ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
DRAFT EIA REPORT

PROPOSED WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE

WESTERN CAPE PROVINCE
(DEAT Ref No. 12/12/20/913)

January 2008

Prepared for
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PROJECT DETAILS

DEAT Reference No.	:	12/12/20/913
Title	:	Environmental Impact Assessment Process Draft Environmental Impact Report: Proposed Wind Energy Facility and Associated Infrastructure, Western Cape Province
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Client	:	Eskom Holdings Limited (Eskom Generation Division)
Report Status	:	Draft Environmental Impact Assessment Report for public review
Review Period	:	7 January 2008 – 7 February 2008

When used as a reference this report should be cited as: Savannah Environmental (2008) Draft Environmental Impact Assessment Report: Proposed Wind Energy Facility and Associated Infrastructure, Western Cape Province

PURPOSE OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holdings Limited (Eskom) is currently undertaking an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed Wind Energy Facility on the West Coast in the Western Cape Province.

The scope of project includes construction, operation and decommissioning activities. Activities associated with all life-cycle phases of the proposed wind energy facility that could potentially impact on the environment have been assessed through this EIA study. The three primary components of the project include the following:

» A **Wind Energy Facility** including up to 100 wind turbine units, a substation, underground electrical cabling between turbines and the substation, internal access roads and an office building and visitors centre at the facility entrance.
» Overhead **power lines** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» Upgrading activities to the existing Divisional Road 2225 (known as Skaapvlei road) to provide access to the site (i.e. act as a **haul road** during the construction phase) from the R363 main tarred road at Koekenaap.

Eskom has appointed Savannah Environmental as an independent environmental assessment practitioner to undertake the EIA. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Draft Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

Chapter 1 provides background to the proposed Wind Energy Facility project and the environmental impact assessment.
Chapter 2 provides the strategic context for energy planning in South Africa.
Chapter 3 describes wind energy as a power option and provides insight to technologies for wind turbines.
Chapter 4 outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5 describes the activities associated with the project (project scope).
Chapter 6 describes the existing biophysical and socio-economic environment.
Chapter 7 presents the assessment of environmental impacts associated with the Wind Energy Facility.

Chapter 8 presents the assessment of environmental impacts associated with the 132 kV power line alternatives.
Chapter 9 presents the conclusions of the facility and power line impact assessment as well as an impact statement.
Chapter 10 provides a list of references and information sources used in undertaking the studies for this Draft EIA Report.

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

The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review of the draft EIA Report prior to submission to the National Department of Environmental Affairs and Tourism (DEAT), the decision-making authority for the project.

PUBLIC REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

In accordance with the EIA Regulations, a draft Environmental Impact Assessment Report has been prepared and made available for review and comment by Interested and Affected Parties (I&APs) and stakeholders from **07 January 2008 to 07 February 2008**. The draft Environmental Impact Assessment Report is available for review at the following public places in the project area:

Town	Venue
Vredendal	Vredendal Library
	Matzikama Municipality
	Department of Agriculture & Land Care
Lutzville	Lutzville Municipal Office / Library
	Lutzville Farmers Association
Vanrhynsdorp	Cape Nature Offices
Ebenhaeser	Post office / Library
Strandfontein	Municipal Office
Doringbaai	Library
Moorreesburg	West Coast District Municipality offices

The report is also available on:
- » www.eskom.co.za/eia
- » www.savannahSA.com

Please submit your comments to
Shawn Johnston of Sustainable Futures ZA PO Box 749, Rondebosch, Cape Town, 7701 Tel: 083 325 9965 Fax: 086 510 2537 E-mail: windfarms@mweb.co.za
The due date for comments on the Draft EIA Report is **7 February 2008**

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

PUBLIC MEETING IN LUTZVILLE & STAKEHOLDER WORKSHOP IN CAPE TOWN

In order to facilitate comments on the draft Environmental Impact Assessment Report, a public meeting and a stakeholder workshop will be held during the review period (in Lutzville and Cape Town respectively). All interested and affected parties are invited to attend:

PUBLIC MEETING

DATE: Thursday, 24 January 2008
TIME: Open House 18h00 – 19h00, Public Meeting at 19h00
VENUE: Lutzville Sports & Rugby Club

STAKEHOLDER WORKSHOP

DATE: Friday, 25 January 2008
TIME: 09h30
VENUE: Koeberg Visitor's Centre

The aim of these meetings is to provide feedback of the findings of the environmental impact assessment studies undertaken, and to invite comment on the proposed project.

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APPENDICES

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CAPE	Cape Action For People and the Environment
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DEAT	National Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DOT	Department of Transport
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
HWC	Heritage Western Cape
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, Ordinance 15 of 1985
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PGWC	Provincial Government of the Western Cape
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

SIA	Social Impact Assessment
SSW	South South West
WCDM	West Coast District Municipality
WCMA01	Western Cape Municipal Area 1
ZVI	Zone of visual influence

DEFINITIONS AND TERMINOLOGY

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

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

Archaeological material: Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

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

Calcrete: A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.

Clean Development Mechanism (CDM): An arrangement under the Kyoto Protocol allowing industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The most important factor of a CDM project is that it establishes that it would not have occurred without the additional incentive provided by emission reductions credits. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialised countries. The CDM is supervised by the CDM Executive Board

(CDM EB) and is under the guidance of the Conference of the Parties (COP/MOP) of the United Nations Framework Convention on Climate Change (UNFCCC) (refer http://unfccc.int/kyoto_protocol/mechanisms/items/2998.php).

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

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

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

Demand-side Management Programme (DSM): A joint initiative between the DME, the National Electricity Regulator (NER) and Eskom which aims to provide lower cost alternatives to generation system expansion by focusing on the usage of electricity. Consumers are incentivised to use electricity more efficiently and at times of the day outside of Eskom's peak periods.

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

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

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

Doorbank horizon: A cemented crusty hard surface from an ancient landscape that underlies Aeolian sands in many areas on the west coast.

Early Stone Age: A very early period of human development dating between 300 000 and 2.6 million years ago.

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

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

Energy utilisation factor (EUF): The percentage of actual generation compared to the total possible installed generation annually.

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

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

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

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

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

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

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

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

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

HWC (Heritage Western Cape): The provincial compliance agency responsible for the conservation of heritage.

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

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

Integrated Energy Plan (IEP): A plan commissioned by the DME in response to the requirements of the National Energy Policy, in order 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 between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

Integrated Strategic Electricity Planning (ISEP): Eskom's planning process which provides strategic projections of supply-side and demand-side options to be implemented to deal with the energy management issues and meet long-term load forecasts.

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

Late Stone Age (LSA): In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).

"Micro-siting": An international convention with regards to wind energy facilities. It refers to the process of specifically determining the position of each turbine based on the wind resource and topographical constraints in order to maximise production.

Middle Stone Age (MSA): An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.

Midden: A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.

Miocene: A geological time period (of 23 million - 5 million years ago).

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

National Integrated Resource Plan (NIRP): Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "...physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Palaeontological: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

Ramsar Convention on Wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

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

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

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters).

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

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

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004.

Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 80 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

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

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

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

Wise Use (*sensu* Convention on Wetlands): Defined in Handbook 1 (citing the third meeting of the Conference of Contracting Parties (Regina, Canada, 27 May to 5 June 1987) as "the wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

INTRODUCTION CHAPTER 1

Eskom Holdings Limited (Eskom) proposes to establish a commercial wind energy facility on a site in the Western Cape Province. This development is proposed to comprise a cluster of up to **100 wind turbines** (typically described as a wind energy facility) to be constructed over an area of less than 20 km^2 in extent, off-set at a distance of 2 km from the coastline. The study area has been investigated in detail through an Environmental Impact Assessment (EIA) process. The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this draft Environmental Impact Assessment (EIA) Report.

1.1. The Need for the Proposed Project

Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change and exploitation of non-renewable resources. The South African Government has set a 10-year target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This is amounts to ~4% (1 667 MW) of the total estimated electricity demand (41 539 MW) by 2013. In order to assist Government in meeting its target, Eskom is investigating potential renewable energy projects, which include a Concentrating Solar Thermal project in the Northern Cape, as well as the proposed Wind Energy Facility in the Western Cape.

In responding to the growing electricity demand within South Africa, the need for diversifying Eskom's energy mix, as well as meeting the country's targets for renewable energy, Eskom has undertaken initiatives to establish **renewable** forms of electricity generation capacity. Eskom embarked upon a research programme to investigate **South Africa's sources** of renewable energy, and identify appropriate alternative solutions to meet the electricity needs of the country. Through this research, the viability of a wind energy facility was investigated, and the potential to establish a wind energy facility at a site along the West Coast within the Western Cape was identified.

1.2. Background to the Project

As a precursor to initiating an Environmental Impact Assessment (EIA) process, Eskom embarked on a wind energy resource research programme, as well as a site identification and selection process to determine areas suitable for wind energy development in South Africa. Meteorological conditions are critically important when considering the siting of wind turbines and identifying ideal wind energy facility sites. Ultimately, the success of the facility is dependent on the available wind resource of a particular site – i.e. wind speed, spatial and temporal variations in the wind climate, turbulence and how the wind resource is affected by terrain.

According to the South African Wind Resource Database compiled by the National Department of Minerals and Energy (DME), the Council for Scientific and Industrial Research (CSIR) and Eskom, the West Coast north of the Olifants River has been identified to experience some of the highest wind speeds in South Africa. Eskom studied this area further and established a meteorological monitoring station to determine the potential for the wind resource north of the Olifants River to support the development of a Wind Energy Facility (i.e. the incidence of wind within the required velocity range). In addition, this area further supports other technical requirements for a wind energy facility in terms of land availability and accessibility, and accessibility of the electricity grid to meet transmission integration requirements.

In April 2007, Eskom embarked on a regional site identification and selection process (the site identification process is detailed in the Scoping Report) to determine and delineate areas north of the Olifants River as suitable sites for commercial wind energy development. In order to assist in addressing the challenge of ensuring that wind energy projects meet economic (including technical), social and environmental sustainability criteria, the study was based on the Western Cape Provincial guidelines for locating wind energy projects and considered other local, provincial and national strategic environmental initiatives.

The regional site identification process aimed to determine and delineate areas suitable for wind energy development and included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of a wind energy facility, including the wind resource (wind potential diminishing with distance from the coastline), factors affecting the wind resource (including relief), land availability, accessibility and existing grid infrastructure.

It was acknowledged that a proactive identification of a location/site appropriate for the introduction of wind energy technology would enhance the viability of the project and inform the scope of the required Environmental Impact Assessment.

