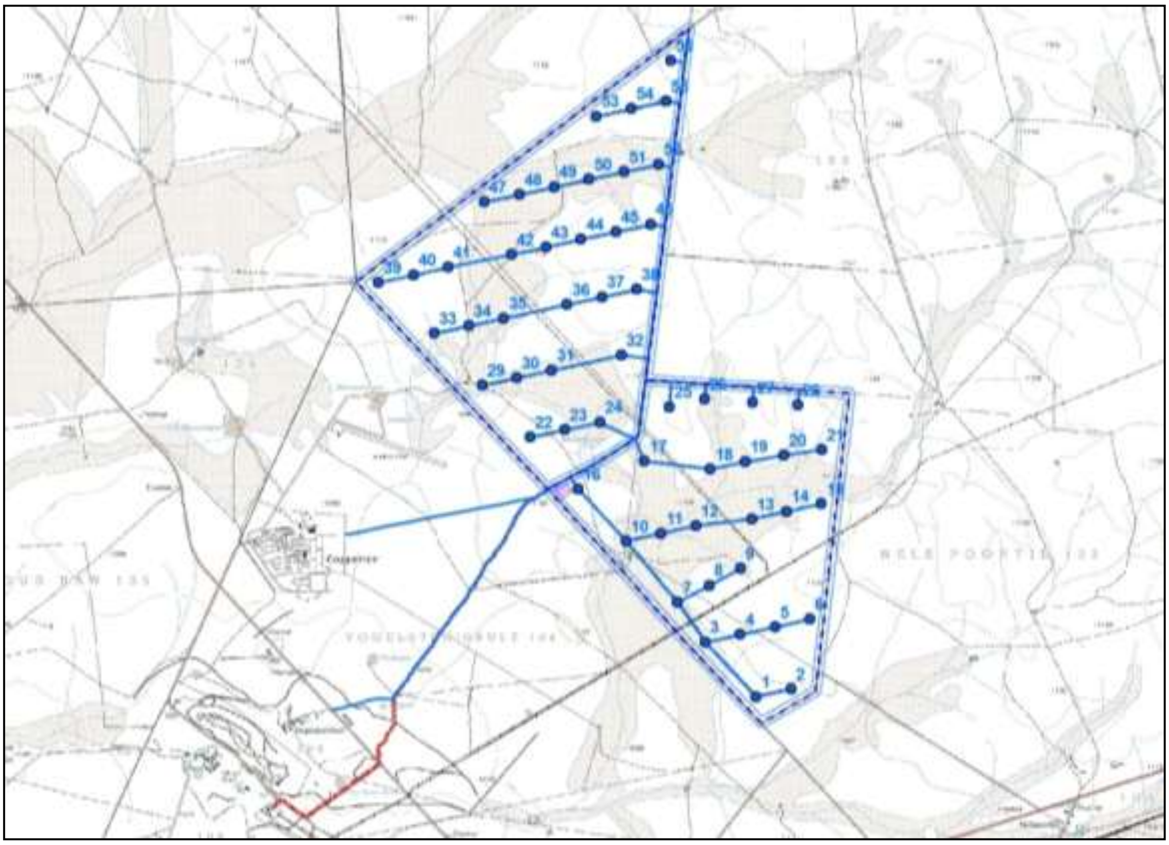

Figure 3.8 Layout, dated September 2011, considered by specialists for the proposed wind energy facility

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 for the proposed wind energy facility;
    - Electricity distribution via onsite linkage to the existing grid; and
    - Electricity distribution via an 8.6 km 132 kV connection to Cuprum substation.
- Activity alternatives:
    - Wind energy generation via wind turbines; and
    - “No-go” alternative to wind energy production.
- Site layout alternatives:
    - One layout (October 2011) alternative.
- Technology alternatives:
    - N100 turbine; and
    - N117 turbine.

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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 Phaseof this project, and updated where necessary, are as follows:

- Operational phase impacts on the biophysical environment:
  - Impact on flora;
  - Impact on avifauna;
  - Impact on bats;
  - Impacts fauna; and
  - Impact on climate change
- Operational phase impacts on the social environment:
  - Impact on heritage resources (including palaeontology);
  - Visual impacts;
  - Impact on energy production;
  - Impact on local economy (employment) and social conditions;
  - Impact on agricultural land;
  - Impact on surrounding land uses; 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;
  - Visual impacts;
  - Impact on local economy (employment) and social conditions;
  - Impact on transport;

Chapter 4

- Noise pollution;
- Storage of hazardous substances on site; and
- 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 development are described and assessed. Mitigation measures are recommended. Finally, comment is provided on the potential cumulative impacts[17] which could result should this development, 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. The terms “No Mit” and “Mit” reflected in the assessment tables in this chapter refer to the impact with no mitigation and with potential mitigation, respectively.

4.2 OPERATIONAL PHASE IMPACTS ON BIOPHYSICAL ENVIRONMENT

4.2.1 Impact on flora

Although the site is used for grazing (sheep, goats and cattle) the indigenous vegetation on site is relatively intact and in fair condition with only certain areas such as at watering points more heavily trampled than elsewhere. The potential therefore exists for the footprint of the proposed wind energy facility to impact on the vegetation. As such a botanical study was undertaken by Mr Dave MacDonald of Bergwind Botanical Surveys and Tours cc. Mr MacDonald undertook a desktop review of relevant literature and also undertook a site visit on 6 and 7 October 2011. The botanical study is included in **Annexure D**. The findings and recommendations of the botanical study are summarised below.

a) Description of the environment

According to the national classification of the vegetation of South Africa (Mucina & Rutherford, 2006) the natural vegetation found in the study area is mainly Bushmanland Arid Grassland (see **Figure 4.1**). It is, however, indicated that patches of Lower Gariep Broken Veld are found scattered through the arid grassland vegetation. This is the case at Struisbult Farm where a ridge with Lower Gariep Broken Veld was identified. The site to which the new airstrip would be constructed is classified as Bushmanland Basin Shrubland. However, all three of these vegetation types are found on Struisbult farm, distributed according to the soil type and drainage of specific areas. All three vegetation types occur over extensive area and are considered to be Least Threatened.

[17] 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.

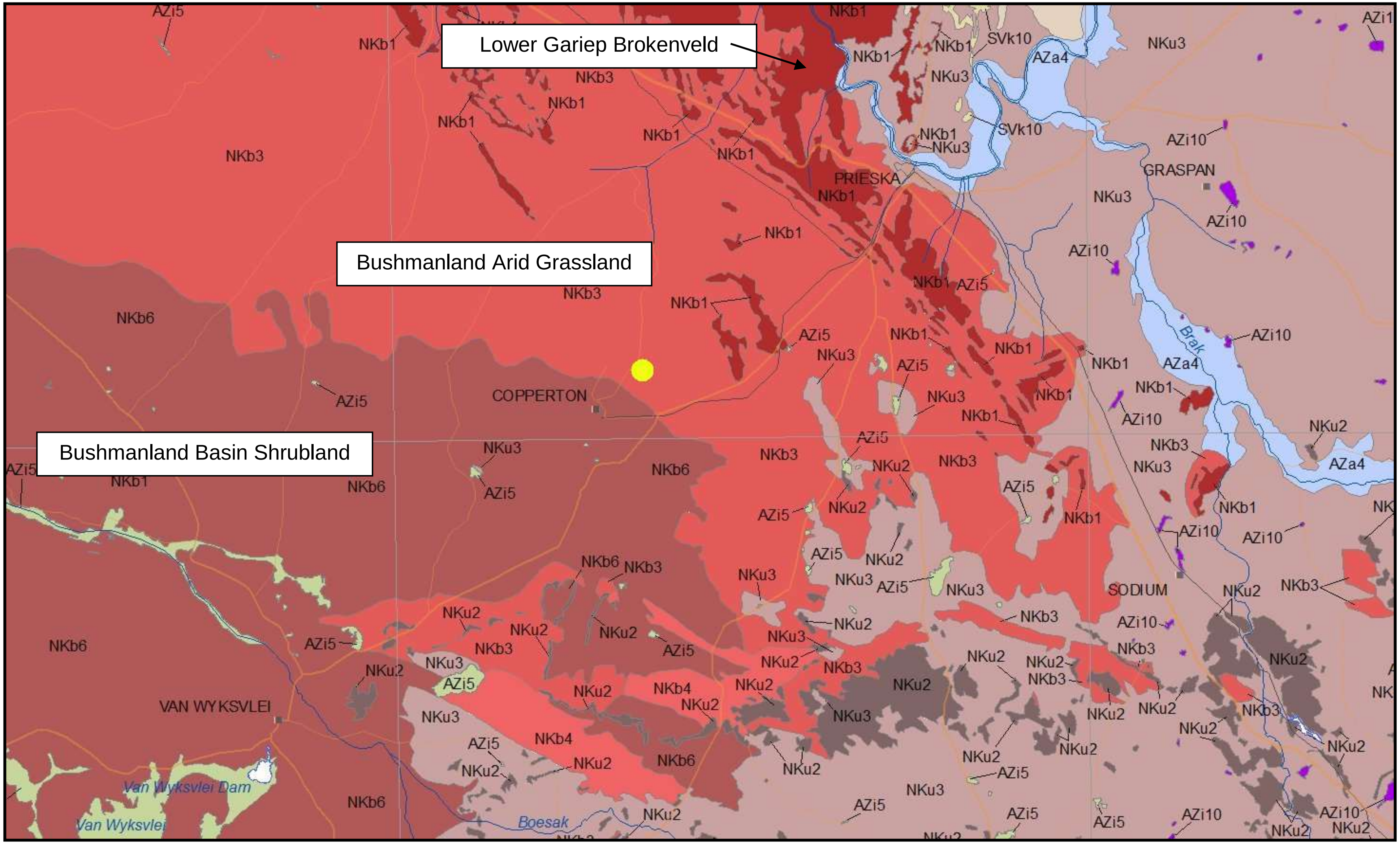

Figure 4.1 Vegetation of the study area (yellow dot) from Mucina *et al*. 2006 (courtesy D MacDonald)

Although there are few statutory conservation areas in these vegetation types, they form agricultural rangelands and are conserved for their grazing potential. Neither of the vegetation types are listed in the Draft National List of Threatened Ecosystems (Notice 1477 of 2009, Government Gazette No. 32689). A number of vegetation communities occur across the site, namely *Rhigozum trichotomum* (granaatbos) Shrubland, Asteraceous (bossieveld) Shrubland, *Stipagrostis* (langbeenboesmansgras) Grassland, *Lycium cinereum* (kriedoring) – *Galenia africana* (kraalbos) Watercourse Shrub Community and *Acacia mellifera* var. *detinens* (swaarthaak) Open Woodland. While the vast majority of the vegetation communities are not considered to be ecologically sensitive the vegetation community found in drainage lines across the site, *Lycium cinereum* (kriedoring) – *Galenia africana* (kraalbos) Watercourse Shrub Community, is considered to be sensitive.

Drainage lines of watercourses have formed in low-lying areas and these are typified by dense stands of tall shrubs together with a high cover of grasses. The dominant species are *Lycium cinereum* (kriedoring) and *Galenia africana* (kraalbos) (see **Figure 4.2**).

These areas are probably selectively grazed by cattle and sheep which may account for the presence of kraalbos, which tends to become abundant in disturbed areas. The drainage lines or watercourses with higher plant biomass also provide cover and a more hospitable habitat for small mammals and birds, compared with the open, exposed shrub veld and grasslands. For this reason these habitats, although not botanically important, are more ecologically sensitive.

A relatively small area of *Acacia mellifera* var. *detinens* (swaarthaak) Open Woodland occurs on a north-south rock ridge to the east of the centre of the site. The red sandy soil surface is strewn with quartzite pebbles and boulders and there is an emergent small trees stratum dominated by *Acacia mellifera* var. *detinens* (swaarthaak) (see **Figure 4.2**). Although this is not a rare or ecologically sensitive community, this is the only area where it occurs in the study area, and as such is considered to be locally sensitive.

The vegetation of the airstrip site consists of the same communities as found at Struisbult, however no ecologically sensitive areas were identified.

No rare or red data listed species were found on site. The sensitive ecological areas are indicated in **Figure 4.3**.

a) Impact assessment

The potential impacts of the proposed project on the vegetation onsite included the loss of vegetation type and habitat and the loss of ecological processes. The total loss of land on Struisbult Farm would be approximately 35 ha (access roads, turbine foundations and crane hardstandings) which is 1.1 % of the site. In the September 2011 layout a number of turbines (14) were located very near to, or in, the sensitive ecological areas and hence would have a negative impact on these areas. Roads and cabling would also cross sensitive areas. However the October 2011 layout avoids most of these areas. Ecological processes operate over a wide area so it is not anticipated that the proposed project, which would only occupy a small portion of the site, would have a significant effect on ecological processes.

Figure 4.2 Mid-high to tall *Lycium cinereum* (kriedoring) – *Galenia africana* (kraalbos) Shrubland in a drainage line (top) and Asteraceous Shrubland (bossieveld) in foreground with *Acacia mellifera* var. *detinens* (swaarthaak) Open Woodland on a rocky ridge (bottom) (courtesy D MacDonald, 2011)

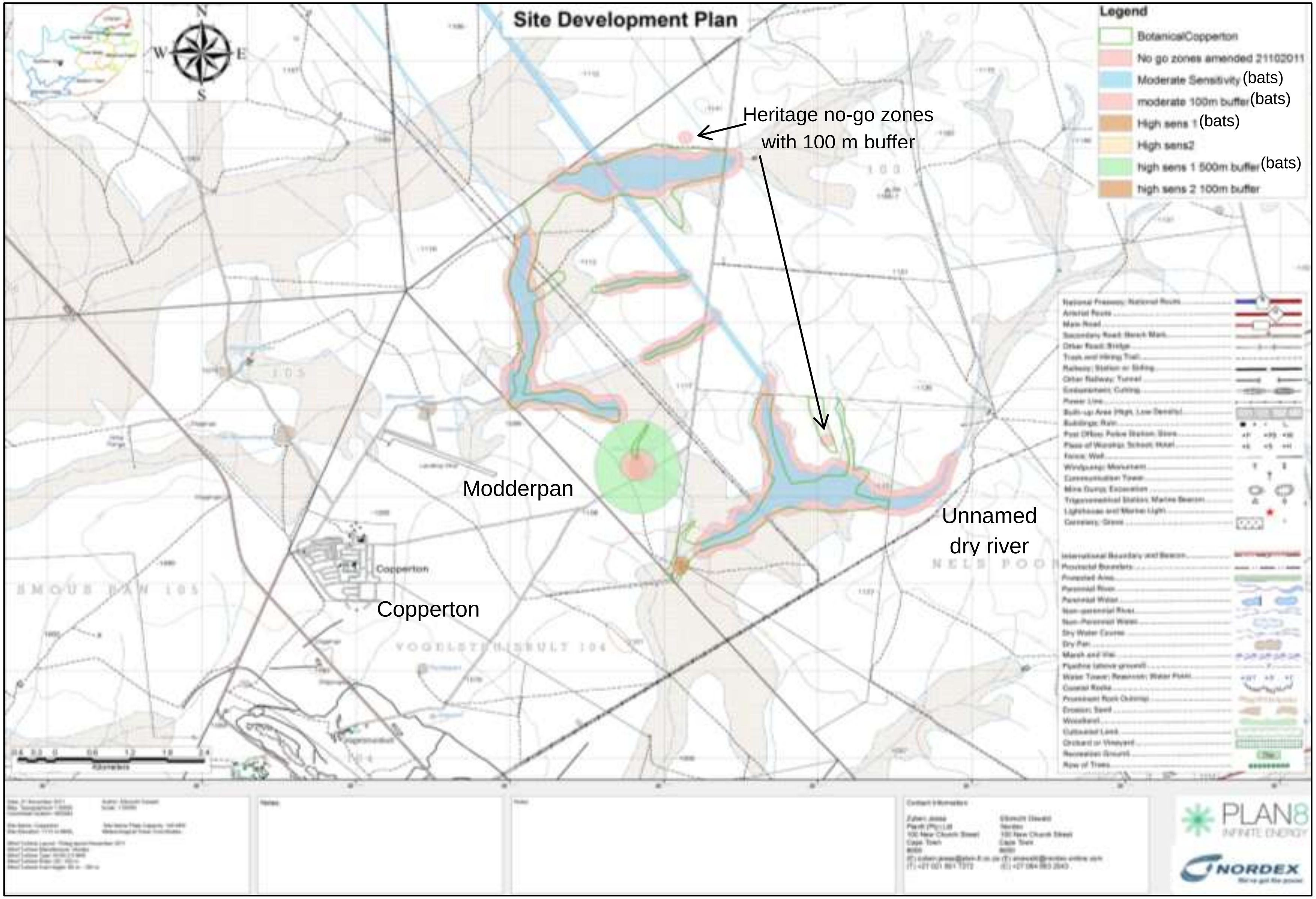

Figure 4.3 Sensitive ecological areas (not to scale)

This potential impact is considered to be of low magnitude, local extent and long term and therefore of **low (-)** significance, without and with mitigation. With mitigation the likelihood of this potential impact would reduce. Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. No difference in significance would result from the proposed turbine alternatives.

The no-go alternative, ongoing grazing, could have long-term negative. As a general rule ecological processes are closely linked to vegetation and habitat and therefore can only function where the habitat is in reasonable condition. As such ecological processes could be affected if grazing has a long term negative impact. The potential impact of the no-go alternative, ongoing grazing, on the vegetation onsite is considered to be of low magnitude, local extent and long term and therefore of **low (-)** significance, without mitigation. No mitigation is recommended.

b) Mitigation measures

The following mitigation measures are recommended:

- An Environmental Control Officer should identify areas for rehabilitation post-construction, including hard-standings and any temporary access roads, etc. These areas should be rehabilitated according to a rehabilitation plan for the site compiled with the aid of a rehabilitation specialist;
- Avoid drainage lines as far as possible when routing roads, cabling and other infrastructure; and
- Minimise the construction footprint.

c) Cumulative impacts

The vegetation types found on site are widespread and not under threat. The cumulative impact of loss of these vegetation types as a result of the proposed wind energy facility and other proposed developments such as photovoltaic and wind energy facilities on nearby farms is considered to be negligible.

4.2.2 Impact on avifauna (birds)

According to Avisense Consulting (2010) in DJEC (2010) at least 215 bird species are likely to occur in the area, of which 18 red listed species and five species which are red listed and endemic. Wind energy facilities are Footprint impacts from the turbines and associated infrastructure such as roads could impact on foraging ground and/or nesting sites. The moving blades of turbines are known to have some impact on birds, although the extent of the impact varies depending on the bird species present in an area. As such an avifaunal study was undertaken by Mr Andrew Jenkins of Avisense Consulting. A desktop review of relevant literature and a site visit on 13 and 14 October 2011 informed the avifaunal study. The avifaunal study is included in **Annexure E**. The findings and recommendations of the avifauna study are summarised below.

a) Description of the environment

Over 200 bird species, including 15 red-listed species, 66 endemics, and five red-listed endemics may occur in the broader area. The birds of greatest potential relevance and importance in terms of the possible impacts of the wind farm are likely to be (i) large terrestrial birds foraging on or commuting over the development area – particularly including Ludwig's Bustard (*Neotis ludwigii*), Kori Bustard (*Ardeotis kori*), Northern Black Korhaan (*Afrotis afraoides*) and Karoo Korhaan (*Eupodotis vigorsii*), and (ii) raptors foraging and/or nesting in the area – particularly Martial Eagle (*Polemaetus bellicosus*), Tawny Eagle (*Aquila rapax*), Lanner Falcon (*Falco biarmicus*), and Secretarybird (*Sagittarius serpentarius*), and (iii) a suite of endemic passerines – particularly including Red Lark (*Calendulauda burra*) and Sclater's Lark (*Spizocorys sclateri*).However, in general, the avifauna of the site is not particularly rich, and the habitats available are fairly uniform and unproductive. The site is not situated close to any presently recognised national Important Bird Areas, recognisable, key avian habitats or landscape features, or on any known or likely fly-ways.

Surveys of large raptors nesting on the steel pylons supporting Eskom's transmission lines in the area showed regularly active Martial Eagle nests within 11 km south of the site and within 22 km to the south-west.

The following birds were noted in DJEC (2010) for the area near to the Copperton mine: the near endemic Ludwig Bustard, the Lanner Falcon as well as the endemic Karoo Bustard *Eupodotis vigorsii*, Northern Black Korhaan (*Afrotis Afraoides*) and Black-eared Sparrowlark (*Eremopterix australis*).

The extent to which these birds may use the site for foraging or as a flight path is not yet clear, due to the brief nature of the site visit undertaken for the EIA.

b) Impact assessment

The potential impacts of the proposed project on birds includes mortality caused by collision with the wind turbine blades or power lines, habitat loss, disturbance by maintenance activities and possibly by the operation of the facility, displacement or disturbance of sensitive species, and electrocution on the required power line and substation infrastructure.

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 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 maneuverability (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[18]), (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. The site at Copperton however is not located along any ridges. However, 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).

It should be noted that the majority, if not all, of the power lines on site are buried and hence are unlikely to present a collision risk to birds.

[18] Perching birds and songbirds.

Habitat loss – destruction, disturbance and displacement

Although the final footprint of the proposed project is relatively small (1.1 % of the site) and maintenance activities fairly unintrusive birds are likely to be disturbed, especially shy and/or ground-nesting species resident in the area. 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. The birds at Copperton will be used to some disturbance due to existing farming activities and disturbances from the weapons testing facility near to the site. 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 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. It is furthermore proposed that the majority, if not all, of the power lines on site are buried.

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.

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

- Disturbance and displacement of resident populations and/or seasonal influxes of large terrestrial birds (especially Ludwig's Bustard, but including Kori Bustard, Karoo Korhaan and Northern Black Korhaan and possibly Blue Crane) from nesting and/or foraging areas and /or mortality of these species in collisions with the turbine blades or associated new power lines while commuting between resource areas (nest sites, roost sites);
- Disturbance and displacement of resident/breeding or visiting raptors (especially Martial Eagle, Tawny Eagle, Lanner Falcon and Secretarybird) from nesting and/or foraging areas and /or mortality of these species in collisions with the turbine blades or associated new power lines while slope-soaring or hunting, or by electrocution when perched on power infrastructure; and
- Disturbance and displacement of influxes of endemic passerines (especially Red Lark and Sclater's Lark) from foraging and/or nesting areas and/or mortality of these species in collisions with the turbine blades.

Based on the above the potential impact on birds is considered to be of medium magnitude, local extent and long term and therefore of **medium (-)** significance, without mitigation. With the implementation of mitigation measures, this is anticipated to reduce to **low - medium (-)** significance.

Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection.

There is very little difference between the overall height of the turbine alternatives proposed (149 m vs 150 m). However, the blades of the shorter 91 m tower option would sweep lower to the ground (33 m above ground level) than the taller 100 m option (50 m above ground level). The shorter turbine is therefore likely to have a greater impact on more birds, as the taller turbines would not affect birds flying lower than 50 m. However, the potential impact of this is likely to be insignificant or could only be determined through ongoing monitoring.

c) Mitigation measures

The following mitigation measures are recommended:

- Implement a comprehensive bird monitoring programme. This programme should inform the final layout and mitigation strategy of the project, and fully monitor the actual impacts of the wind farm on the broader avifauna of the area, from pre-construction and into the operational phase. The monitoring programme would recommend mitigation measures for inclusion in the final layout and operation of the project. These mitigation measures would need to be complied with. These mitigation measures could include, but are not limited to:
    - Locate turbines such that key habitats are avoided;
    - Minimise the footprint of the project;
    - Differentiate blades by markings, painting a single blade per turbine black, or some other means, should it be identified that raptors are likely to be frequent collision casualties. The evidence for this as an effective mitigation measure is not conclusive, and as such it may be best to adopt an experimental approach to blade marking, identifying a sample of pairs of potentially high risk turbines in pre-construction monitoring, and marking the blades on one of each pair. Post-construction monitoring should test the efficiency, which would inform subsequent decisions about the need to mark blades more widely in this facility;
    - Site turbines away from any areas of high avifaunal density or aggregation, regular commute routes or hazardous flight behaviour areas;
    - Use low risk turbine designs and configurations, which discourage birds from perching on turbine towers or blades, and allow sufficient space for commuting birds to fly safely through the turbine rows;
    - Carefully monitor collision incidence and be prepared to shut-down problem turbines at particular times or under particular conditions[19];
    - Minimise disturbances associated with maintenance activities by scheduling activities to avoid disturbances in sensitive areas or seasons; and
    - Keep disturbances to key bird species to a minimum.
- Use bird-safe structures (ideally with critical air gaps greater than 2 m), should above-ground power lines be used. Exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;.

[19] Plan 8 has indicated that this may be difficult to achieve without affecting the economic viability of the proposed project hence the EAP and Specialist will engage further with Plan 8 on this matter to ensure minimisation of the impact.

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- Minimise the length of any above-ground power lines and mark all new lines with bird flight diverters. Mark above-ground lines for their entire length as there is currently insufficient data to indicate high risk areas. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future. Where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line;
- Restrict any lighting of turbines to coloured (red or green) intermittent, lighting, as required by CAA; and
- Ensure that the results of monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other energy projects within 10 km of the site to be mitigated.

d) Cumulative impacts

All the potential impacts identified above are likely to be amplified should there be additional wind energy facilities within 10 km of the site. The proposed project, in combination with a large, neighbouring facility, may contribute to the formation of a significant barrier to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become a substantial array of many 100s of turbines. A wind energy facility, consisting of up to 190 turbines, has been proposed by Mainstream Renewable Energy on a site, approximately 8.5 km to the south. Four solar energy facilities, one already approved, have also been proposed and these are located immediately adjacent and within 8.5 km of the site (see **Figure 4.4**). While these would not result in collisions with turbine blades, other impacts such as disturbance and displacement, and collisions with power lines would still be amplified.

Based on the above the potential impact on birds is considered to be of medium–high magnitude, local extent and long term and therefore of **medium-high (-)** significance, without mitigation. With the implementation of mitigation measures for each potential project proposed in the area, this is anticipated to reduce to **low - medium (-)** significance.

4.2.3 Impact on bats

Bats occur throughout South Africa and, as noted in the Scoping Report, bats are likely to be found on site. 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. As such a study of bats was undertaken by Ms Monika Moir and Mr Werner Marais of Animalia Zoological & Ecological Consultation cc. A desktop review of relevant literature and a site visit on 9 and 10 October 2011 informed the bat study. The bat study is included in **Annexure F**. The findings and recommendations of the bat study are summarised below.