1.3. Project Overview

Through the regional site identification process, an area ~37 km^2 in extent falling within the Matzikama Local Municipality and the District Management Area WCMA01 within the West Coast District Municipality (WCDM) (depicted on Figure 1.1) was identified by Eskom as being potentially suitable for wind energy development. This area was put forward for consideration within an EIA process, and comprised the following farms:

- Portion 5 of the farm Gravewaterkop 158 (known as Skaapvlei)
- A portion of Portion 620 of the farm Olifants River Settlement (known as Skilpadvlei)
- A portion of Portion 617 of the farm Olifants River Settlement (known as Nooitgedag)

The overarching objective for the wind energy facility planning process is to maximise electricity production through **exposure to the wind resource**, while minimising infrastructure, operational and maintenance costs, as well as **social and environmental impacts**. As **local-level environmental and planning issues** (except for the identification of obvious fatal flaws) were not assessed in sufficient detail through the regional-level site identification process, these issues were considered within **site-specific studies** and assessments through the EIA process in order to delineate areas of sensitivity within the broader site, and ultimately assess the potential impacts associated with the placement of the wind turbines and associated infrastructure on the site.

The performance of the wind turbines is also determined by disturbances to the wind resource, which requires that the turbines are appropriately spaced on the site. The wind energy facility is proposed to accommodate up to **100 turbines**. The turbines and associated infrastructure are proposed to be positioned over an area of less than **20 km^2**.

The construction and commissioning of the facility is proposed to be implemented in **two phases**, with the first commissioned phase of the project planned to generate in the order of 100 MW (that is, approximately fifty 2 MW industry standard turbines). The second phase would comprise the remaining fifty turbines (the total facility not exceeding 100 turbines). The generating capacity of the facility will be dictated by the choice of turbine (a current industry standard of 2 MW turbines has been assumed at this time). The infrastructure associated with the total wind energy facility would, therefore, include:

- Up to 100 **wind turbine units** (hub height of ~80 m - 78 m high steel tower plus 2 m high nacelle); 90m diameter rotor (consisting of 3x45 m blades)).
- A concrete **foundation** (of 15 m x 15 m) to support each turbine tower.

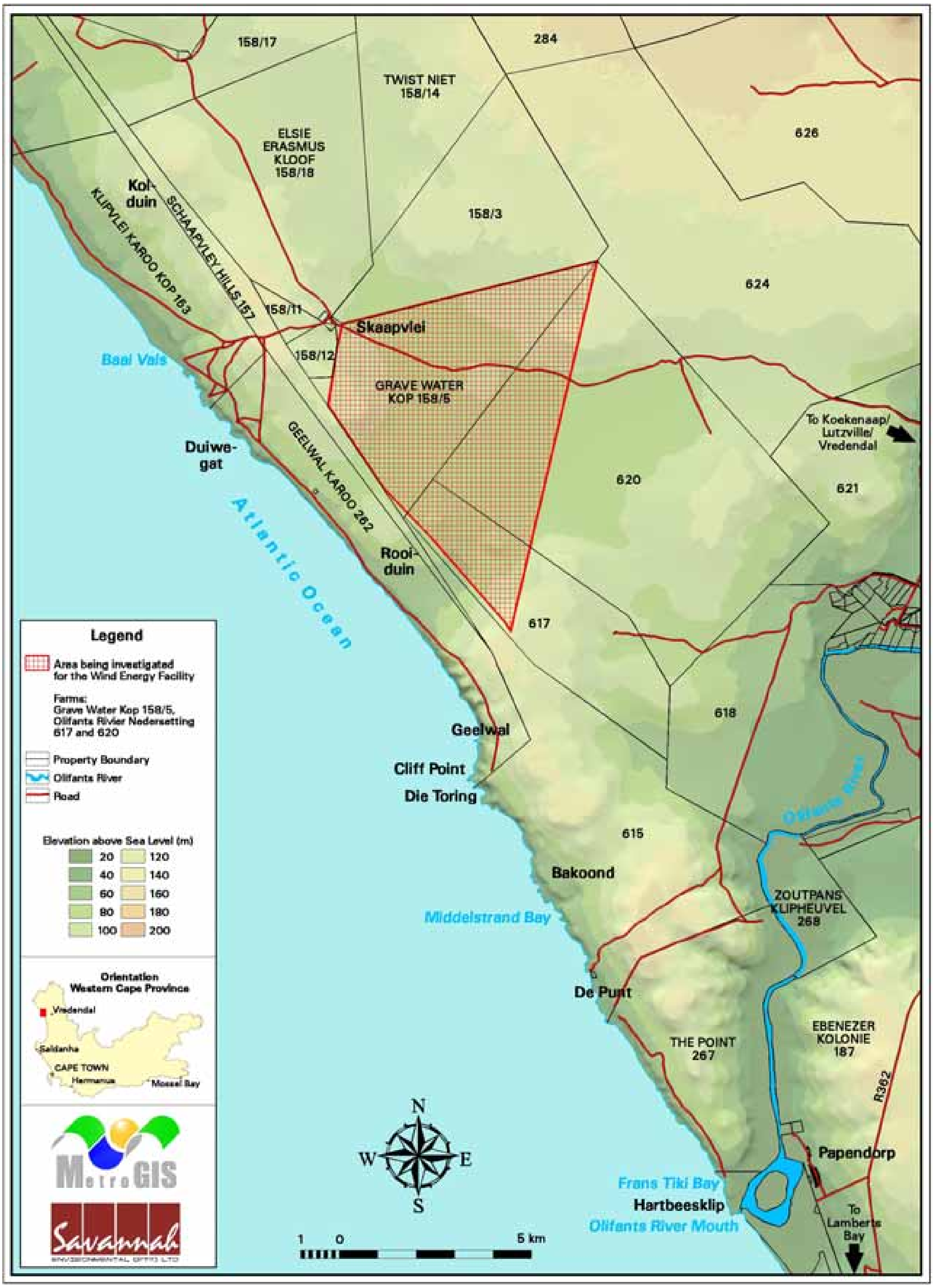


Figure 1.1: Locality map showing the 37 km^2 study area for the establishment of a wind energy facility on the West Coast north of the Olifants River

» Underground electrical **cabling** between each turbine and the substation.
» A **substation** (with a footprint of 80 m X 80 m) in an appropriate position to receive generated power via underground distribution cabling from each wind turbine.
» Overhead **power line** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» An **access/haul road** to the site from the main R363 road at Koekenaap
» **Internal access roads** providing access to each wind turbine site (with a permanent travel surface of approximately 6 m in width)
» A small office building and **visitors centre** at the facility entrance (with a footprint of ~400 m^2 under roof).

The scope of the proposed wind energy facility project on the West Coast, including details of all elements of the project (for the construction, operation and decommissioning phases) is discussed in detail in Chapter 5. Eskom have utilised specialist software to assist in selecting the optimum position for each turbine (for optimum power generation). This layout of the turbine field has informed the positioning of the other infrastructure such as access roads and the substation. The positioning/layout of all the components of this wind energy facility have been determined (with 90% confidence) and has been utilised in this assessment of potential impacts at a site-specific level (refer to Chapter 7).

1.4. Requirement for an Environmental Impact Assessment Process

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

NEMA is national legislation that provides for the authorisation of certain controlled activities known as “listed activities”. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs and Tourism (DEAT) is the competent authority for this project as Eskom is a parastatal body. An application for authorisation has been accepted by DEAT (under Application Reference number 12/12/20/913). Through the decision-making process, DEAT will be supported by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP).

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

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

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006):

No & date of relevant notice	Activity No (in terms of relevant Regulation / notice)	Description of listed activity
Government Notice R387 (21 April 2006)	1(a)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where (i) the electricity output is 20 megawatts or more; or (ii) the elements of the facility cover a combined area in excess of 1 ha.
Government Notice R387 (21 April 2006)	1(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kV or more.
Government Notice R387 (21 April 2006)	2	Any development, activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be 20 ha or more.
Government Notice R386 (21 April 2006)	12	The transformation or removal of indigenous vegetation of 3 ha or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the

No & date of relevant notice	Activity No (in terms of relevant Regulation / notice)	Description of listed activity
		National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004).
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding (a) masts of 15 m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles.
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4m or that has a reserve wider than 6m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.
Government Notice R386 (21 April 2006)	16(a)	The transformation of undeveloped, vacant or derelict land to residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 ha.
Government Notice R386 (21 April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 m^3 but less than 1 000 m^3 at any one location or site.

This report documents the assessment of the potential environmental impacts of the proposed construction and operation of up to 100 wind turbines on a site on the West Coast north of the Olifants River. This EIA Phase follows the Scoping Phase, and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.5. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialists with experience in EIAs for similar projects, and a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and recommends appropriate

mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.
The release of a draft EIA Report provides stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report will incorporate all issues and responses raised during the public review of the draft EIA Report prior to submission to DEAT.

The EIA Report consists of nine chapters, which include:

Chapter 1 provides background to the proposed Wind Energy Facility project and the environmental impact assessment.
Chapter 2 provides the strategic context for energy planning in South Africa.
Chapter 3 describes wind energy as a power option and provides insight to technologies for wind turbines.
Chapter 4 outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5 describes the activities associated with the project (project scope).
Chapter 6 describes the existing biophysical and socio-economic environment.
Chapter 7 presents the assessment of environmental impacts associated with the Wind Energy Facility.
Chapter 8 presents the assessment of environmental impacts associated with the 132 kV power line alternatives.
Chapter 9 presents the conclusions of the facility and power line impact assessment as well as an impact statement.

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

Savannah Environmental was contracted by Eskom Holdings as an independent environmental assessment practitioner to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any its specialist sub-consultants on this project are subsidiaries of or affiliated to Eskom Holdings Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools.

The Savannah Environmental team have considerable experience in environmental assessment and environmental management, and have been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa. Strong competencies have been developed in project management of environmental EIA processes, as well as strategic environmental assessment and compliance advice, and the identification of environmental management solutions and mitigation/risk minimising measures.

Karen Jodas and Jo-Anne Thomas, the principle authors of this draft Environmental Impact Assessment Report, are both registered Professional Natural Scientists (in the practice of environmental science) with the South African Council for Natural Scientific Professions. They have gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes over the past ten (10) years. They have successfully managed and undertaken EIA processes for other power generation projects for Eskom Holdings Limited throughout South Africa. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Details of these specialist studies are included in Chapter 4. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 2

Eskom's core business is in the generation and transmission (transport) of electricity. Eskom is responsible for the provision of reliable and affordable power to its South African consumers, and currently generates approximately 95% of the electricity used in the country. Therefore the reliable provision of electricity by Eskom is critical for industrial development and related employment in the region and therefore a contributing factor to the overall challenge of poverty alleviation and sustainable development in South Africa. Electricity, by nature, cannot be readily or inexpensively stored and therefore must be used as it is generated. Therefore, electricity is generated in accordance with supply-demand requirements, and must be efficiently transmitted from the point of generation to the end-user. Eskom's capacity expansion programme supports Government's drive to boost economic growth to 6% by 2010, and investment decisions will be based on this growth target. It is estimated that this will translate in an average growth in demand for electricity of approximately 4% per annum.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission powerlines on an on-going basis. With current energy and electricity demands within the country projected to continue increasing, new investments in electricity generation and transmission capacity are required.