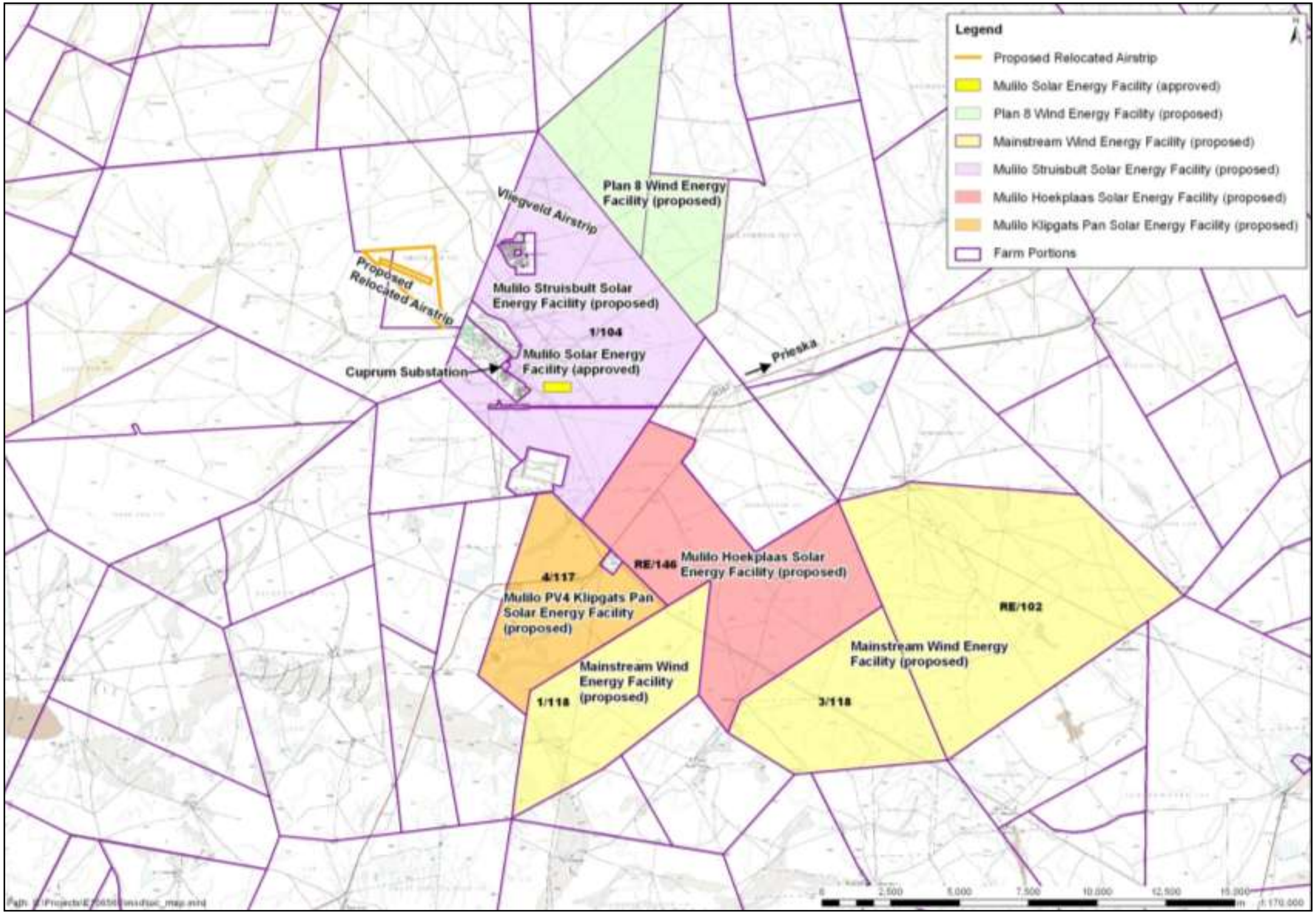

Figure 4.4 Proposed energy developments in the area surrounding Copperton

a) Description of the environment

From desktop studies, it was anticipated that 12 bat species may be found on site. Three species, namely Roberts's flat-headed bat (*Sauromys petrophilus*), Egyptian free-tailed bat (*Tadarida aegyptiaca*) and Cape serotine bat (*Neoromicia capensis*) were confirmed to be common on site. It is likely that any structure on the site, or in surrounding areas, such as buildings and large trees (either singly or in clusters) are probable roosting structures for the Cape serotine bat and the buildings for Egyptian free-tailed bat. From recordings of the bats it was considered likely that the Egyptian free-tailed bat and the Cape serotine bat are roosting in the town of Copperton and that they use the surrounding areas for foraging. Robert's flat-headed bat (*Sauromys petrophilus*) makes use of cracks within rocks and areas below exfoliating rock slabs for roosting areas and are probably roosting somewhere in the larger area around the site.

Water bodies and small seasonal streams offer valuable foraging terrain for bats in the area. Insects tend to be more abundant at open surface water and would therefore attract insectivorous bats on a nightly basis, and additionally the above-mentioned species also need water to drink. Based on these findings a number of areas were considered to be of particular sensitivity. The sensitive bat areas indicated by **Figure 4.3** are based on the bat activity detected by a bat detector and the probability of certain areas and features to be used as foraging space and roosting space. Two areas were considered to be of high sensitivity, namely Modderpan and a building on Portion 4 (southern portion) with associated large trees. Areas of moderate sensitivity were indicated along drainage lines on site.

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.

Since bats have highly sophisticated navigation by echolocation, it is not understood why they would get 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 the turbine and subsequently attract 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 such that the threat to migrating bats is negligible.

Some foraging habitat would be destroyed be lost to the proposed project. Diggings related to the placement of underground cables could damage bat roosts. However, the site does not have any major rocky outcrops or known underground roosts.

Based on the above, the potential impact of the proposed project on bats is considered to be of a high magnitude, local extent and long term, and thus of a **high (-)** significance without mitigation. With the implementation of mitigation measures, the significance would reduce to **low (-)**.

Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. The shorter turbine is therefore likely to have a greater impact on more bats, as the taller turbines would not affect bats flying lower than 50 m. However, the potential impact of this is likely to be insignificant or could only be determined through ongoing monitoring.

c) Mitigation measures

The following mitigation measures are recommended:

- Apply a 100 m buffer area to all moderately sensitive areas as well as the building indicated to be of high sensitivity. Apply a buffer area of 500 m to Modderpan (a high sensitive area). No turbines should be placed within the high sensitivity areas. Avoid areas of moderate sensitivity as far as possible for the location of turbines but where unavoidable apply additional mitigation measures to any turbines placed in moderate sensitivity areas;
- Curtail turbines to a preliminary cut-in speed of 5 - 5.5 m/s as a mitigation measure to lessen bat mortalities[20]. This is where the turbine cut-in speed is raised to a higher wind speed premised on the principle that bats will be less active in strong winds due to the fact that their insect food can't fly in strong wind speeds, and the small insectivorous bat species need to use more energy to fly in strong winds. This measure should only be implemented after long term monitoring has indicated under which weather conditions, times of day, season, etc it should be implemented and the recommended cut-in speed has been suitably refined by a bat specialist;
- Consider implementing an ultrasonic deterrent device so as to repel bats from wind turbines if any turbines are placed in moderate sensitivity areas. This measure may negate the need for curtailment but this would need to be informed by 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

[20] Plan 8 has indicated that this may be difficult to achieve without affecting the economic viability of the proposed project hence the EAP and Specialist will engage further with Plan 8 on this matter to ensure minimisation of the impact.

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 corrolated with bat activity to determine whether curtailment is required, and if so limiting factors for curtailment, and fine tune other mitigation measures.

d) Cumulative impacts

Bat populations are slow to recover to equilibrium numbers once major mortalities take place due to low reproductive rates. If the mortalities due to blade collisions are allowed to continue without mitigation for a long period of time across the proposed wind energy facility as well as the second wind energy facility proposed in the area, 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 is not known whether migrating bats occur near Prieska and this would need to be determined by ongoing monitoring as recommended in the mitigation measures.

4.2.4 Impacts on fauna

Any animals found on site could be impacted by the maintenance and operation of the proposed project, through a disturbance or reduction of habitat.

a) Description of the environment

Animals likely to be found on site and the surrounding environment are likely to include small antelope such as Steenbok, mongoose, Bat-eared Foxes, Black-backed Jackals, Caracal, Aardvark, snakes, etc. Various faunal species, or evidence of these animals, were observed during a site visit on 1 November 2010: Springbok, Black Korhaan, Meerkat, Pied Crow, shelduck and various pipits and larks. A nearby farmer, Mr Johannes Human of Hoekplaas farm approximately 4 km south of the site, also indicated that Black-Footed Cat (also called the Small Spotted Cat) and Brown Hyena have been seen on rare occasions in the area (pers. comm. 28/09/11). The IUCN Red List lists the Black Footed Cat as Vulnerable and the Brown Hyena is listed as Near Threatened (IUCN, 2011). The Black-footed Cat is a specialist of open, short grass areas with an abundance of small rodents and ground-roosting birds, and hence is likely to breed and feed in the area. The Brown Hyena is more likely to be an occasional visitor to the area as its presence would have been noticed by local farmers due to its relatively large size and it is likely the local farmers would have tried to kill any hyena based on common negative perceptions of this animal.

Black-footed cats are threatened primarily by habitat degradation by grazing and agriculture, as well as by poison and other indiscriminate methods of pest control (IUCN, 2011). Brown Hyena are often shot, poisoned, trapped and hunted with dogs in predator eradication or control programmes, or inadvertently killed in non-selective control programmes (IUCN, 2011).

Vegetation is generally accepted to be a proxy for biodiversity- the distribution of threatened species and communities is closely aligned with areas where indigenous vegetation has been extensively cleared (Department of the Environment, Water, Heritage and the Arts, 2008). As the vegetation types on site are generally of fair condition and are widespread (see **Section 4.2.1**) it is unlikely that other animals occurring within these vegetation types would be rare or endangered.

b) Impact assessment

The proposed project would have a footprint of approximately 35 ha or 1.1 % of the site. The density of the proposed project would also be very low, with project components, and in particular turbines, spaced far apart. Operation and maintenance of the proposed project would entail very few or rare on site activities and as such disturbance of animals or habitat are likely to be very limited. Existing human activities in the area are likely to have habituated most animals to the presence of humans and as such it is anticipated that any disturbance would result in animals leaving an area for a short period, if at all, and returning once the disturbance has passed. As such the potential impact of the proposed project on fauna is considered to be of low magnitude, local extent and short term (due to the infrequent disturbances and short nature of disturbances) and therefore of **very low (-)** significance, with or without mitigation.

Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. No difference in significance would result from the proposed turbine alternatives.

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

Although a number of energy projects are proposed for the area, these are widely spaced apart and are unlikely to result in cumulative impacts on animals.

4.2.5 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, as opposed 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 to 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 4.4**, 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.

4.3 OPERATIONAL PHASE IMPACTS ON SOCIO-ECONOMIC ENVIRONMENT

4.3.1 Impact on heritage resources (including palaeontology)

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). Due to the relatively undisturbed nature of the site, and the findings of the archaeology study on an adjacent property, it is likely archaeological or cultural material would be found on site. However, due to the underlying geology of the area there is a low possibility of finding palaeontological material. 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*. A Heritage, Archaeological and Palaeontology Impact Assessment were therefore undertaken.

The Heritage Impact Assessment (HIA) was undertaken by Mrs Melanie Attwell of Melanie Attwell and Associates. A desktop review was undertaken and the information gathered from a previous site visit to Copperton for an adjacent proposed solar energy facility, was used to inform the HIA. The Archaeology Impact Assessment (AIA) was undertaken by Mr Nicholas Wiltshire of Agency for Cultural Resource Management (ACRM). A desktop review and a site visit on8-12 September 2011 to inform the AIA. Mr John Almond undertook a desktop review of palaeontological aspects for the Palaeontological Impact Assessment (PIA). The HIA, AIA and PIA are included in **Annexure G**. The findings and recommendations of the studies are summarised below.

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a) Description of the environment

The general environment around Copperton includes the town itself which is partially empty, the disused mine containing some structures associated with mining activity, the Alkantpan weapons testing facility range (a division of Armscor Defense Institutes (Pty) Ltd) and an airstrip. The town of Copperton nearly remains but the urban fabric, consisting of low density grid plan housing built at the same time as the mine (circa 1970), has little to no heritage significance. Some of the housing stock is derelict, damaged and abandoned. Copperton contains no buildings or sites of heritage significance nor any buildings older than 60 years. The site is not part of the early mining history of the Northern Cape.

The general landscape of the site is flat with long extensive views with low horizons and an expansive skyline. The lack of vertical elements creates a landscape of some monotony which is punctuated only the power lines and the occasional tree. The most notable landscape feature within the site is the Modderpan, a seasonal pan. The site is characterized by a sense of remoteness and cannot be regarded in terms of standard definitions as a significant cultural landscape. The site is used for grazing stock and does not contain structures or any buildings over 60 years.

An AIA undertaken by ACRM for a proposed 20 MW solar energy facility on an adjacent site found many stone tools but no significant findings were made. A massive database of over 16000 sites accumulated by Sampson between the 1970s and 1980s (Sampson, 1985) is often referred to by others working in this area. Large numbers of Stone Age open site scatters were therefore anticipated on site. The archaeological visibility was generally high on site except for certain areas covered in moderate to deep Kalahari sands were the artefact count appeared to be reduced. A major constraint was the sheer size of the properties.

There were no significant large dolerite boulders on site. These dolerite boulders are often covered in engravings made by San (or Bushmen) hunter-gatherers, Khoekhoen herders and colonists in historical times.

Three sites were found which were classified as having a deserving a high, local significance rating (rating 3A), which is intended to be managed at a local municipal level. These are Modderpan, a stone kraal found on a low ridge on the eastern side of Struisbult and a stone kraal on the southern slope of the north-eastern corner ridge (see **Figure 4.6**). Currently these areas are used for grazing sheep and cattle and this does not pose a major threat to the conservation of these sites.

Modderpan has a range of representative artefact assemblages in contexts which could be dated. Raw materials used for stone tools at Modderpan were more diverse than elsewhere on the property. A jeep track runs through the south-eastern area of Modderpan and some minor surficial disturbance has taken place as a result of this. A small erosion gully had formed between the jeep track and the pan on the south-eastern side and artefacts were seen embedded in the walls of the erosion gully.

A total of 127 observations and sites were found. Stone Age quarries, a knapping site (where stone tools were made) and dense (>50 artefacts per square metre at times) deflated artefact scatters were found. The scatters were in their original contexts due to a lack of water flow (e.g. runoff). However, the mixture of Early Stone Age (ESA), Middle Stone Age (MSA) and Later Stone Age (LSA) artefacts from higher and lower soil horizons was visible and therefore downward deflation has definitely occurred in most places (i.e. soil layers have been removed by for instance wind, resulting in the artefacts all occurring in the same layer).

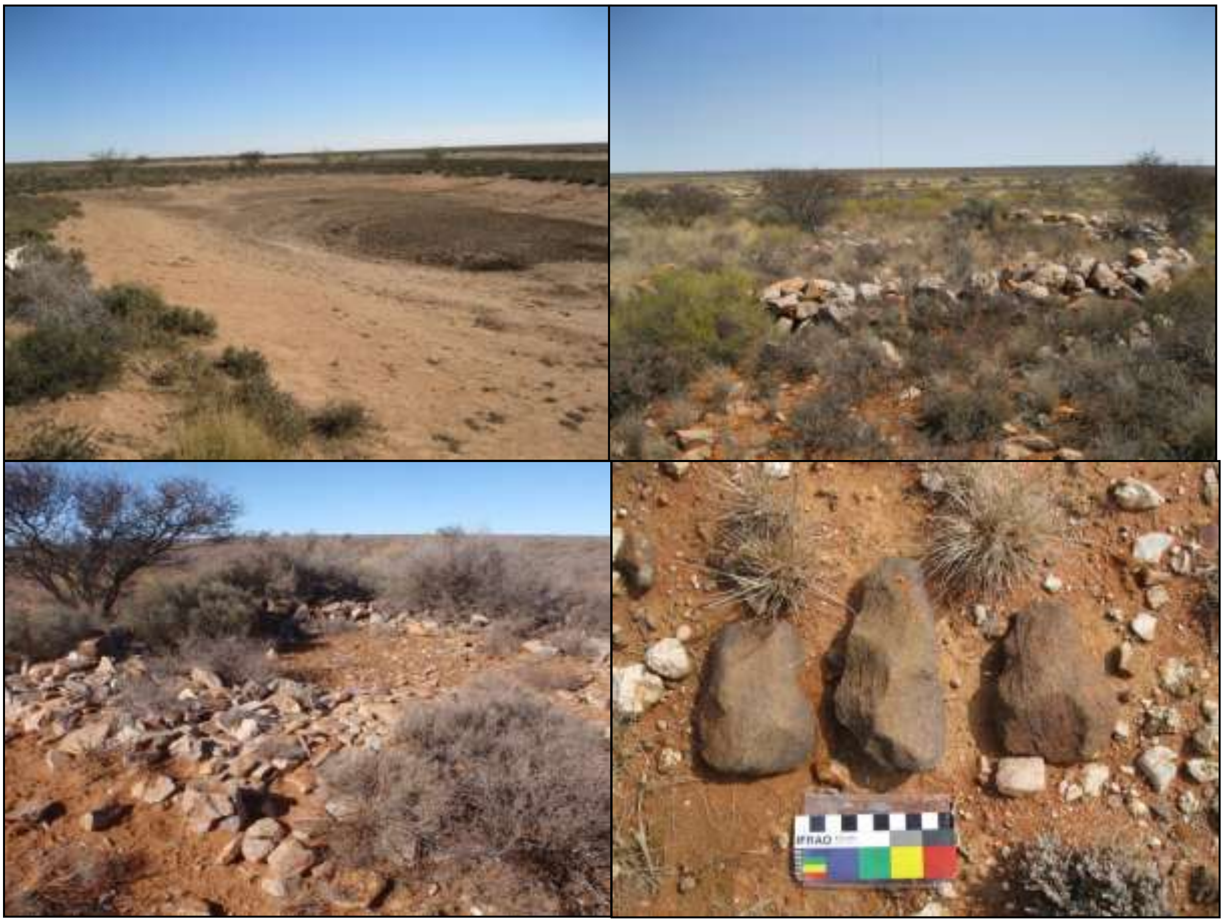

Figure 4.6 Photographs of some of the more significant archaeological finds onsite, from left to right starting at the top: Modderpan, kraal 1, kraal 2 and ESA artefacts

Blue-grey quartzite, vein quartz and light grey quartzite Stone Age quarries were found near Modderpan moving north-west from the site. Almost every quartzite outcrop on the site had evidence of flake scarring. No engravings were found on any of these outcrops. These quarries were rated as having local, medium heritage significance (rated 3B).

A stone kraal measuring 6m x 5m was also found on a slightly elevated koppie and this most likely dates to the historical period (perhaps shortly after the farm was settled by colonial farmers)as broken glass and a rusted metal plate were found nearby.

A second stone kraal was found by Mr Mike Meyer (landowner) on the property. The second kraal also lies on the southern, gentle slope of the north-easternmost koppie on Struisbult. This kraal is slightly larger but the walls are scattered and very low. Both kraals are considered to be of local, high heritage significance (rated 3A).

Many MSA artefacts littered the landscape over which the offsite connection would be routed. A large number of artefacts were also found on the site on which the new airstrip would be located. However, no findings of particular significance were noted at these locations. All scatters were considered to have local, low heritage significance (rating 3C).

The study area is largely covered by aeolian sands of the Kalahari Group (Quaternary to Recent

Gordonia Formation). Permocarboniferous glacially-related rocks of the Dwyka Group (Mbizane Formation) may be present locally in the subsurface. Several rocky inliers of metamorphic rocks assigned to the Proterozoic (Late Precambrian) Uitdraai Formation (Brulpan Group) and the Archaean (Early Precambrian) Spioenkop Formation (Marydale Group) also crop out in the area. The palaeontological sensitivity of all these rock units ranges from zero to low.

The main geological units in the Copperton area, as mapped in **Figure 4.7**, are:

- Precambrian basement rocks (igneous / metamorphic):
  - Reddish-brown with dots (Mu) = Uitdraai Formation (Brulpan Group);
  - Purple (Ms) = Spioenkop Formation (Marydale Group); and
  - Dark blue (Mv) = Vogelstruisbult Formation (Jacobsmyn Pan Group).
- Karoo Supergroup sediments:
  - Grey (C-Pd) = Mbizane Formation (Dwyka Group).
- Late Caenozoic (Quaternary to Recent) superficial deposits:
  - Pale yellow (Qg) = Gordonia Formation (Kalahari Group).

b) Impact assessment

As no heritage sites were identified no impacts would result on cultural heritage.

A number of archaeological sites have been identified and three are considered to be worthy of conservation (Modderpan and two stone kraals). Other findings, including quarries, a knapping site and stone age tools were considered to be common in the surrounding landscape and hence not conservation worthy. The turbines in the September 2011 layout do not come within 250 m of any of the three sites of concern, although it would be necessary to widen the existing road which is on the southern side of Modderpan. As such the potential impact of the proposed project on archaeological resources is considered to be of low magnitude, local and long term and therefore of **low (-)** significance, without mitigation for all alternatives. With the implementation of mitigation measures the potential impact is likely to remain of **low (-)** significance although the probability would decrease.

Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. No difference in significance would result from the proposed turbine alternatives.

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 are any potential impact it would be of low magnitude, local and long term and therefore of **low (-)** significance, for both layout alternatives. No mitigation is considered to be necessary. No difference in significance would result from the proposed alternatives.

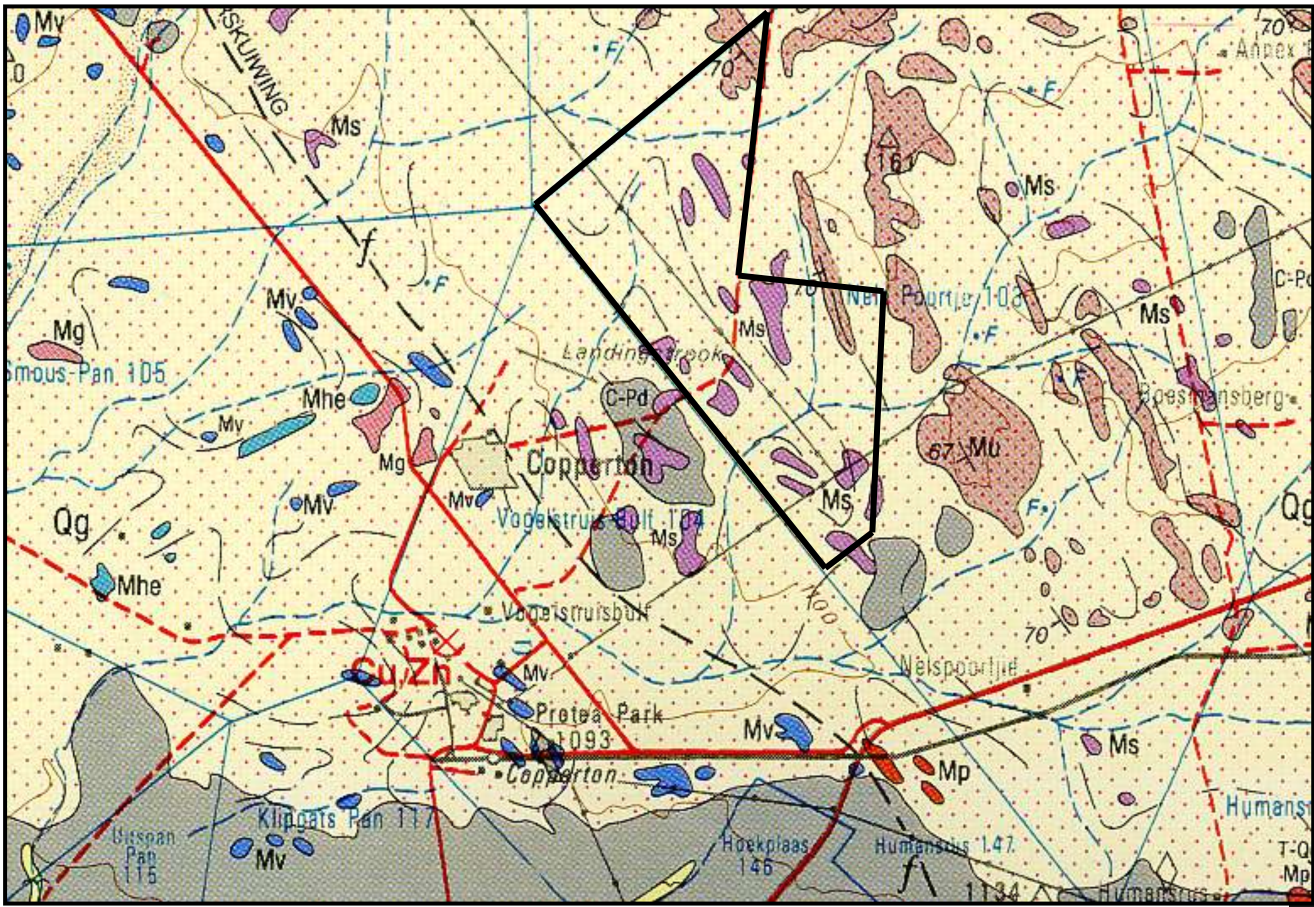

Figure 4.7 Extract from 1: 250 000 geology map 2922 Prieska (Council for Geoscience, Pretoria) showing approximate outline of the proposed wind energy facility near Copperton (black polygon) (courtesy J Almond)

c) Mitigation measures

The following mitigation measures are recommended:

- Avoid development within 250 m of the centre of Modderpan as well as within 100 m from the centre of the stone kraals. Confirm the co-ordinates of the smaller stone kraal via GPS;
- Do not exceed 1 m on the northern side of the road nor 2 m on the southern side of the road when upgrading the existing access road which is within 250 m of Modderpan. Do not move the fence on the northern side in order to minimise disturbance, however the fence on the southern side could be moved if required; and
- Archival research for the stone kraals and a conservation management plan for Modderpan and the kraals are highly recommended and should be commissioned by the owner of Struisbult at some point in the future.

d) Cumulative impacts

Cumulative impacts are not foreseen as the potential impacts identified are limited to heritage resources on site.

4.3.2 Visual impacts

The area surrounding the site is located at some 1 100 – 1 200 metres above mean sea level. The area is gently undulating to flat, with a very gradual slope east to west. The landscape is covered in shrubs with a few sparse trees. Any tall structures, such as existing powerlines, are visible for many kilometres. The potential therefore exists that the proposed wind turbines and associated infrastructure would 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 project. The VIA, and comments on the updated site layout, is contained in **Annexure H**. 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 personal experience as well as that 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, sparsely populated lands, typical of the rural open plains of the Karoo. Existing vertical elements in the landscape are the lines of transmission pylons leading to and from existing substations, telegraph poles, the abandoned mine shaft and other tall, bulky, remnant mine buildings. These bring some industrial character into this rural area however the overall visual impression of the locality is one of an open, flat, rural, landscape with some industry, offering long expansive views (see **Figure 4.8**). There are no formally protected areas in the vicinity of the site.