The decision to expand Eskom's electricity generation capacity is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Minerals and Energy (DME), the National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation is illustrated in Figure 2.1.

Figure 2.1: Hierarchy of electricity policy and planning documents

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

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, that is:

» Increasing access to affordable energy services
» Improving energy sector governance
» Stimulating economic development
» Managing energy-related environmental impacts
» Securing supply through diversity.

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

2.2. Renewable Energy Policy in South Africa

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol (the enabling mechanism for the convention) in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

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

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

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

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

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

In order to meet the long-term goal of a sustainable renewable energy industry, the South African Government has set the following 10-year target for renewable energy: "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013"* (DME, 2003).

At present no sector or company specific targets have been put in place. However, government is currently finalising proposals which will in all likelihood impose renewable energy obligations or targets on energy generators such as Eskom. In order to assist Government in meeting its target, Eskom is already investigating potential renewable energy generation projects, which include a Concentrating Solar Thermal project in the Northern Cape, as well as the proposed Wind Energy Facility.

2.3. Integrated Energy Plan (IEP) - 2003

In response to the requirements of the National Energy Policy, the DME commissioned the Integrated Energy Plan (IEP) 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 between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

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 recognises:

» That South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy.
» That new electricity generation will remain predominantly coal-based, but with the potential for hydro, natural gas and nuclear capacity.
» The need to diversify energy supply through increased use of natural gas and new and renewable energies.
» Continuing investigations into nuclear options as a future new energy source.
» The promotion of the use of energy efficiency management and technologies.
» The need to ensure environmental considerations in energy supply, transformation and end use.
» The promotion of universal access to clean and affordable energy, with the emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes.
» The need to introduce policy, legislation and regulation for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data.
» The need to undertake integrated energy planning on an on-going basis

2.4. National Integrated Resource Plan (NIRP), 2003/2004

In response to the National Energy Policy's objective relating to affordable energy services, NERSA commissioned a National Integrated Resource Plan (NIRP) in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies. The planning horizon for the study was from 2003 to 2022. The objective of the NIRP is to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power generating projects, and evaluate the security of supply.

The national electricity demand forecast took a number of factors into account. These include:

» A 2,8% average annual economic growth

» The development and expansion of a number of large energy-intensive industrial projects
» Electrification needs
» A reduction in electricity-intensive industries over the 20 year planning horizon
» A reduction in the number of electricity consumers – NIRP anticipates people switching to the direct use of natural gas
» The supply of electricity to large mining and industrial projects in Namibia and Mozambique
» Typical demand profiles.

Various demand side management and supply-side options are considered in the NIRP process, prior to identifying the least cost supply options for South Africa. The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010.

2.5. Integrated Strategic Electricity Planning (ISEP) in Eskom

Eskom uses a modelling tool called Integrated Strategic Electricity Planning (ISEP) to plan its future capacity strategy. By analysing usage patterns and growth trends in the economy, and matching these with the performance features of various generation technologies and demand side management options, ISEP identifies the timing, quantity and type (base load or peaking) of new capacity options required in the long-term. These options include the Return-to-Service of the three mothballed coal-fired Simunye Power Stations (i.e. Camden, Komati and Grootvlei), conventional pulverised fuel power plants (i.e. coal-based power), pumped storage schemes, gas-fired power plants, nuclear plants, greenfield fluidised bed combustion technologies, renewable energy technologies (mainly wind and solar projects), and import options within the Southern African Power Pool. As the older Eskom power plants reach the end of their design life from approximately 2025, the use of all available technologies will need to be exploited in order to supply the country's growing electricity demand.

The ISEP process identifies the timing, quantity and type (e.g. base load or peaking) of new electricity generating capacity required over the next 20 years. The planning scenarios are based on an average 4% growth in demand for electricity over the 20 year period. This translates into a 6% growth in GDP. The most recently approved ISEP plan identifies the need for increased *peaking* electricity generating by *2007* and additional *baseload* capacity by approximately *2010*. An increase in peaking supply has since been achieved through the commissioning of new plant, such as the OCGT facilities at Atlantis and Mossel Bay in the Western Cape. Figure 2.2 illustrates Eskom's "project funnel", which shows the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country. There are many projects at various stages in the project funnel including research projects, transmission lines and generating options in South Africa and Southern Africa.

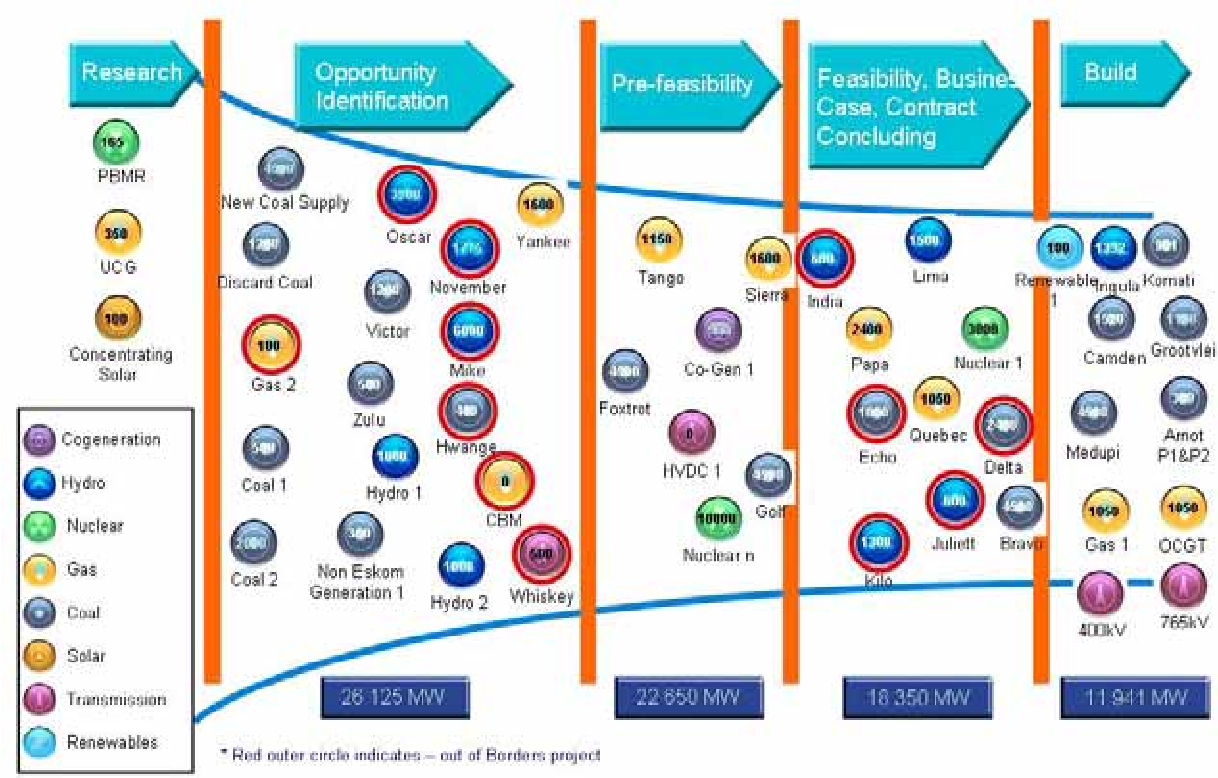


Figure 2.2: Eskom Project funnel showing the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country

As can be seen from Figure 2.2, Eskom has concluded the required feasibility and business case studies for 100 MW of renewable energy (indicated by the pale blue circle entitled 'Renewable 1' evident on the boundary between 'Feasibility' and 'Build'). This business case is proposed to be implemented in the form of a commercial Wind Energy Facility on the West Coast (i.e. the subject of this EIA study).

2.6. Eskom Renewable Energy Strategy

Renewable energy technologies are among the supply-side options being considered by Eskom. The organisation has developed a renewable energy strategy which outlines a number of focus areas, including research and development, and participation in clean development mechanism (CDM) project opportunities. The wind energy facility project is in a process of being registered for participation in the CDM projects for carbon credit trading.

The establishment of a wind energy facility qualifies as a CDM project as it meets all international requirements, as well as South African sustainable development criteria as defined by the designated national authority. The Wind Energy Facility will potentially reduce ~278 400 tons of CO_2 per annum.

Renewable energy sources which are being evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure, namely:

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

Eskom have identified the Western Cape (with the Cape West Coast in particular) as a wind resource-rich region, with the DME/CSIR/Eskom South African Wind Resource Database identifying the West Coast north of the Olifants River as experiencing some of the highest wind speeds in South Africa. Eskom commissioned the Klipheuwel Wind Energy Demonstration Facility (north of Durbanville in the Western Cape) in February 2003 in order to conduct operational research. Research at this facility focused on how available wind energy technologies interact with the South African environment and results highlighted unique factors that can impact performance. A strategy is now in place in order for Eskom to commission a viable commercial wind energy facility project.

2.7. Draft Western Cape Integrated Energy Strategy

The draft Western Cape Integrated Energy Strategy outlines the key energy concerns and opportunities facing the Western Cape and proposes a range of policies, strategies and actions that will allow the Province to develop a sustainable portfolio of energy solutions, while also reducing pollution and increasing access to energy for all citizens in the Province. The strategy document notes that due to the recent energy crisis in the Western Cape, the process of introducing a renewable energy policy, strategy and programme of action has been fast-tracked. It is believed that this is necessary to ensure that measures to reduce energy consumption and increase the supply of clean, renewable energy can be taken as soon as possible.

The strategy lists the potential opportunities for increasing power supply to the Province, and includes the option of wind energy. In this regard, the strategy states that the wind energy potential in the Western Cape is considered to be high (potential in the order of 3 000 MW, but that wind resources do require confirmation). The potential advantages associated with wind are identified to include:

» Technology and capital costs are reducing with technology advancements.
» Maintenance is low.
» It is a clean energy option.
» Should the wind resource be favourable, the technology can be relatively quickly installed in areas needing supply.

In terms of recommendations of the Strategy, the Provincial Government of the Western Cape (PGWC) is committed to energy efficiency and renewable energy, and to reducing the Province's carbon footprint and eradicating energy poverty. In order to achieve this vision, the PGWC will:

» Support an approach to energy planning, which takes into account environmental, social and economic considerations.
» Support research and development around renewable energy and energy efficiency technologies.

2.8. Regional Methodology for Wind Energy Site Selection: a Guideline Document prepared by DEA&DP

Detailed planning, including the use of criteria and thresholds to designate areas of suitability for development is supported by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) for the Western Cape, specifically with regards to the siting of wind energy facilities in the Province. The consideration of environmental and spatial issues together with technical issues at a strategic regional level is supported, as this results in a well-informed siting process.