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 remoteness, however the site does not have a strong or identifiable sense of place.

Figure 4.8 Photograph of the site landscape indicating its open nature and expansive views. This image shows the existing wind monitoring mast (WMM), a very lightweight structure, 80 m high.

The 25 km viewshed for the site includes Copperton, the Alkantpan test range, surrounding farms, the abandoned mine, transportation corridors and the wider landscape. Areas with an open and consistent view would be Copperton, the R357, Alkantpan, the proposed new airstrip site and scattered farmsteads. Areas with a view that is extensive but more broken include the mine and a sector to the north east and east. The rail line parallel with the N10, and the N10, both lie in valleys and would not be visually impacted upon. The areas of visibility are largely the same for both proposed turbine alternatives. All areas of site are considered to be equally visible.

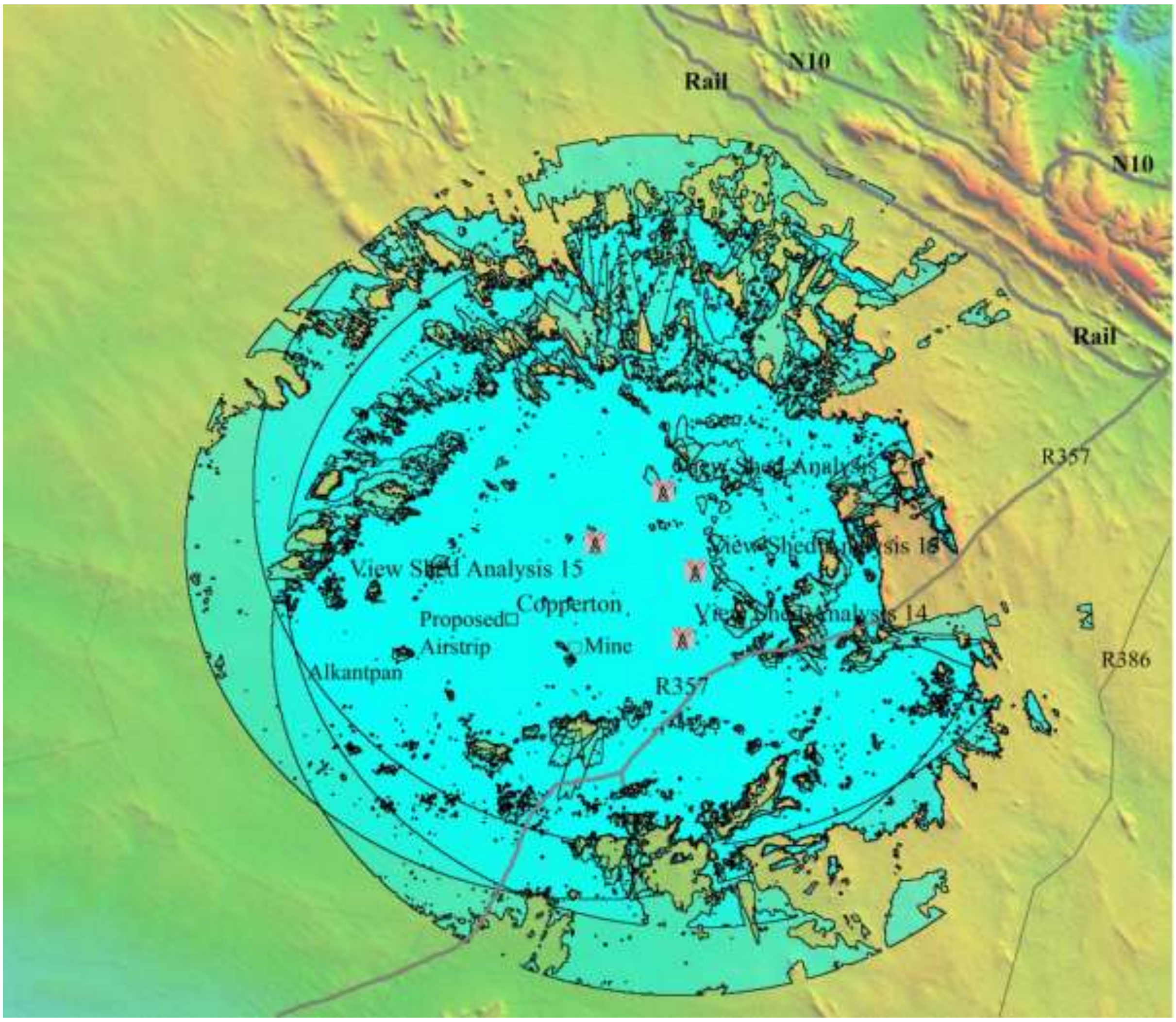

Figure 4.9 Viewshed calculated at a radius of 25 km for tallest proposed turbines (100 m tower and 50 m rotor)

The degree to which the proposed project would be visible is determined by the height of the turbines and rotors, but is moderated by the distance over which this would be seen, the weather and season conditions and built form and terrain.

b) Impact assessment

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 the proposed site 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 it would strongly influence the view and act as a visual focus.

The community of Copperton is small in number and would be a minimum of 3.5 km from the nearest proposed turbine. The dwellings are all single storey, few trees grow taller than 9 m, and there is little or no other shielding. The most northerly dwellings and 'IetsNeitz', (accommodation for visitors to Alkantpan, etc) would be most affected. Others would have a broken view from houses and an open view from roads (see **Figure 4.10**). The prevailing wind direction is likely to result in very infrequent face-on views of rotating turbines.

Alkantpan test range is not residential. Of the people who work there, few are permanent, most are transient, and the site is generally about 10 km away from the nearest proposed turbine. The scale of the proposed development in the landscape would be large, but at a distance that reduces the degree to which the view is influenced and moderates the visual focus.

Within a 10 km radius of the proposed development there are seven groups of buildings which appear to be farmsteads and working farms. The nearest of which would be 4 km from the nearest proposed turbine. These farmsteads would have an open view as there is little or no shielding by terrain (most have a few trees planted adjacent for shelter but this would not influence the view significantly). While some of the farmsteads in the area are permanently inhabited, many are not, and it is not known which buildings are working farms, which are permanently inhabited, and which are managed by visits only. Within a 25 km radius of the proposed development there are an additional 15 groups of buildings which appear to be farmsteads and working farms. The scale of the proposed development in the landscape would be large, but at a distance that reduces the degree to which the view is influenced and moderates the visual focus.

The mine is inhabited by only five to six people, who are employed as labourers by the site landowners. The mine is about 6.5 km from the nearest proposed turbine.

Travelling north-east towards Prieska on the R357, the proposed project would come into view as the road turns to the north on its approach to the mine. The distance would be 25 km from the nearest turbine at this point and the view would become slightly broken up as the road user approaches the slime dam. The development would then be temporarily obscured but would reappear and be visible up to where it is behind the user and therefore deemed to be out of view at about 10 km from the nearest proposed turbine (see **Figure 4.10**). This represents a distance of about 40km and could be experienced by a road user for about 24 minutes if travelling at 100 km/h.

Travelling south west towards Vanwyksvlei the R357 approaches and passes a low ridge, about 1 230 m high when the road is at an elevation of between 1140 and 1160 m above sea level. The proposed project would then come into view about 13 km distant. Beyond the ridge the project would be in full view and continue till it would be behind the user and therefore deemed to be out of view; (assessed as a point where the road draws level with the slime dam). This represents a distance of about 23.5 km and could be experienced by a road user for about 14 minutes if travelling at 100 km/h.

Figure 4.10 Images showing the proposed project superimposed on photographs from various locations

(1) Image of site from the R357 looking west, about 10 km away, with turbines superimposed to indicate the possible visual effect. Source: Viridian

(2) Image of site from the R357 looking north, about 4 km away, with turbines superimposed to indicate the possible visual effect.

(3) Image of the site from the corner of Silver Street, Copperton, where people live, looking east to turbines

which would be about 3.5 km, and more, away.
(4) Image from the road through Copperton from the roundabout at its entrance up to Ietsnietz and off which most properties are accessed. The view would be to the east and looking at turbines about 3.5 km, and more, away.

Note: Images were taken both during the morning and the afternoon in the month of August 2011. The weather was clear and open, and deemed to be typical.

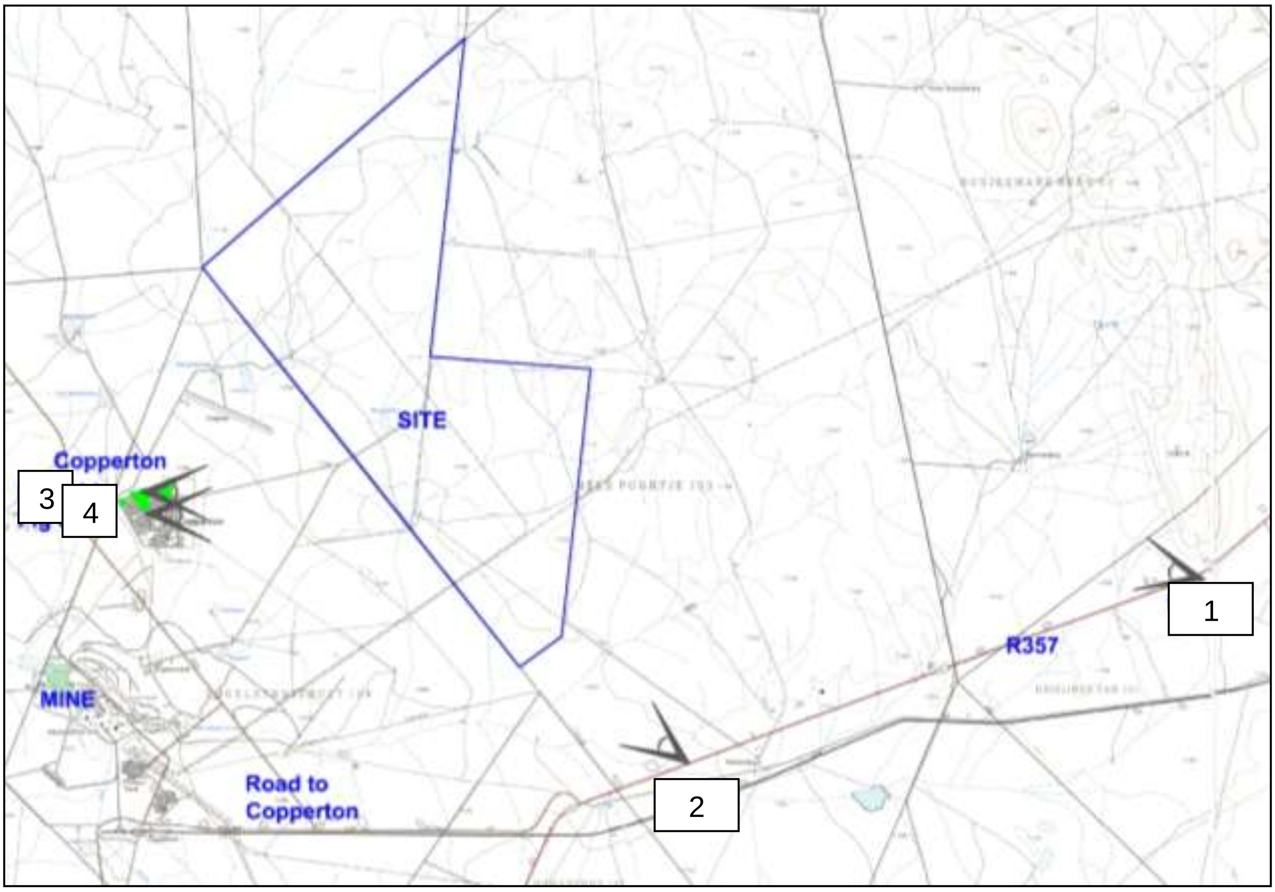

Figure 4.11 Location from which images were taken

From a number of other roads around Copperton receptors would see the proposed propejct for lengths varying from 4-38 km or approximately 13-24 minutes.

If the longer transmission line, across to Cuprum substation were implemented it would be seen by users of the road to Copperton from the R357. There are many such transmission lines locally, and therefore this alternative would not be considered to have an additional measureable impact. Because this road is, in part, to the south of the proposed turbines users would likely experience a face-on view of the rotating blades.

All receptors within 10 km of the site would most likely be aware of aircraft warning lights (flashing red lights) on turbines at night.

There are scattered farmsteads which have been discussed in para 5.9.3 and there is a network of gravel roads within the whole of the assessed area. Other receptors in the area include people either accessing surrounding farmlands via gravel roads or undertaking maintenance inspections on the Eskom transmission lines. There would also be a limited number of recreational users (such as aeroclub members).

The general zone of visual influence was is assessed as moderate-high

The visual absorption capacity, the ability of the surrounding area to visually absorb the project, is considered to be medium. This is because the area can absorb the proposed project to some degree due to the existing network of power lines and mine buildings, all prominent n the landscape, which provide an industrial aspect to the locality.

The proposed project would change the land use to an industrial use, however the existing powerlines, mine buildings and associated infrastructure means that the proposed project is moderately compatible with the surrounding landscape.

Based on the above, and the large scale nature of the proposed project, the potential visual impact is considered to be of medium to high magnitude, regional extent and long term and therefore of **medium-high (-)** significance, without or with mitigation. This potential impact would decrease, the further away one goes from the proposed project. This potential impact remains the same for both turbine alternatives as the 30 m height difference is not considered to be significant when the scale of the proposed project is considered. Furthermore, there is no difference in significance between the two connection alternatives, as the existing power lines would visually absorb either option.

Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. No difference in significance would result from the proposed turbine alternatives due to the insignificant difference in heights (149 vs 150 m).

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:

- Consider temporary hardstandings for cranes in place of permanent hardstandings;
- As much as possible, place any new structures where they are least visible to the greatest number of people;
- 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;
- 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; and

- Maintain turbines in operational condition.

d) Cumulative impacts

As noted previously a number of other 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 Copperton context, with the long views, few roads with little traffic, and the low numbers of houses, the cumulative impact is considered to be of low magnitude, regional extent and long term and therefore a **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 project 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 facility 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[21].

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 project could provide 140 MW, or 3.8 %, 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 project on energy production is considered to be of low magnitude, regional and long term and therefore of ***low (+)*** significance, without or with mitigation measures.

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

No difference in significance would result from the proposed alternatives.

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

As shown in **Figure 4.4** five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. The potential cumulative impact of these proposed project 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 facility would provide a number of direct, indirect and induced jobs. Direct jobs are created during manufacturing, construction and installation, operation and maintenance. The proposed project 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

Copperton falls within the Siyathemba Local Municipality (LM). The population of Siyathemba LM is 19 360 and this is split into 74 % Coloured, 14 % African, 11 % White and 1 % Other. The total number of households is 4 542. The main employment industry is farming, followed by mining. Agricultural activities extend to sheep, wheat, maize, lucerne, cotton, beans, vineyards and peanuts. There are 12 schools in the LM and, four clinics (one of which is in Prieska) and one hospital[22].

The site is located in a rural area and as such the population density is very low, with neighbours located kilometres away. Whilst Copperton itself was once a populated town, providing accommodation for the mine workers, this is no longer the case and the majority of houses have been demolished. A few houses are however still rented to retired farmers. According to the Pixley ka Seme DM SDF (2007) the 2001 population of Copperton (which fell under the DM's management, prior to being assimilated into the Siyathemba LM) was 37, with nine households. Employment opportunities in the immediate area stem from farming, the local accommodation lodge, Ietznietz, and Alkantpan weapons testing facility (see **Figure 1.1**).

b) Impact assessment

Up to 337 operation and maintenance jobs would be created during the operational phase. Indirect and induced jobs would also result from the proposed project. It is important to note that the number of jobs does not equate to the number of people employed.

[22] Taken from http://www.siyathemba.co.za/demographics.htm (accessed 02/01/11)

The operating expenditure of the proposed project would be roughly R 700 million, of which up to R 250-300 million would be spent in South Africa. Increased spending (procurement of goods and services) in South Africa would indirectly result in more employment opportunities. Increased employment opportunities (direct and indirect) would allow for an improvement in social conditions for those who obtain employment. The project would also result in an increase in the revenue of the LM 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 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:

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

d) Cumulative impacts

As noted previously, five other renewable energy projects are proposed for the area, with a combined capacity of 900-950 MW. 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 20 m x 20 m, which could be recovered with top soil to allow vegetation growth around the 6 m diameter steel tower. In order for a crane to erect the turbines, a hardstanding consisting of an impermeable material such as concrete or tar and approximately 20 m x 6 m in size, would be constructed adjacent to each turbine. Access roads of 6 m we would also be required between each turbine. Although it was recommended in the Scoping Report that the EAP assess the potential impact of a loss of agricultural land, DEA requested that a specialist study be undertaken to determine the potential impacts on agriculture in their letter of acceptance of the Scoping Report. As such Mr Kurt Barichievy of SiVEST (Pty) Ltd was appointed to undertake a desktop Agricultural Impact Assessment. A desktop review was undertaken and the information gathered from a previous site visit to the Copperton area for an adjacent wind energy facility, was used to inform the Agricultural Impact Assessment. The Agricultural Impact Assessment is included in **Annexure I**. The findings and recommendations of the study is summarised below.

a) Description of the environment

The agricultural potential of a site is classified based on climate, geology, land use, slope and soil characteristics.

Climate

Copperton has an arid continental climate with a summer rainfall regime i.e. most of the rainfall is confined to summer and early autumn. According to the Daily Rainfall Extraction Utility (Lynch, 2003) the Mean Annual Precipitation (MAP) for the Copperton area is approximately 176 mm per year with 62 % of this falling between January and April. Mean Annual Precipitation of 176 mm is extremely low, considering that 500 mm is the minimum amount of rain required for sustainable dry land farming). Therefore, without some form of supplementary irrigation, natural rainfall for the Copperton area is insufficient to produce sustainable harvests. This is reflected in the lack of dry land crop production within the area. The region typically experiences hot days and cold nights with the average summer temperature of approximately 33 ^{o}C and the average winter night time temperatures of approximately 1 ^{o}C.

Geology

The study area is underlain by a variety of parent materials including quartzite, sedimentary and tillite (see **Figure 4.7**). Tillite is however, the most dominant geologic material and underlies the central portions of the site. Tillite consists of consolidated masses of unweathered blocks and unsorted glacial till. Quartzite, a medium grained metamorphic rock, underlies the north eastern and eastern portions of the site and is formed from recrystallised sandstone with the fusion of sedimentary quartz grains. Non-descript sedimentary geologic materials are found in the northern areas and along the south western boundary of the site.

Slope

The Copperton area is characterised by flat and gently sloping topography with an average gradient of less than 10 %, which is considered to be an ideal slope for intensive agriculture, with high potential for large scale mechanisation.

Land use

The site consists of a mix of natural veld and vacant land which is used as general grazing land for sheep, cattle and some goats. Vast unimproved grazing land is interspersed by non-perennial stream beds and pans. Stocking rates for the region are estimated at 1 small animal unit per 6 hectares. According to the land use data there are no signs of formal agricultural fields or cultivation.

Soils

According to the Environmental Potential Atlas for South Africa (ENPAT) database (DEAT, 2001) the site is dominated by red apedal soil types. Apedal (structureless) soils lack well formed peds (layers) other than porous micro-aggregates and are weakly structured. Apedal soils tend to be freely drained, and due to overriding climate conditions these soils will tend to be eutrophic (high alkaline status). The site 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
The ENPAT database (DEAT, 2001) also provides an overview of the study area's agricultural potential based on its soil characteristics, although it should be noted that this dataset does not take *climate into account*. According to ENPAT (DEAT, 2001), the site is dominated by soils which are not suited for arable agriculture but which can still be used as grazing land. However, when climate is considered (the strong summer rainfall regime, moisture stress and low winter temperatures) the agricultural potential of the site is further reduced.

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

b) Impact assessment

The proposed project would result in the loss of approximately 35 ha (or 1.1 %) of grazing land through the footprint of the proposed project (e.g. access roads, hard standings, turbine footprints etc). Grazing would continue around the turbines and infrastructure. Furthermore there are no centre pivots, irrigation schemes or active agricultural fields which could be affected by the proposed project.

Due to the low agricultural potential of the site, limited footprint and continuation of grazing within the site the potential impact of loss of agricultural land is considered to be of low magnitude, local extent and long terms and therefore of **low (-)** significance, with or without mitigation. Although there would be a slightly greater impact due to the offsite connection alternative the significance of the potential impact would not be significantly different to the onsite connection. No difference in significance would result from the proposed turbine alternatives.

It was noted in the specialist study that a full agricultural assessment was not considered to be necessary.

c) Mitigation measures

No mitigation measures are recommended.

d) Cumulative impacts

No cumulative impacts are anticipated.

4.3.6 Impact on surrounding land uses

The predominant surrounding land use is agriculture, however, a few other land uses exist and the proposed project could impact on these surrounding land uses.

a) Description of the environment

At the abandoned Copperton mine, a photovoltaic power generation facility is proposed by Mulilo Renewable Energy (Pty) Ltd (DEA Ref. No. 12/12/20/1722) has been approved, and further west of the site is Alkantpan, a weapons testing range. Closer to the site, a 1.7 km airstrip, is located immediately west of the site and is used by a number of aeroclubs (e.g. Aeroclub SA). The current world record for paragliding (502 km) was set from Copperton. Copperton produces good thermal activity with minimal low level obstructions to facilitate safe launching and departures for paragliders and light aircraft.

Copperton itself consists of a few dwellings and a small shop is also located immediately west of the site.

As noted in Section 1.2.3 the proposed wind energy facility falls outside of the Karoo Core Astronomy Advantage Area, but inside the Karoo Central Astronomy Advantage Area. Furthermore, two SKA satellite stations are located 15 and 45 km from the site, as shown in **Figure 4.12**. The Karoo Core Astronomy Advantage Area will contain the MeerKAT radio telescope and the proposed core planned SKA radio telescope that will be used for the purposes of radio astronomy and related scientific endeavours. South Africa, along with Australia, has been shortlisted to host the world's largest telescope, the SKA. South Africa's bid proposes that the core of the telescope be located in an arid area of the Northern Cape, with approximately four antenna stations in Namibia, three in Botswana, two in each of Mozambique and Madagascar, and one each in Mauritius, Kenya, Ghana and Zambia[23]. A final decision on the location is expected to be made in early 2012 by the SKA Board of Directors.

a) Impact assessment

It is known that wind turbines interfere with radio communications, and this could affect radio communications from Alkantpan as well as any radio communications used by paragliders or small planes utilising the nearby airstrip. Wind turbulence and approach hazards due to the height of the turbines and the fan effect of the blades could also affect paragliders and light aircraft. However, in order to avoid effects on paragliders and light aircraft it is proposed to move the airstrip as part of the project. The new location of the airstrip is not anticipated to affect users of the airstrip. Furthermore, Alkantpan uses directional radar which is not affected by wind turbines.

Interference with the SKA, should the Carnavon site in South Africa be selected, could also result from the wind turbines (see **Figure 4.12** indicating the line of site visibility of turbines from proposed SKA satellite stations).

[23] http://www.ska.ac.za/bid/index.php (accessed 19/10/11)

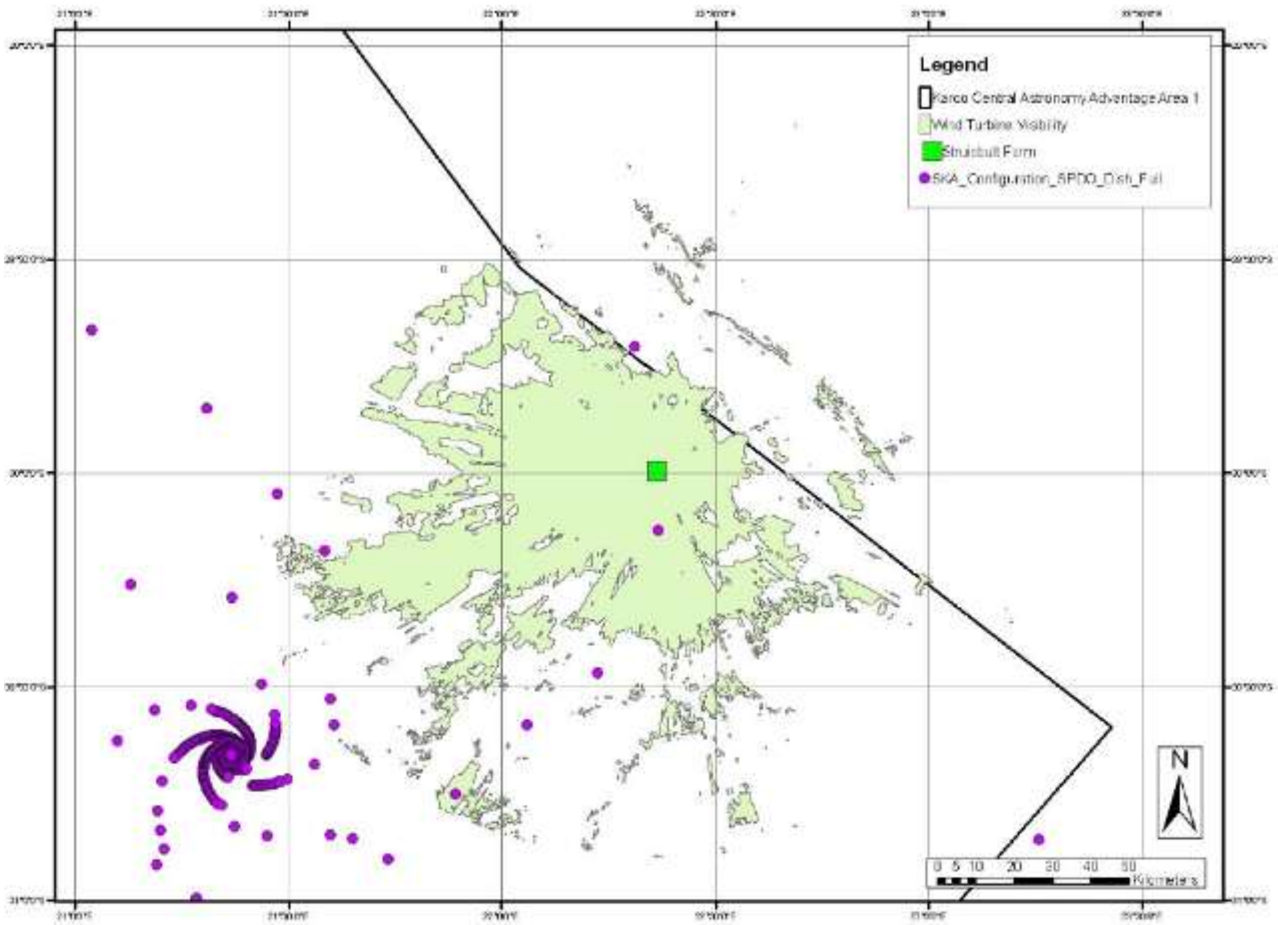

Figure 4.12 Line of site visibility of proposed wind turbines at Struisbult farm, Copperton. the area of detrimental effect includes at least two SKA stations

Potential detrimental impact on the SKA results from two potential radio frequency sources. Firstly, radio frequency signals may be reflected, and scattered, by turbine blades onto nearby SKA stations. This may result in very distant, yet high powered, signals that are generally not visible by the SKA stations causing interference due to the extended 'line of sight' of the stations as a result of secondary reflections.. The turbines and their associated electrical infrastructure (e.g. the 8.6 km offsite connection) also have the potential of generating electromagnetic noise that could interfere with the data collection of the radio telescopes. The precise nature of this potential interference is not yet fully understood and needs to be modelled using data gathered during technology-specific electromagnetic interference (EMI) measurements. Plan 8. in discussions with Dr Adrian Tiplady of SKA, have agreed upon the nature of this model, the nature of the data that needs to be gathered, and the methodology involved in the measurement campaign and will soon initiate this study. It is anticipated that results of the study would be available in March 2012 and that these could provide input into the EIAR.