In this regard, DEA&DP developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006).

The vision of the strategic initiative was to develop and establish a policy on the implementation of a *methodology* to be used for the identification of areas suitable for the establishment and implementation of wind energy developments (i.e. appropriate site selection) in the Western Cape. This overall objective was supported by a number of sub-objectives, including:

» To facilitate the practical implementation of wind energy generation technology in a manner that meets the principles of the White Paper on Energy Policy for the Republic of South Africa.
» To introduce wind energy developments to the Western Cape in a co-ordinated manner, that meets all requirements of sustainability as reflected in the National Environmental Management Act (Act No 107 of 1998), and which is based on international best practice.
» To encourage responsible and rational wind energy developments, which are beneficial not only to developers, but to communities at large.
» To discourage the investment of time and money in potentially unsuitable sites.
» To introduce the wind energy industry to the public and thereby increase support for and interest in alternative renewable energy sources.
» To provide policy guidance in terms of the environmental impact assessment process.

The methodology proposed within this guideline document is intended to be a regional-level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters).

In summary, this methodology includes guidelines for the assessment and delineation of areas appropriate for wind energy development, including the use of appropriate 'negative' and 'positive' buffer zones (suitable to the South African context) to build in cumulative impact concerns, and the incorporation of landscape issues relating to landscape character, value, sensitivity and capacity. It was not the intention of the Regional Assessment Methodology developed by DEA&DP to consider local level issues in significant detail. It is stated that these issues are to be considered within site-specific studies and assessments (i.e. through an EIA) for the suitable area/site identified through the Regional Assessment approach.

In April 2007, Eskom embarked on a regional site identification and selection process to determine and delineate areas north of the Olifants River on the West Coast as suitable for siting of a commercial wind energy development. In order to assist in addressing the challenge of ensuring that wind energy projects meet economic (including technical), social and environmental sustainability criteria, the study was based on the Provincial guidelines for locating wind energy projects (specifically Report 5: Proposed Regional Methodology) and also considered other local, provincial and national strategic environmental initiatives.

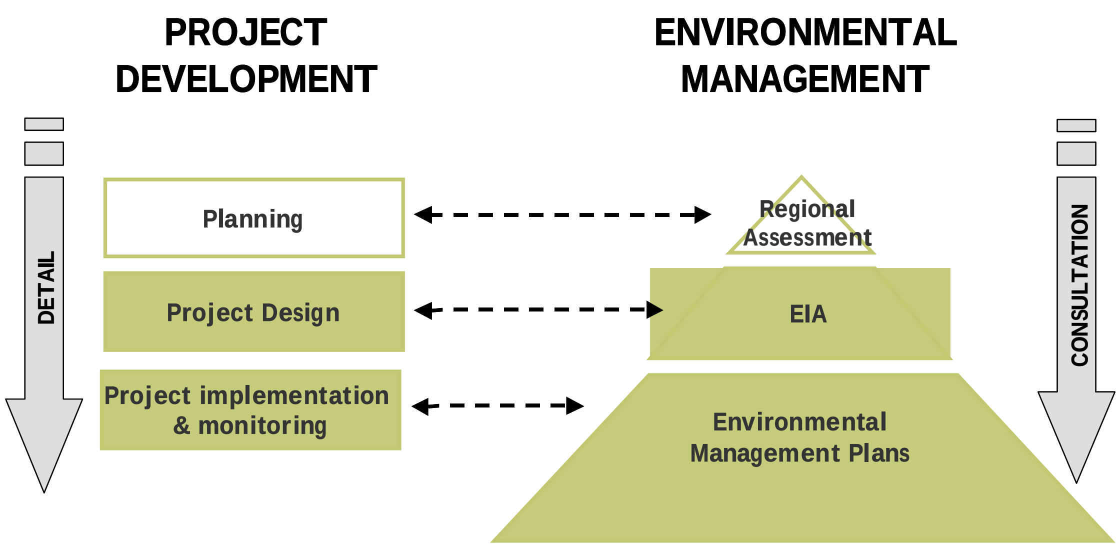
Based on the outcomes of the regional assessment and site identification process, Eskom has taken the site identified through this process forward into the EIA process for assessment through site specific studies.

2.9. Project Planning and the site-specific Environmental Impact Assessment

Eskom Generation's planning process is based on anticipated electricity demand, rather than immediate load requirements in order to timeously supply the anticipated increased demand in the country. This is due to the long lead-time process of acquiring the necessary permissions to construct such infrastructure from DEAT and the National Energy Regulator of South Africa (NERSA), and negotiations with landowners, and power generation infrastructure purchase, delivery and ultimately construction.

In terms of the EIA Regulations under NEMA, a Scoping and EIA report (including an environmental management plan (EMP)) are required to be compiled for this proposed project. The EIA is considered as an effective planning and decision-making tool in the planning process of a new power generation facility. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed through project design and implementation. The level of detail at a site-specific level is refined through the process, and allows for resolution of potential issue(s) through dialogue with affected parties.

The relationship between project development and the environmental assessment and management process is depicted in the figure below.



WIND ENERGY AS A POWER GENERATION OPTION CHAPTER 3

Wind energy is firmly established as a mature technology for electricity generation, with a reported 65 000 MW installed base worldwide. It is one of the fastest growing electricity generating technologies with installed capacity increasing by ~10 000 MW annually, and features in energy plans worldwide. Use of wind for electricity generation is essentially a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its life cycle. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets the international requirements in this regard.

Knowing and understanding the challenges faced by fossil fuels requires that there be a shift in the way that energy is generated and consumed, and this renewable energy project is part of Eskom's contribution in increasing its role in implementing such technologies that complement South Africa's energy mix. Worldwide, many solutions and approaches are being developed to reduce environmental pollution and CO_2 emissions. It is acknowledged that the more cost effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy options follow such a model in that such ventures typically have high capital costs, however, the fuel costs for such a facility are free. This has a net result of a low long-term cost for such a facility, with added benefits of reduced (or zero) environmental pollution. Renewable energy is considered one of the 'clean sources of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future.

3.1. Investigations into Wind Energy for South Africa

Eskom commissioned the Klipheuwel Wind Energy Demonstration/Research Facility (north of Durbanville in the Western Cape) in February 2003. Research at this facility has focused on how the technology interacts with the South African environment and has highlighted unique factors that can impact performance. The research information collected ranges from production statistics, daily operational requirements, detailed condition monitoring and national resource understanding and analysis. This 3.2 MW installation generates about 4 GWh annually with an availability of the turbine of 90%, and an energy utilisation factor[1] of 16% over a year period.

The demonstration facility has been a major success and results of the research have provided Eskom with valuable technical and strategic information pertaining to utilising wind as a source of energy, and has provided guidance with regards to the establishment of a large scale commercial facility.

Figure 3.1: Photograph of the existing three turbines at the Klipheuwel Demonstration Facility, Durbanville

As a part of Eskom's wind research programme a national wind atlas for South Africa was compiled (in conjunction with the DME and the CSIR for the South African Renewable Resource Database). Results indicate that wind energy in South Africa is limited to particular areas (typically on the coastline). Areas of high potential for future commercial wind farm development were earmarked, and high-accuracy meteorological measurement stations erected at these sites for on-going monitoring.

Based on the lessons learnt from the Klipheuwel pilot demonstration facility as well as the analyses on Eskom's measured wind data, Eskom determined that a full-scale commercial wind energy facility could successfully be established in South Africa. The West Coast north of the Olifants River was identified to experience some of South Africa's best wind resources for the development of a wind energy facility (i.e. the incidence of wind within the required velocity range). The construction of such a commercial facility is now being proposed on a site to the north of the Olifants River.

[1] Energy utilisation factor is an indication of the operation of the turbine to the total time within the same period (i.e. average operation over a year expressed as a percentage). The wind turbine utilisation factor is a function of the availability of the wind resource.

3.2. The Importance of the Wind Resource for Energy Generation

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

Wind speed is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. With a doubling of average wind speed, the power in the wind increases by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm (for example, an increase of average wind speed from 22 km/hr to 36 km/hr (6 m/s to 10 m/s) increases the amount of energy produced by over 130%). Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (~12.5 m/s to 17 m/s). Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain.

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

Wind direction at a site is important to understand, but it is not critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

South Africa can be considered as having a moderate wind resource as compared to Northern Europe (Scandinavia), Great Britain and Ireland and New Zealand where wind energy facilities are already implemented. Typical annual wind speeds range from 15 km/hr to 25 km/hr (4 m/s to 7 m/s) around South Africa's southern, eastern and western coastlines (with more wind typically along the coastline). This translates to an expected annual energy utilisation factor of between 15% and 30%, the value depending on the specific site selected.

Actual wind measurements (over a period of 3 years) in the vicinity of the proposed site to the north of the Olifants River applied to typical wind turbine performance has indicated that a wind energy facility on the West Coast would perform as well as international facilities, with an energy utilisation factor of ~26%. Climatic variation may impact this production figure by as much as 30% on a year-on-year basis (both negative and positive). Therefore, by comparing recorded annual energy utilisation factors for wind energy facilities internationally, it is evident that the performance of a South African facility would be in line with international trends (refer Table 3.1).

Table 3.1: Record of Annual Energy Utilisation Factors

Location	Average Capacity Factor
UK	29%
Rural Germany	16%
Denmark	24%
Klipheuwel Demonstration facility – South Africa	16%*
Proposed Facility on the West Coast	26%

*Actual performance over a period of 3 years

Figure 3.2 provides a wind rose[2] of actual measured data from the Eskom meteorological station on the farm De Punt, north of the Olifants River. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke. The wind direction is conventionally indicated from the periphery towards the centre of the graph, and not from the centre outwards.