Based on the height of the offsite connection, similar to existing transmission lines on site, and distance to the satellite stations (15 and 45 km) the connection is unlikely to affect the stations. However, a low risk still exists of detrimental impact on the nearest SKA station, which would be dependent on specific electromagnetic compatibility designs and mitigation measures used in the design and construction of the wind power facility, and connecting power infrastructure.

Should the turbines interfere with SKA satellite stations the potential impact is considered to be of high magnitude, regional extent and long term and therefore of **high (-)** significance, without mitigation. Note that the confidence in this impact is considered to be Unsure[24]. No difference in significance would result from the proposed alternatives.

As mitigation measures have not yet been determined it is not possible to ascertain the significance of the potential impact after mitigation at this point. However, it is anticipated that mitigation measures would be sufficient to reduce the significance of the potential impact to a level acceptable to SKA, failing which the proposed project would not be allowed to proceed. The significance of the potential impact would only be determined after the modelling study is complete.

It should be noted that should the SKA project be awarded to Australia no impact would result from the proposed wind energy facility. This decision is due to be taken in early 2012 by the SKA Board of Directors.

b) Mitigation measures

It is anticipated that mitigation measures would be identified after modelling has taken place. Mitigation measures could include, for instance, shielding turbine components which produce high levels of EMI, reducing the height of turbines, relocating the satellite stations, etc. The effectiveness and feasibility of these measures would need to be determined prior to their recommendation.

c) Cumulative impacts

It is anticipated that the potential impact on SKA would be reduced to a level acceptable to SKA. Furthermore, it is expected that any other wind energy facilities would need to reduce their potential impact (including cumulative impact) to a level acceptable to SKA.

4.3.7 Impact of noise

The area surrounding the site consists predominantly of relatively flat grazing lands. As such, the rural atmosphere generates little noise, although intermittent blasts are heard from the Alkantpan weapons testing facility. The potential exists for noise from the proposed wind turbines to affect surrounding landowners.

a) Description of the environment

As noted previously the site and surrounds are predominantly rural with relatively low ambient noise levels, although intermittent blasts are heard from the Alkantpan weapons testing facility. However, due to the rural landscape there are few nearby sensitive receptors, with the closest receptor being Copperton town itself, 3 km east of the site.

[24] Limited useful information on and understanding of the environmental factors potentially influencing this impact is available.

b) Impact assessment

Sound is a pressure wave. A unit measure for sound is decibels (dB). The human ear is sensitive to A-weighted dB (higher harmonics of middle A between 2 and 4 kHz), and hence when looking at impacts on humans dBA is considered (Jain, 2011). Typical noise levels of various sources are provided in **Table 4.1**.

According to Jain (2011) noise is generated in a turbine from two primary sources:

- Aerodynamic interactions between the blades and wind. This is the persistent "whoosh" sound as the blades slice the wind. This is the dominant noise from a turbine; and
- Mechanical noise from different parts of the turbine, like gearbox and generator.

In addition to the above audible frequencies, turbines produce low frequency noise in the range of 20-100 Hz.

Table 4.1 Typical noise levels of various noise sources

Sound Level (dBA)	Noise source
140	Jet engine at 25 m
120	Rock concert
100	Jackhammer at 1 m
80	Heavy truck traffic
60	Conversational speech and TV
50	Library
40	Bedroom
30	Secluded wood
20	Whisper

Source: Minnesota Pollution Control Agency (2008) in Jain (2011)

Since sound is a compression wave, the dB level drops quickly as distance from the sound source is increased. For a line source of sound, doubling of distance reduces pressure by one half, which reduces dB level by approximately 3 dBA (Jain, 2011). The loudest sound from a turbine is heard when the blade cuts through the air closest to the ground, and this is considered to be a line source. According to Burton *et al* (2001) the noise generated by a wind turbine is approximately proportional to the tip speed of the turbine blade. Turbines are generally limited to a tip speed of approximately 65 m/s as this generally results in wind turbine noise levels on a par with ambient levels, or below 35 dBA, at a distance of 400 m. It should also be borne in mind that as the wind increases, and hence the noise from a turbine increases, the ambient noise also increases due to the wind.

As the nearest sensitive receptor is the residences at Copperton, 3 km from the border of the site, and as noise levels are expected to be on par with ambient noise levels at a distance of 400 m, it is anticipated that the proposed project would have **no impact** on noise levels.

c) Mitigation measures

Not mitigation measures are recommended.

d) Cumulative impacts

No cumulative impacts are anticipated.

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 project:

- Disturbance of flora, avifauna, bats and fauna;
- Sedimentation and erosion of water ways;
- Impact on heritage resources;
- 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 three years. Many of the construction phase impacts could be mitigated through the implementation of an appropriate EMP. A life-cycle EMP is contained in **Annexure J** of this report, which specifies the mitigation measures that could be implemented to mitigate construction phase impacts, amongst others.

4.4.1 Disturbance of flora, avifauna, bats and fauna

Flora

This impact considers impacts beyond the permanent footprint impacts of the proposed wind energy facility. Alien plant seeds could be introduced with construction material such as sand or other materials, with any disturbed areas being particularly vulnerable.

Avifauna

Although the final footprint of the proposed project is relatively small (1.1 % of the site), 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 Red Lark and Sclater's Lark, Martial Eagle, Tawny Eagle, Lanner Falcon, Secretarybird, Ludwig's Bustard, Kori Bustard, Karoo Korhaan, Northern Black Korhaan and possibly Blue Crane

Fauna
Any affected fauna would generally be largely mobile and would relocate during the construction phase and are likely to recolonise the area, once the construction phase has been completed and the disturbed areas rehabilitated.

Bats
During the construction phase of the project, bat roosts can be negatively impacted by earthworks and large machinery, although highly unlikely.

Potential impacts on flora, avifauna, fauna and bats are considered to be of low-medium magnitude, local extent and medium term as vegetation would take a long time to rehabilitate and therefore of **low-medium (-)** significance, without mitigation. The potential of this impact would reduce to **low (-)** significance with the implementation of the recommended mitigation measures. No difference in impact significance would result from the proposed alternatives.

The following mitigation measures are recommended:

- Compile and implement a vegetation rehabilitation plan with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The specialist is to recommend species to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal;
- Compile and implement a comprehensive bird monitoring programme, as indicated in Section 4.2.2(c);
- Demarcate no-go areas identified during pre-construction monitoring; and
- Re-schedule construction activities on site, where required by the results of the bird monitoring programme.

4.4.2 Sedimentation and erosion impacts

The study area falls within the arid region of South Africa. Average annual rainfall is low (189 mm) and as such it is expected that few rivers and low groundwater tables will be found in the area. The majority of the site is located within the D54D quartenary catchment of the Lower Orange River whilst the northern most portion is within D54G. With few rivers, apart from the Orange River 42 km east of the site, draining the area endorheic (inward flowing) pans occur. Pans such as Modderpan are an important wildlife habitat, particularly for birds (especially migratory birds), mammal species and invertebrates. A dry river crossing the southern portion of site can also be seen in **Figure 4.3** as can other drainage lines. This river would only flow during large rain events and can remain dry for years at a time. Numerous small dry drainage lines cross the area.

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 across drainage lines and other construction related activities. This would be exacerbated during the wet season and during any intense rainfall events. Three turbines (numbers 20, 24, 52) and a number of roads do lie within 32 m of a number of drainage lines.

The potential impact of sedimentation and erosion from the construction of the proposed project is considered to be of medium magnitude, site specific and short term and therefore of **low (-)** significance, without mitigation measures. The potential of this impact would reduce to **very low (-)** significance with the implementation of the EMP. No difference in impact significance would result from the proposed alternatives.

4.4.3 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. The potential impact on these resources has however been assessed as a permanent impact under the operational phase impacts (Section 4.3.1) and as such will not be assessed here. However a number of mitigation measures, for implementation during the construction phase, are included here.

The following mitigation measures are recommended:

- Safeguard any substantial fossil remains exposed during construction, preferably *in situ*, and SAHRA should be notified by the ECO so that appropriate mitigation can be undertaken;
- Cordon off the no-go areas including their buffer zones cordoned off during the construction phase; and
- Record the varying depth of the Kalahari sands, the calcrete layers and the quartzitic bedrock when excavating the foundations for the. Section drawings, measurements and photographs must be taken of the pit for each turbine and for each pit wall (i.e. 4 sections per pit with a metre scale) by the contracted engineer assigned to the construction phase. The format for this report must be drawn up in consultation with the archaeologist. The engineer must be briefed on the recording requirements by the archaeologist before excavations are done. This report must be submitted to the consultant archaeologist for dissemination to SAHRA, Mr Kiberd and the McGregor Museum to aid others in the development of a broader understanding of the Pleistocene landscape of this area.

4.4.4 Visual impact

Construction activities on the site are likely to be visible to receptors in the surrounding area, and particularly those within 5 km of the site. Areas of land cleared temporarily as well as construction plant may also be visible from transportation corridors such as the R357.

The potential construction phase visual impact is considered to be of medium-high magnitude, local extent and short term and therefore of **medium (-)** significance, without mitigation. With the implementation of mitigation measures this would reduce to **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.

4.4.5 Impact on local economy (employment) and social conditions

The proposed wind farm would employ a medium local content i.e. up to 40% of the expenditure would be within South Africa. The turbines and blades would, however, be imported from Europe. The local financial value of the project equates to roughly R 2.3 billion (or R 17 million per MW).

Local labour would be employed during construction. Up to 548 construction, installation and manufacturing direct jobs could be created. The construction period would last for some three years.

The project would generate 548 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 Prieska, an increase in spending would result in Prieska thereby stimulating the local economy. The project would also result in an increase in the revenue of the LM 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. No difference in impact significance would result from the proposed alternatives.

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.

4.4.6 Impact on transport

Construction vehicles are likely to make use of the existing roads, including the R375, 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 (Nordex Energy GmbH (Nordex), 2009). The proposed project consists of 56 turbines hence approximately 4 032 – 4 648 construction vehicles would be required. This equates to 3.6 - 4.2 construction vehicles per day, assuming an even spread over the three year 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 3.2.2 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 Saldanha Bay or Port Elizabeth 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 project on transport is considered to be of medium magnitude, regional extent and short term and therefore of **medium (-)** significance, with or without mitigation. 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.

4.4.7 Noise pollution

An increase in noise pollution would be expected from the operation of heavy machinery during the construction period, as well as due to the increased traffic. The severity of this impact is likely to be reduced due to the low numbers of people in close proximity to the site, with residents at Copperton being the closest receptors at 3 km from site. 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:

- If the gravel road through Copperton is used as the access road, make use of this road only between 08h00 to 17h00 Monday to Friday for construction traffic.

4.4.8 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 term and therefore of **low (-)** significance, with and without mitigation. 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.

4.4.9 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. 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 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 project assessed above is included in **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 table below applies to all proposed alternatives.

Table 4.2 Summary of potential impacts of the proposed project

Potential impact	No mit/Mit[25]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[26]	Reversibility
OPERATIONAL PHASE								
Impact on botany:	No mit	Local	Low	Long term	**Low (-)**	Definite	Sure	Irreversible
Preferred layout	Mit	Local	Low	Long term	**Low (-)**	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	Medium	Long term	**Medium (-)**	Probable	Sure	Irreversible
	Mit	Local	Low- Medium	Long term	**Low – Medium (-)**	Probable	Sure	Irreversible
Impact on bats	No mit	Local	High	Long term	**High (-)**	Probable	Low	Reversible
	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Reversible
Impact on fauna	No mit	Local	Low	Short term	**Very Low (-)**	Probable	Low	Reversible
	Mit	Local	Low	Short 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
Impact on heritage resources:	No mit	Local	Low	Long term	**Low (-)**	Definite	Low	Irreversible
Archaeology	Mit	Local	Low	Long term	**Low (-)**	Probable	Sure	Irreversible
Palaeontology	No mit	Local	Low	Long term	**Low (-)**	Unlikely	Low	Reversible
	Mit	Regional	Low	Long term	**Low (-)**	Unlikely	Sure	Reversible
Cultural heritage	No mit	-	-	-	**-**	-	-	-
	Mit	-	-	-	**-**	-	-	-
Visual aesthetics	No mit	Regional	Medium - High	Long term	**Medium- High (-)**	Definite	Sure	Reversible
	Mit	Regional	Medium - High	Long term	**Medium- 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 on surrounding land uses	No mit	Regional	High	Long term	**High (-)**	Probable	Unsure	Reversible
	Mit				Undetermined			

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

Potential impact	No mit/Mit[25]	Extent	Magnitude	Duration	SIGNIFICANCE	Probability	Conf.[26]	Reversibility
Impact of noise	No mit	-	-	-	**No impact**	-	-	-
	Mit	-	-	-	**No impact**	-	-	-
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
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 (employment) and social conditions	No mit	Regional	Medium	Short term	***Medium (+)***	Probable	Sure	Reversible
	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 on site	No mit	Local	High	Short term	**Low (-)**	Probable	Sure	Irreversible
	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 project comprises:

- A wind energy facility consisting of approximately 56 turbines;
- Associated infrastructure including, *inter alia*:
    - Hardstandings alongside turbines;
    - Access roads 6 m wide between turbines; and
    - A power line connection to the existing grid.