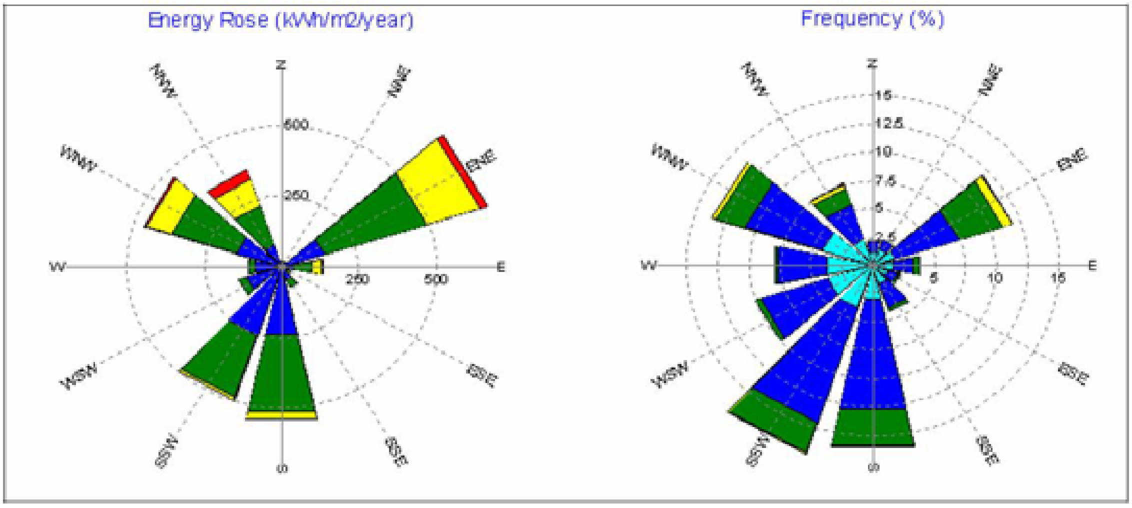


Figure 3.2: Wind Rose from measured data at the Eskom meteorological station at De Punt, indicating both wind energy as well as frequency of wind direction (% of time in a direction)

Figure 3.2 illustrates that the predominant wind direction experienced on the West Coast is from the SSW (i.e. percent of time in a direction). This is, however, not the strongest wind (or wind with most energy) experienced in this area, but the SSW wind is experienced most frequently. The design (and micro-siting[3]) of a wind farm is sensitive to the shape of the wind rose for the site. Although modern wind turbines are able to yaw to the direction of the wind, the micro-siting must consider the wind direction and strength of the wind in the optimal positioning of the turbines.

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[2] 'Wind rose' is the term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location.

[3] 'Micro-siting' is a term used within the wind energy facility industry and refers to the detailed final positioning in a wind farm layout to maximise energy production.

The wind speed measured at a meteorological station is also affected by the local topography (extending to a few tens of kilometres from the station) or surface roughness. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography exerts a profound influence on the flow of air, and results in turbulence within the air stream, and this also has to be taken into account in the placement of turbines.

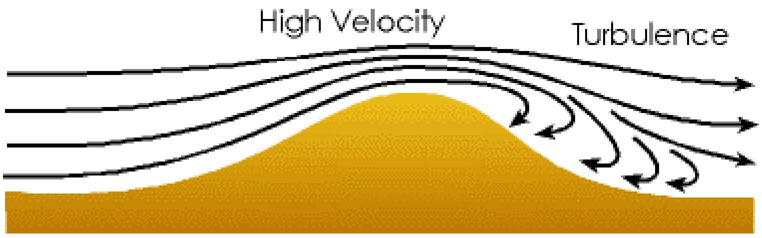


Figure 3.3: Illustration of the effect of relief on air flow

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

The placement of a wind energy facility, and in fact the actual individual turbines must, therefore, consider the following technical factors:

- Predominant wind direction and frequency
- Distance from coast, where wind moving over the land mass results in a loss of wind energy (and ultimately a loss in production)
- Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)
- Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 2 to 3xD apart, and 5 to 7xD where a turbine is behind another (D = the diameter of the rotor blades). This is required to minimise the induced wake effect the turbines might have on each other. The micro-siting of the turbines on the site has been determined using industry standard software systems, which automatically consider the spacing requirements. Considering a typical 2 MW capacity turbine whose rotors are approximately 90 m in diameter (each blade is 45 m in length), each turbine within a turbine row is separated by approximately 300 m. The erection of turbines in subsequent parallel rows requires a separation distance of 600 m to 700 m.

3.3. What is a Wind Turbine and How Does It Work

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

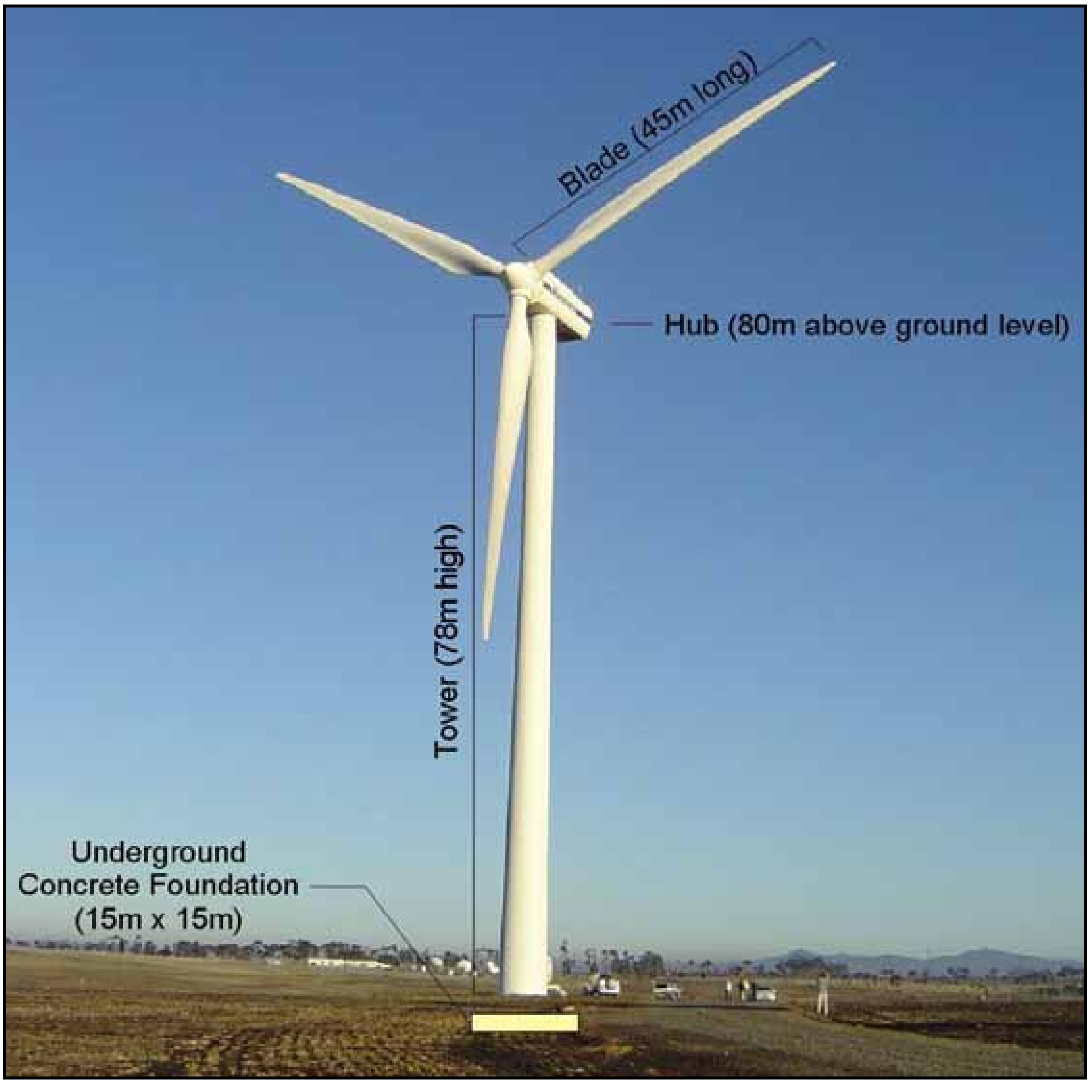
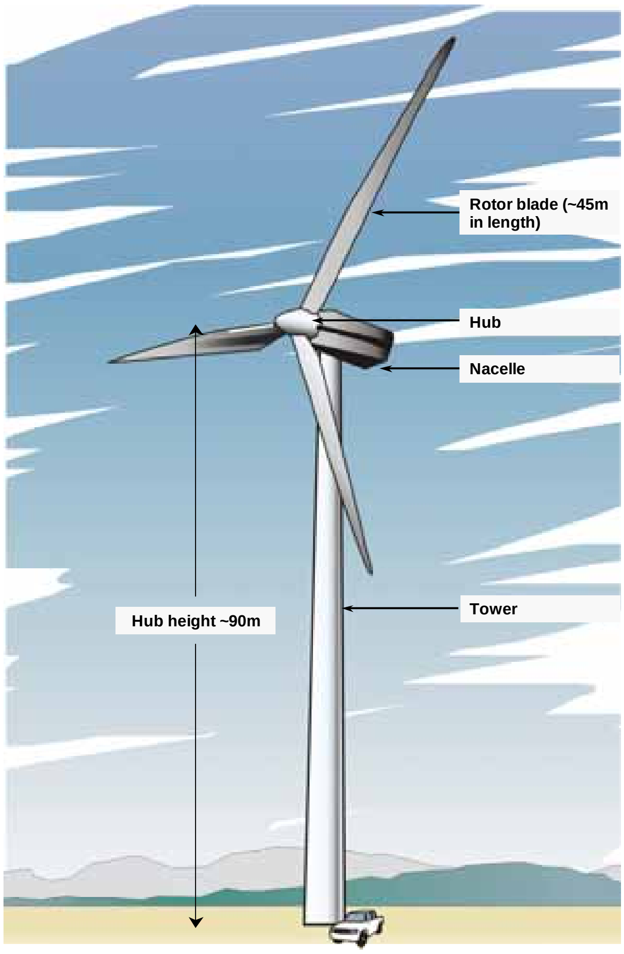


Figure 3.4: Illustration of the main components of a wind turbine (turbine at Eskom's Klipheuwel wind demonstration facility)

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed wind energy facility on the West Coast will have a hub height of ~80 m, and a rotor diameter of ~90 m (i.e. each blade ~45 m in length). These turbines would be capable of generating in the order of 2 MW each (in optimal wind conditions). Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (12.5 m/s and 17 m/s).

3.3.1. Main Components of a Wind Turbine



A wind turbine consists of the following major components:

» Tower
» Rotor
» Nacelle

The Tower

The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower.

The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 m to 80 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

The Rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm). The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of **lift** (Bernoulli). When air flows past the blade, a wind speed and pressure differential is created between the upper and lower blade surfaces. The pressure at the lower surface is greater and thus acts to "lift" the blade. When blades are attached to a central axis, like a wind turbine rotor, the lift is translated into rotational motion. Lift-powered wind turbines are well suited for electricity generation.

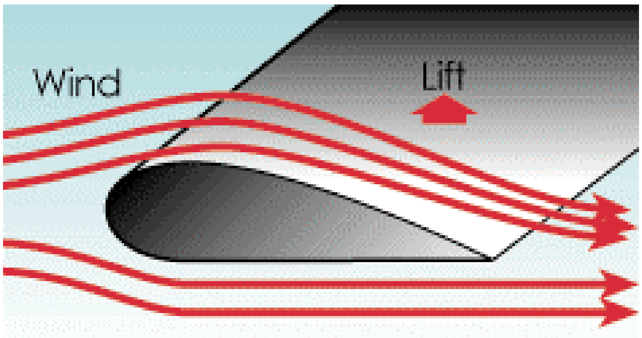


Figure 3.5: Illustration of the principle of lift

The rotation of the rotor blades produces a characteristic 'swishing' sound as the blades pass in front of the tower roughly once a second. The other moving parts, the gearbox and generator, cannot be heard unless the observer is physically inside the turbine tower.