The following feasible alternatives were also considered:

- Location alternatives:
    - One location for the proposed wind energy facility;
    - Electricity distribution via onsite linkage to the existing grid; and
    - Electricity distribution via an 8.6 km 132 kV connection to Cuprum substation.
- Activity alternatives:
    - Wind energy generation via wind turbines;
    - "No-go" alternative to wind energy production;
- Site layout alternatives:
    - One layout (October 2011) alternative.
- Technology alternatives:
    - Two technology alternatives (towers 91 and 100 m and rotors of 58 and 50 m respectively).

Aurecon submits that this Draft EIAR provides a comprehensive assessment of the environmental issues associated with each of the feasible alternatives of the proposed project 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 project.

Table 5.1 Summary of significance of the potential impacts associated with the proposed development

IMPACT			Preferred Layout No Mit	Preferred Layout With Mit
OPERATIONAL PHASE IMPACTS				
1.1	Impact on botany:	Preferred layout	L	L
1.2		No-go alternative	L	L
2	Impact on birds		M	L-M
3	Impact on bats		H	L
4	Impact on fauna		VL	VL
5	Impact on climate change		L+	L+
6.1	Impact on heritage resources:	Archaeology	L	L
6.2		Palaeontology	L	L
6.3		Cultural heritage	N	N
7	Visual aesthetics		M-H	M-H
8	Impact on energy production		L+	L+
9	Impact on local economy (employment) and social conditions		M+	M+
10	Impact on agricultural land		L	L
11	Impact on surrounding land uses		H	Undetermined
12	Impact of noise		N	N
CONSTRUCTION PHASE IMPACTS				
13	Impacts on flora, avifauna, fauna and bats		L-M	L
14	Sedimentation and erosion		L	VL
15	Visual aesthetics		M	L
16	Impact on local economy (employment) and social conditions		M+	M+
17	Impact on transport		L	L
18	Noise pollution		VL	VL
19	Storage of hazardous substances on site		L	L
20	Impact of dust		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
L	Low Significance	L+	Low positive 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 the Plan 8'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 project 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 project 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.

5.3 OPERATIONAL PHASE IMPACTS

With reference to **Table 5.1**, the most significant (**high (-)**) operational phase impacts on the biophysical and social environment, without mitigation was for the potential impacts of the proposed wind energy facility on bats, visual aesthetics and surrounding landuses. With the implementation of mitigation measures the impact on bats would decrease to **low-medium (-)**. It is not currently known what the significance of the impact on surrounding landuses would decrease to, however it is anticipated that mitigation measures agreed to in consultation with SKA would decrease to a level acceptable to SKA, failing which the proposed project could not proceed. However the impact on visual aesthetics would remain the same. It should be noted that two potential positive impacts on energy production and local economy (employment) and social conditions would result and these would be of ***low (+)*** significance, with and without mitigation measures.

In terms of differences in the significance of potential impacts of the feasible alternatives, including the distribution and turbine alternatives, they are all considered to be equivalent, and therefore no significant differences would result. As such it is recommended that Plan 8 choose its preferred option based on technical and financial considerations.

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5.4 CONSTRUCTION PHASE IMPACTS

None of the negative construction phase impacts were deemed to have a significant impact on the environment, given their duration (approximately three years) and localised extent. The 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 (-)**. 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 project. 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:

Botanical impacts

- An Environmental Control Officer should identify areas for rehabilitation post-construction, including hard-standing any temporary access roads, etc. These areas should be rehabilitated according to a rehabilitation plan for the site compiled with the aid of a rehabilitation specialist;
- Avoid drainage lines as far as possible when routing roads, cabling and other infrastructure; and
- Minimise the construction footprint.

Avifaunal (bird) impacts

- Implement a comprehensive bird monitoring programme. This programme should inform the final layout and mitigation strategy of the project, and fully monitor the actual impacts of the wind farm on the broader avifauna of the area, from pre-construction and into the operational phase. The monitoring programme would recommend mitigation measures for inclusion in the final layout and operation of the project. These mitigation measures would need to be complied with. These mitigation measures could include, but are not limited to:
  - Locate turbines such that key habitats are avoided;
  - Minimise the footprint of the project;
  - Differentiate blades by markings, painting a single blade per turbine black, or some other means, should it be identified that raptors are likely to be frequent collision casualties. The evidence for this as an effective mitigation measure is not conclusive, and as such it may be best to adopt an experimental approach to blade marking, identifying a sample of pairs of potentially high risk turbines in pre-construction monitoring, and marking the blades on one of each pair. Post-construction monitoring should test the efficiency, which would inform subsequent decisions about the need to mark blades more widely in this facility;

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- Site turbines away from any areas of high avifaunal density or aggregation, regular commute routes or hazardous flight behaviour areas;
- Use low risk turbine designs and configurations, which discourage birds from perching on turbine towers or blades, and allow sufficient space for commuting birds to fly safely through the turbine rows;
- Carefully monitor collision incidence and be prepared to shut-down problem turbines at particular times or under particular conditions[27];
- Minimise disturbances associated with maintenance activities by scheduling activities to avoid disturbances in sensitive areas or seasons; and
- Keep disturbances to key bird species to a minimum.

- Use bird-safe structures (ideally with critical air gaps greater than 2 m), should above-ground power lines be used. Exclude birds physically from high risk areas of live infrastructure and comprehensively insulate such areas to avoid bird electrocution;.
- Minimise the length of any above-ground power lines and mark all new lines with bird flight diverters. Mark above-ground lines for their entire length as there is currently insufficient data to indicate high risk areas. Recommendations from bird monitoring could indicate high risk areas to remain marked in the future. Where new lines run in parallel with existing, unmarked power lines, this approach has the added benefit of reducing the collision risk posed by the older line;
- Restrict lighting of turbines to coloured (red or green) intermittent, lighting, as required by CAA; and
- Ensure that the results of monitoring are applied to project-specific impact mitigation in a way that allows for the potential cumulative effects on the local/regional avifauna of any other energy projects within 10 km of the site to be mitigated.

Bat impacts

- Apply a 100 m buffer area to all moderately sensitive areas as well as the building indicated to be of high sensitivity. Apply a buffer area of 500 m to Modderpan (a high sensitive area). No turbines should be placed within the high sensitivity areas. Avoid areas of moderate sensitivity as far as possible for the location of turbines but where unavoidable apply additional mitigation measures to any turbines placed in moderate sensitivity areas;
- Curtail turbines to a preliminary cut-in speed of 5 - 5.5 m/s as a mitigation measure to lessen bat mortalities[28]. This is where the turbine cut-in speed is raised to a higher wind speed premised on the principle that bats will be less active in strong winds due to the fact that their insect food can't fly in strong wind speeds, and the small insectivorous bat species need to use more energy to fly in strong winds. This measure should only be implemented after long term monitoring has indicated under which weather conditions, times of day, season, etc it should be implemented and the recommended cut-in speed has been suitably refined by a bat specialist;
- Consider implementing an ultrasonic deterrent device so as to repel bats from wind turbines if any turbines are placed in moderate sensitivity areas. This measure may

Chapter 5

[27] Plan 8 has indicated that this may be difficult to achieve without affecting the economic viability of the proposed project hence the EAP and Specialist will engage further with Plan 8 on this matter to ensure minimisation of the impact.

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negate the need for curtailment but this would need to be informed by 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 corrolated with bat activity to determine whether curtailment is required, and if so limiting factors for curtailment, and fine tune other mitigation measures.

Heritage resources (including palaeontology)impacts

- Avoid development within 250 m of the centre of Modderpan as well as within 100 m from the centre of the stone kraals. Confirm the co-ordinates of the smaller stone kraal via GPS;
- Do not exceed 1 m on the northern side of the road nor 2 m on the southern side of the road when upgrading the existing access road which is within 250 m of Modderpan. Do not move the fence on the northern side in order to minimise disturbance, however the fence on the southern side could be moved if required; and
- Archival research for the stone kraals and a conservation management plan for Modderpan and the kraals are highly recommended and should be commissioned by the owner of Struisbult at some point in the future.

Visual impacts

- Consider temporary hardstandings for cranes in place of permanent hardstandings;
- As much as possible, place any new structures where they are least visible to the greatest number of people;
- Tidying up of derelict buildings and associated landscape around Copperton, as well as planting endemic scrub, would unify and give clarity to the close and middle distance views from Copperton and visually upgrade the Copperton setting;
- 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;
- 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; and
- Maintain turbines in operational condition.

Impacts on local economy (employment) and social conditions

- Give preference to local communities for employment opportunities; and
- Base recruitment on sound labour practices and with gender equality in mind.

Surrounding land uses impacts

- Implement measures recommended in the modelling study, as agreed to with SKA.

Construction phase impacts:

Flora, avifauna, bats and fauna impacts

- Compile and implement a vegetation rehabilitation plan with the aid of a rehabilitation specialist, for inclusion in the Construction EMP. The specialist is to recommend species

to be used in rehabilitation as well as any special measures for rehabilitation such as shade-netting and alien vegetation removal;
- Compile and implement a comprehensive bird monitoring programme, as indicated in Section 4.2.2(c);
- Demarcate no-go areas identified during pre-construction monitoring; and
- Re-schedule construction activities on site, where required by the results of the bird monitoring programme.

Sedimentation and erosion impacts
- Implement the EMP.

Heritage resources impacts
- Safeguard any substantial fossil remains exposed during construction, preferably *in situ*, and SAHRA should be notified by the ECO so that appropriate mitigation can be undertaken;
- Cordon off the no-go areas including their buffer zones cordoned off during the construction phase; and
- Record the varying depth of the Kalahari sands, the calcrete layers and the quartzitic bedrock when excavating the foundations for the. Section drawings, measurements and photographs must be taken of the pit for each turbine and for each pit wall (i.e. 4 sections per pit with a metre scale) by the contracted engineer assigned to the construction phase. The format for this report must be drawn up in consultation with the archaeologist. The engineer must be briefed on the recording requirements by the archaeologist before excavations are done. This report must be submitted to the consultant archaeologist for dissemination to SAHRA, Mr Kiberd and the McGregor Museum to aid others in the development of a broader understanding of the Pleistocene landscape of this area.

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.

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; and
- Engage with the roads authorities prior to construction to ensure the necessary road upgrades, permits, traffic escorts etc are scheduled.

Noise impacts

- If the gravel road through Copperton is used as the access road, make use of this road only between 08h00 to 17h00 Monday to Friday for construction traffic.

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; and
- 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 in the EIAR, the next step in the EIA process is for Plan 8 to identify their preferred option, utilising this EIAR together with technical and financial considerations to inform their decision.

In comparing the proposed project and the "no-go" alternatives it can be seen that the "no-go" alternative results in only one negative impact of **low (-)** significance on the biophysical and socio-economic environment whilst the proposed wind energy facility results in **low to medium (+)** impacts and **low to high (-)** impacts on the environment. The negative impacts of the proposed project are considered to be environmentally acceptable, considering the positive impacts.

With regards to the alternatives considered, including the distribution and 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 project 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 but one impact.

Associated with the proposed project are positive impacts on energy production and local economy (employment) and social conditions of **Low (+)** significance.

Based on the above, the EAP is of the opinion that the proposed wind energy facility 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.

It should be noted that, should the SKA project be awarded to South Africa, and it is not possible to implement mitigation measures to ensure an acceptable impact on the SKA project, the proposed project should not be authorised.

5.6 WAY FORWARD

The Draft EIAR has been lodged at the Prieska (Elizabeth Vermeulen) Public Library, Ietznietz in Copperton and on the Aurecon website (www.aurecongroup.com/)(change "Current Location" to South Africa and follow the public participation links). 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. The public will have until 6 March 2012 to submit written comment on the Draft EIAR to Aurecon.

Registered I&APs were invited to a public meeting being held on 22 February 2011 at Ietznietz Conference Room in Copperton from 17h00 – 19h00 to discuss the findings of the EIAR. Due to low attendance of the public meeting held at the Scoping Phase (three I&APs) I&APs have been requested to RSVP by 15 February 2012, and should the number of RSVP's be insufficient the meeting will be cancelled and I&APs will instead be contacted telephonically/electronically to discuss any issues and concerns they may have.

The Final EIAR will be completed via the addition of any I&AP comments and the addition of a letter from Plan 8 indicating which mitigation measures will be implemented. 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 project. 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 Authorisation, 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

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