The tip-speed is the ratio of the rotational speed of the blade to the wind speed. The larger this ratio, the faster the rotation of the wind turbine rotor at a given wind speed. Electricity generation requires high rotational speeds. Lift-type wind turbines have optimum tip-speed ratios of around 4 to 5.

The Nacelle

The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction (as shown in Figure 3.6).

The **generator** is what converts the turning motion of a wind turbine's blades into electricity. Inside this component, coils of wire are rotated in a magnetic field to produce electricity. The generator's rating, or size, is dependent on the length of the wind turbine's blades because more energy is captured by longer blades.

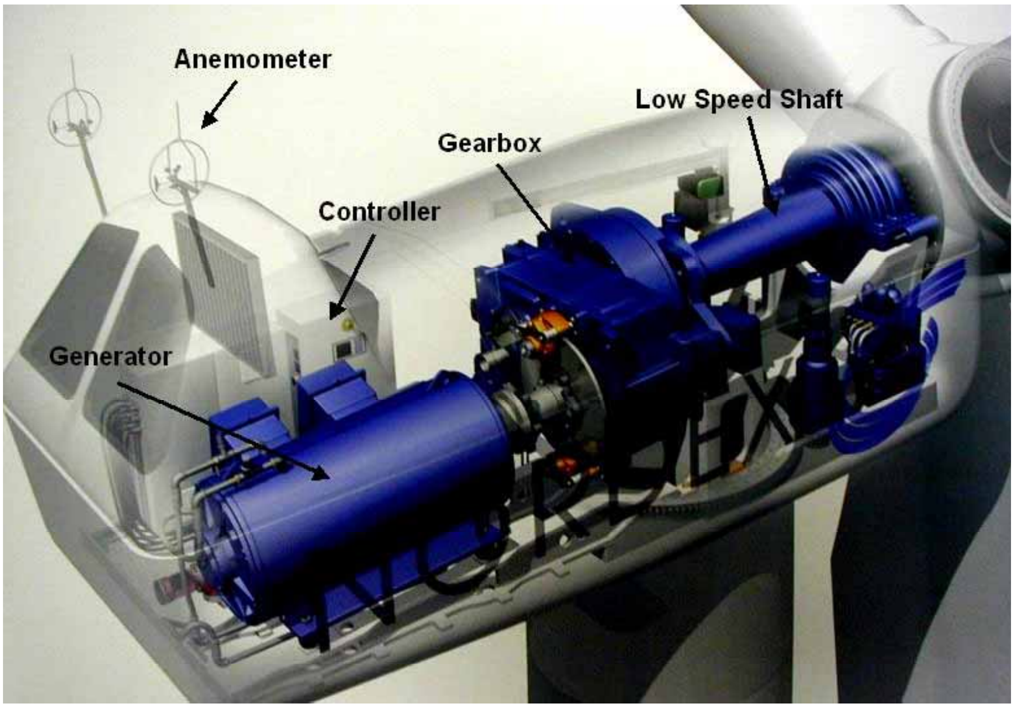


Figure 3.6: Detailed structure of a nacelle of a horizontal axis turbine

3.3.2. Operating Characteristics of a Wind Turbine

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

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 10 and 15 km/hr (~3 m/s and 4 m/s).

At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

3.3.3. Understanding the Betz Limit

It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The more kinetic energy a wind turbine extracts from the wind, the more the wind will be slowed down as it passes the turbine. In reality, a wind turbine will deflect the wind, even before the wind reaches the rotor plane. This means that it will never be possible to capture all of the energy in the wind using a wind turbine.

The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%[4]. This value is known as the Betz Limit. If the blades were 100% efficient, a wind turbine would not work because the air would give up all its energy, and the air would not be able to move away from the rotor (i.e. the air could not leave the turbine). In practice, the collection efficiency of a rotor is not as high as 59%. A more typical efficiency is 35% to 45%. A wind energy system (including rotor, generator etc) does not exhibit perfect efficiencies, and will therefore deliver between 15% and 30% of the original energy available in the wind (between 20% to 25% being typical for modern systems).

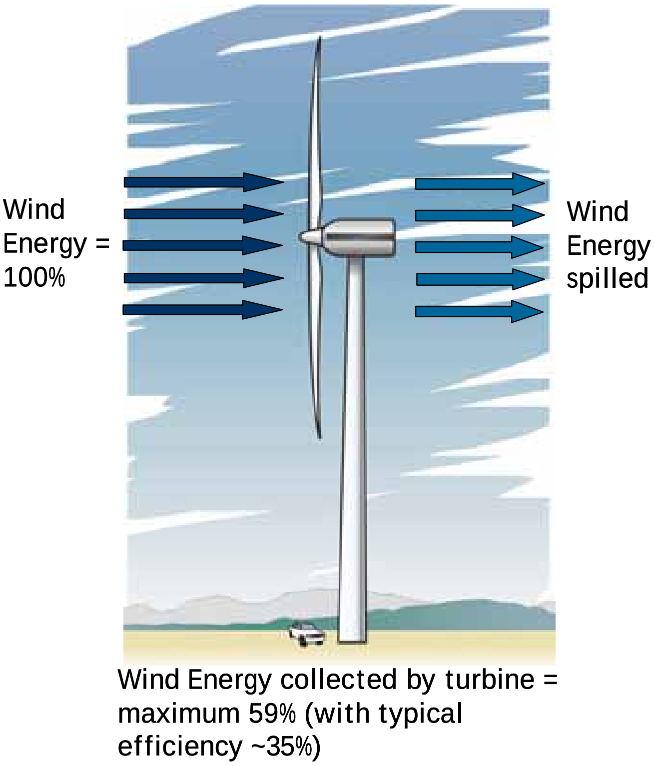


Figure 3.7: Illustration of the principle of the Betz Limit

3.4. Wind Energy on the West Coast as a Power Option

Actual wind measurements at the proposed site applied to typical wind turbine performance has indicated an energy utilisation factor of 26%. However climatic variation may impact this production figure by as much as 30% on a year-on-year basis (both negative and positive). This is based on European experience

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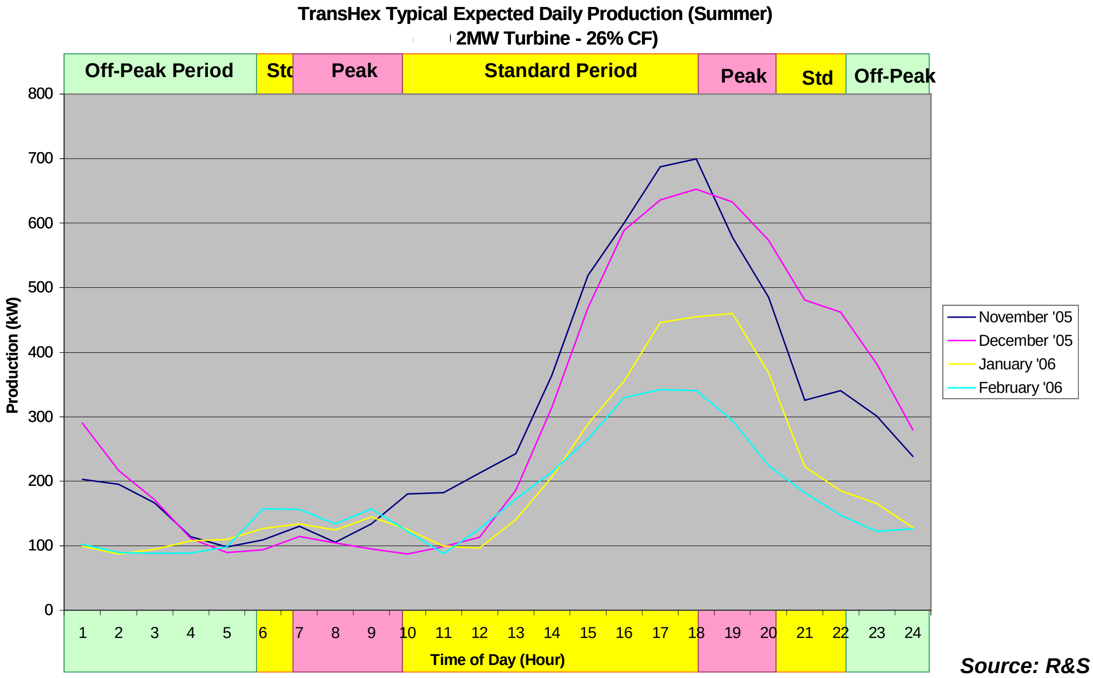
[4] Betz' Law says that you can only convert less than 16/27 (or 59%) of the kinetic energy in the wind to mechanical energy using a wind turbine. Betz' Law was first formulated by the German Physicist Albert Betz in 1919.

over the last 100 years. Experiences in wind at the site also indicate large variations in wind resource. This variation could potentially change the possibilities of the proposed project to 16% utilisation (18 km/hr (5 m/s) average annually) and a 36% utilisation (25 km/hr (7 m/s) average annually).

Figure 3.8 indicates the typical expected daily production (for summer) on the West Coast site (assuming the use of a 2 MW industry standard wind turbine).



Source: R&S

Figure 3.8: Graph indicating the typical expected daily production (for summer) on a site on the West Coast north of the Olifants River

APPROACH TO UNDERTAKING THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE CHAPTER 4

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

The EIA Phase for the proposed Wind Energy Facility on the West Coast has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1. Phase 1: Scoping Study

The Scoping Study, which commenced in July 2007, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed win energy facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the “do nothing” option) were identified for consideration within the EIA process.

The draft Scoping Report compiled was made available at public places for I&AP review and comment. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report and plan of study for EIA. The Scoping Report was submitted to the National Department of Environmental Affairs and Tourism (DEAT) and the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) in September 2007. The Final Scoping Report was accepted by DEAT, as the competent Authority (refer correspondence included in Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, no environmental fatal flaws were identified to be associated with the development of the proposed wind energy facility, and no absolute 'no-go' areas were identified within the broader area evaluated. However, a number of issues requiring further study for both the wind energy development site as well as the associated infrastructure (including the 132 kV power line) were highlighted. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aimed to achieve the following:

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

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

The EIA process followed for this project is described below.

4.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public involvement process throughout the EIA process in accordance with Regulation 56 of Government Notice No R385 of 2006 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 59 of Government Notice No R385 of 2006).
» Undertaking of independent specialist studies in accordance with Regulation 33 of Government Notice No R385 of 2006.
» Preparation of a Draft EIA Report in accordance with the requirements of the Regulation 32 Government Notice No R385 of 2006.
» Preparation of a Draft Environmental Management Plan (EMP) in accordance with the requirements of the Regulation 34 Government Notice No R385 of 2006.

These tasks are discussed in detail below. As part of a quality system, control sheets detailing the requirements for the key tasks as listed above have been completed by the EIA team, and are included in Appendix C.

4.3.1. Regulating Authority Consultation

The National DEAT is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. Consultation with the regulating authorities (i.e. DEAT and DEA&DP) has continued throughout the EIA process. On-going consultation included the following:

» Invitation to attend a stakeholder workshop during the review period of the Draft Scoping Report (i.e. 23 August 2007).
» Submission of a Final Scoping Report (September 2007) following a 30-day public review period (and consideration of stakeholder comments received).
» Ad hoc discussions with DEAT and DEA&DP in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following will also be undertaken as part of this EIA process:

- Provision of an opportunity for DEAT and DEA&DP representatives to visit and inspect the proposed site and study area (planned for January 2008).
- Submission of a Final Environmental Impact Assessment (EIA) Report following the 30-day public review period (planned for February 2008).
- A consultation meeting with DEAT and DEA&DP in order to discuss the findings and conclusions of the EIA Report.

4.3.2. Consideration of Alternatives

The following project alternatives were investigated in the EIA:

- The **'do nothing' alternative**: Eskom does not establish a wind energy facility in the Western Cape (maintain status quo).
- **Site-specific alternatives**: in terms of actual turbine positions and positions of the associated infrastructure on the site (i.e. access roads, substation/s, visitors centre over an area of less than 20 km^2.
- **Alternative servitudes for power line routing**: A 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal). Alternative routes/corridors for the 132 kV power line have been assessed in the EIA phase.
- **Transportation route alternatives:** for transportation of all components associated with the project to the site. The various transportation options (harbour, rail, air, road), as well as the possible routes associated with these options were assessed through the transportation study (refer Appendix Q) and summarised in Chapter 8.

4.3.3. Public Involvement and Consultation

The aim of the public participation process was primarily to ensure that:

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

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix D for a listing of recorded parties). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been ongoing for the duration of the EIA process and the project database has been updated on an on-going basis. 193 parties have registered their interest in the project to date.

The following variables were considered in the decision regarding the level of public participation required for the EIA Phase as well as the process to be followed:

» *The scale of anticipated impacts of the proposed project:* the project is a greenfields development.
» *The public sensitivity and the degree of controversy of the project:* the project concept is new to South Africa, and has had both positive and negative exposure. The project affects privately-owned properties.
» *The characteristics of the potentially affected parties:* there are existing organisational structures that represent I&APs and their interests, and good exposure/information sharing of the project to the local communities took place during the scoping phase (i.e. I&APs are well informed on the project).

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

» **Focus group meetings** (pre-arranged and stakeholders invited to attend)
» One-on-one **consultation meetings** and telephonic consultation sessions (consultation with various parties, for example with directly affected landowners, by the project participation consultant as well as specialist consultants)
» Written, faxed or e-mail **correspondence**.

Table 4.1 provides details of the formal focus group meetings held during the EIA phase of the public consultation process.

Table 4.1: Details of the focus group meetings held during the EIA phase of the public consultation process

Organisation	Parties Present	Date
West Coast District Municipality	Municipal Manager, Officials and Councillors	19 November 2007
Lutzville Farmers Union Executive	Members and individuals	19 November 2007
Matzikama Municipality, Provincial Departments & Key Stakeholders of Vredendal area	Officials and Councillors, Cape Nature, Western Cape Department of Transport and Public Works, Department of Agriculture & Land Care, Transhex Mining, SAWAWA	20 November 2007

Notes from focus group meetings held with stakeholders are included within Appendix E.

4.3.4. Identification and Recording of Issues and Comments

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to Appendix F for the Comments and Response Reports compiled from both the Scoping and EIA Phases). A summary of the key issues raised to date includes:

» Visual impacts
» Social impacts and benefits
» Impacts on landowners
» Tourism
» Agriculture concerns
» Noise impacts
» Transportation and road access
» Construction phase concerns
» Safety and security
» Site waste management
» Site footprint
» Land use and planning
» Biodiversity impacts
» Impacts on birdlife
» Integration with the electricity grid
» Project cost
» Technology and equipment specifications
» Aviation airspace

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

4.3.5. Assessment of Issues Identified through the Scoping Process

Based on the findings of the Scoping Study, the following issues were identified as not requiring further investigation within the EIA:

» Potential impacts on agricultural potential for the proposed wind energy facility site.
» Potential impacts on groundwater resources.
» Potential impacts associated with geology and soil conditions (subject to a detailed geotechnical study being undertaken by the project proponent).

Issues which require further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.2.

Table 4.2: Specialist studies undertaken within the EIA phase

Specialist	Specialist study	Refer Appendix
Nick Helme of Nick Helme Botanical Surveys	Flora	Appendix G
Prof. Le Fras Mouton of the Department of Botany & Zoology, Stellenbosch University	Terrestrial fauna	Appendix H
Andrew Jenkins & Jon Smallie of the Endangered Wildlife Trust (EWT)	Avifauna	Appendix I
Pete Illgner (Environmental Consultant and Researcher)	Geomorphology, surface processes and wetlands	Appendix J
Garry Paterson of the Agricultural Research Council (ARC): Institute for Soil, Climate and Water	Agricultural potential (for power line alternatives)	Appendix K
Tim Hart of the Archaeology Contracts Office, Department of Archaeology: University of Cape Town	Heritage	Appendix L
Lourens du Plessis of MetroGIS	Visual	Appendix M
Mike Fabricius of The Journey	Tourism	Appendix N
Tony Barbour (Environmental Consultant and Researcher)	Social Impact	Appendix O
Adrian Jongens of Jongens Keet Associates	Noise	Appendix P
Mark Pinder of Arup SA (Pty) Ltd	Transportation & access	Appendix Q

A peer review of the EIA process is being undertaken by Jonathan Crowther of CCA Environmental.

Specialist studies considered direct and indirect environmental impacts associated with the development of the wind energy facility and all associated infrastructure (including alternatives with regards to site design and layout), as well as the alternative alignments/corridors of the proposed 132 kV power line. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:

  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
- The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- the **status**, which is described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

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

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

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

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

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

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

The specialist EIA studies are contained within Appendices G - Q.

4.3.6. Public Review of Draft EIA Report and Feedback Meeting

This is the **current stage** of the EIA Phase. Hard copies of the draft EIA Report has been made available for public review from **7 January 2008 to 7 February 2008** at the following locations:

Town	Venue
Vredendal	Vredendal Library
	Matzikama Municipality
	Department of Agriculture & Land Care
Lutzville	Lutzville Municipal Office / Library
	Lutzville Farmers Association
Vanrhynsdorp	Cape Nature Offices
Ebenhaeser	Post office / Library
Strandfontein	Municipal Office
Doringbaai	Library
Moorreesburg	West Coast District Municipality offices

The report has also been made available on websites, including:
- www.eskom.co.za/eia
- www.savannahSA.com

In addition, soft copies (CDs) of the report have also been made available to stakeholders requesting such copies (for example, the Matzikama Business Chamber).

In order to facilitate comments on the Draft EIA Report, a public meeting and a stakeholder workshop will be held during the review period for the Draft EIA Report as follows:

» Public feedback meeting in study area: 24 January 2008 at the at the Lutzville Sport and Rugby Club, Open House at 18h00 to 19h00 and Public Meeting at 19h00
» Stakeholder meeting in Cape Town: 25 January 2008 at the Koeberg Visitors Centre at 09h30

The public review process and details of the public meeting have been advertised in regional and local newspapers: Die Burger, Ons Kontrei and the Olifantsrivier Herald. Posters were erected in public places (including shops, post office, municipal office etc). In addition to printed media, radio announcements were also made on Radio Namakwaland. All registered I&APs were notified of the availability of the report and public meeting by letter (refer Appendix R). Identified key stakeholders were personally invited to attend the key stakeholder workshop by letter (refer to Appendix R).

4.3.7. Final EIA Report

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

4.4. Regulatory and Legal Context

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

As wind energy development is a multi-sectoral issue (encompassing economic, spatial biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for wind energy facility project and the related statutory environmental assessment process.

4.4.1. Regulatory Hierarchy

At National Level, the main regulatory agencies are:

» *Department of Minerals and Energy (DME):* This department is responsible for policy relating to all energy forms, including renewable energy. Wind energy is considered under the White Paper for Renewable Energy and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Act (Act No 41 of 1987).
» *National Energy Regulator (NER):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environment and Tourism (DEAT):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. As Eskom is a statutory body, DEAT is the competent authority for this project, and charged with granting the relevant environmental authorisation.
» *Department of Transport and Public Works:* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Department of Transport - Civil Aviation Authority:* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

At Provincial Level, the main regulatory agencies are:

» *Provincial Government of the Western Cape (PGWC) – Department of Environmental Affairs and Development Planning (DEA&DP):* This is the principal authority involved in the EIA process and determines many aspects of Provincial environmental policy. The Department is a commenting authority for the EIA Application, and the regulating authority for any sub-division or rezoning which may be required in terms of the relevant town planning legislation.
» *Heritage Western Cape:* Considers the application and provides comment (and a decision regarding the project) in terms of Section 38(8) of the National Heritage Resources Act (Act No 25 of 1999) and Regulation 3(3)(a) of PN 298 (29 August 2003).
» *CapeNature:* This Department's involvement relates specifically to the biodiversity and ecological aspects of the proposed development activities on the receiving environment to ensure that developments do not compromise the biodiversity value of an area. The Department considers the significance of impacts specifically in threatened ecosystems as identified by the National Spatial Biodiversity Assessment or systematic biodiversity plans.

» *Western Cape Department of Transport and Public Works - Roads infrastructure branch:* This Department's involvement relates specifically to the consideration of the impact to transport infrastructure, and specifically the road network, as well as application for new access points on the proclaimed road network and/or servitudes within proclaimed road reserves.
» *Department of Agriculture and Land Care:* This Department's involvement relates specifically to sustainable resource management and land care.

At Local Level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Western Cape, both Local Municipalities and District Municipalities play a role. The relevant Municipalities include:

» *Matzikama Municipality:* Offices in Vredendal
» *West Coast District Municipality (WCDM):* Offices in Moorreesburg

The following is relevant regarding regulation at a district and/or local level:

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control. The IDP process, specifically the spatial component (Spatial Development Framework), in the Western Cape Province is based on a bioregional planning approach to achieve continuity in the landscape and to maintain important natural areas and ecological processes.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.
» Municipal legislation and by-laws regulate zoning within the local/district municipal areas, and application would be required for the required rezoning of any property.

4.4.2. Legislation and Guidelines that have informed the undertaking of this EIA Process

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

» National Environmental Management Act (NEMA; Act No 107 of 1998)

» EIA Regulations, published under Chapter 5 of the NEMA (GN R385, GN R386 and GN R387 in Government Gazette 28753 of 21 April 2006)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  * Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006)
  * Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  * Guideline on Public Participation, 2006 (DEA&DP, July 2006)
  * Guideline on Alternatives, 2006 (DEA&DP, July 2006)
» Guideline document developed by DEA&DP entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006)
» Specialist study guidelines published by DEA&DP, in particular:
  * Strategic initiative to introduce commercial land-based wind energy development to the Western Cape (specifically Reports 5 and 6)
  * Guideline for determining the scope of specialist involvement in EIA processes (June 2005)
  * Guideline for involving visual and aesthetic specialists in EIA processes (June 2005)
  * Guideline for involving biodiversity specialists in EIA processes (June 2005)
  * Fynbos Forum Ecosystem Guidelines for environmental assessment in the Western Cape (2005)
  * Guideline for involving heritage specialists in EIA processes (June 2005)
  * Guideline for involving hydrogeologists in EIA processes (June 2005)
  * Guideline for Environmental Management Plans (June 2005)
  * Guideline for involving social assessment specialists in EIA processes (February 2007)
  * Guideline on public participation: NEMA Environmental Impact Assessment Regulations (September 2007)

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in the EIA process, and the various permitting requirements associated with the proposed Wind Energy Facility. A listing of relevant legislation and permitting requirements is provided in Table 4.3 overleaf.

Table 4.3: Relevant legislative permitting requirements applicable to the Wind Energy Facility Project EIA

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed Wind Energy Facility and associated infrastructure	National Department of Environmental Affairs and Tourism – lead authority. Western Cape Department of Environmental Affairs and Development Planning – commenting authority.	This EIA report is to be submitted to DEAT and DEA&DP in support of the application for authorisation submitted in March 2007.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.	Department of Environmental Affairs and Tourism (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed Wind Energy Facility, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	Section 20(1) provides that where an operation accumulates, treats, stores or disposes of waste on site for a continuous period, it must apply for a permit to be classified as a suitable waste disposal facility.	National Department of Environmental Affairs and Tourism and Department of Water Affairs and Forestry.	As no waste disposal site is to be associated with the Wind Energy Facility or associated infrastructure, no permit is required in this regard.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992). Provincial noise control regulations have been	National Department of Environmental Affairs and Tourism	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	promulgated for the Western Cape in Provincial Notice (PN 627/P5309/2299) dated 20 November 1998. In terms of these Regulations, industrial noise limits are 61 dBA and noise limits from any source other than an industrial source are 65 dBA. Draft regulations relating to noise control published in Provincial Gazette No 6412, PN 14 dated the 25th of January 2007. Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (administers the WCMA01)	be undertaken in accordance with SANS 10328. This has been undertaken as part of the EIA process (refer to Appendix P). There are noise level limits which must be adhered to. If these are exceeded, then mitigation (like noise zones) are required to be implemented From the findings of the noise assessment, no exceedance of noise limits is anticipated.
National Water Act (Act No 36 of 1998)	Section 21 sets out the water uses for which a water use license is required.	Department of Water Affairs and Forestry	As no water use (as defined in terms of S21 of the NWA) will be associated with the Wind Energy Facility, no water use permits or licenses are required to be applied for or obtained.
National Water Act (Act No 36 of 1998)	In terms of Section 19, Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs and Forestry (as regulator of NWA)	While no permitting or licensing requirements arise directly by virtue of the proposed Wind Energy Facility, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Atmospheric Pollution Prevention Act (Act No 45 of 1965)	In terms of section 27, the Minister may declare certain areas as dust control areas. The area in which the project site where the proposed WEF is to be situated has not been declared as a dust control area. Section 28 sets out prescribed steps or, where no steps have been prescribed, adopt the best practicable means for preventing such dust from becoming so dispersed or causing such nuisance.	National Department of Environmental Affairs and Tourism - Chief Air Pollution Control Officer (CAPCO)	Although there is no legal obligation relating to the activities to be undertaken within the proposed development area (as the area is not a declared dust control area), it is suggested that as best practice and in accordance with Section 28, best practicable means should be used to prevent dust generation from the roads and excavations during

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
			construction in order to prevent dust from becoming a nuisance.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain developments, including: * Construction of a road, power line, pipeline or other similar linear development or barrier exceeding 300 m in length. * Any development or other activity which will change the character of a site exceeding 5 000m^2. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains Heritage Western Cape – all Provincial heritage sites (grade 2 sites), generally protected heritage and structures (grade 3a – 3c sites) and prehistoric human remains	Subsection 4 of the NHRA provides that within 14 days of receipt of notification, the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe that a heritage resource may be affected or notify the Proponent that this section does not apply. Heritage Western Cape have reviewed the Final Scoping Report (including a Heritage Assessment) and have indicated that HWC has no objection to the development on the proposed site, and that no further heritage related studies are required (refer to record of decision included within Appendix F). A permit may be required should identified cultural/heritage sites identified on the site be required to be disturbed or destroyed as a result of the proposed development.
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of Section 57, the Minister of Environmental Affairs and Tourism has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came	National Department of Environmental Affairs and Tourism	As Eskom will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies are required to be undertaken as part of the EIA process. These studies have been

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase.		undertaken for the proposed Wind Energy Facility and associated infrastructure (refer to Appendix G and H) A permit may be required should the protected plant species which are present on the proposed development site are to be disturbed or destroyed as a result of the proposed development.
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking (defined in terms of article 2 to include, cut, chop off, take, gather, pluck, uproot, break, damage or destroying of certain flora. Schedule 3 lists endangered flora and Schedule 4 lists protected flora. Articles 26 to 47 regulates the use of wild animals	CapeNature	A permit may be required should any endangered or protected plant species present on the proposed development site are to be disturbed or destroyed as a result of the proposed development.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Weeds are described as Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be developed and implemented.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the	Department of Minerals and Energy.	As no borrow pits are expected to be required for the construction of the Wind Energy Facility and associated

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	provisions of the Act.		infrastructure, no mining permit or mining right is required to be obtained. All borrow material will be commercially sourced for use during the life cycle of this project.
National Veld and Forest Fire Act (Act No 101 of 1998)	In terms of Section 12 Eskom would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that same does not spread to adjoining land. In terms of Section 13 Eskom must ensure that the firebreak is wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading; not causing erosion; and is reasonably free of inflammable material. In terms of Section 17, Eskom must have such equipment, protective clothing and trained personnel for extinguishing fires as are prescribed or in the absence of prescribed requirements, reasonably required in the circumstances.	Department of Water Affairs and Forestry.	While no permitting or licensing requirements arise from this legislation, this Act will find application during the operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site by the activity and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	products. Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; Group IV: any electronic product; Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARs) 1997	Any structure exceeding 45m above ground level, or structures where the top of the structure exceeds 150m above the mean ground level (like on top of a hill), the mean ground level considered to be the lowest point in a 3 km radius around such structure. Structures lower than 45m, which are considered as a danger or a potential 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 that it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport - CAR Part 139.01.33 relates specifically to appropriate	Civil Aviation Authority (CAA)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in CAR Part 139.01.33 (refer to the relevant excerpt included in Appendix T)

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	marking of wind energy facilities.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): “Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads” outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Western Cape Department of Transport and Public Works (provincial roads) South African National Roads Agency (national roads)	An abnormal load/vehicle permit will be required to transport the various components to site. These include: * Route clearances and permits will be required for transporting the nacelles by road-based transport. * Transport vehicles exceeding the dimensional limitations (length) of 22m and will require a permit. * Depending on the trailer configuration and height when loaded, some of the turbine components may not meet specified dimensional limitations (height and width) but will be permitted under certain permit conditions.
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Eskom must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area, must comply with the extensive procedures set out in the DFA.

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
Land Use Planning Ordinance 15 of 1985	Details land subdivision and rezoning requirements and procedures	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Given that the wind energy development is proposed on land that is zoned for agricultural use, a rezoning application in terms of Section 17 of LUPO to an alternative appropriate zone will be required. It is anticipated that the wind energy development would require a rezoning to either Industrial Zone 1[5] or Special Zone[6] as defined in the Scheme Regulations in terms of Section 8 of LUPO (Government Gazette, December 1988). Rezoning is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements & procedures. Applies for subdivision of all agricultural land in the Province.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.

[5] "Industry: means an enterprise defined in the regulations made in terms of Section 35 of the Machinery and Occupational Safety Act (Act 6 of 1983)" (note, these Regulations include any 'electrical installation')."

[6] "Special Usage: means a use which is such, or in respect of which the land use restrictions are such, that it is not catered for in these regulations, and which is set out in detail … by means of conditions of approval, or by means of conditions applicable to the special zone."

SCOPE OF THE WIND ENERGY FACILITY PROJECT CHAPTER 5

This chapter provides details regarding the scope of the proposed wind energy facility on the West Coast, including all required elements of the project and necessary steps for the project to proceed. The scope of project includes construction, operation and decommissioning activities. Activities associated with all life-cycle phases of the proposed wind energy facility that could potentially impact on the environment have been assessed through this EIA Study. The three primary components of the project (i.e. areas of activity) include the following:

» A **Wind Energy Facility** including up to 100 wind turbine units, a substation, underground electrical cabling between turbines and the substation, internal access roads and an office building and visitors centre at the facility entrance.
» Overhead **power lines** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» Upgrading activities to the existing Divisional Road 2225 (known as Skaapvlei road) to provide access to the site (i.e. act as a **haul road** during the construction phase) from the R363 main tarred road at Koekenaap.

The details of these activities are provided in the sections which follow.

5.1. Project Construction Phase

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The erection and commissioning of the turbines will be completed in a 2-phased approach, as this facility lends itself to phased-construction. It is proposed that Phase 1 comprise a facility with a capacity of approximately 100 MW (i.e. in the order of 50 industry-standard 2 MW capacity turbines). The construction phase for erection of approximately 50 wind turbines plus all of the required associated infrastructure is expected to take in the order of 12 months. Phase 2 of the proposed wind energy facility (i.e. the remaining 100 MW) is proposed to commence on commissioning of Phase 1. As this second phase will also involve the erection of approximately 50 turbines, it is estimated that the construction phase for erection of approximately 50 wind turbines plus all of the required associated infrastructure is expected to take a further 12 months. Therefore, a total construction period of 24 months is anticipated for the entire development.

It is expected that there will be between 6 and 15 people in a construction crew, depending on the construction phase of project and the nature of activities being undertaken. There will be more than one crew operating on the site at any one time. It is anticipated that on average 4 teams of 15 people (i.e. on average 60 people) will be working on the site during the course of the construction phase for the project, including the construction of the substation and power lines. A peak maximum of 300 people working on the wind energy facility site, access road and power lines can be expected during the accelerated programme (i.e. when there is a need to accelerate some of the activities to meet key dates).

Construction crews will constitute mainly skilled and semi-skilled workers. No employees will reside on the construction site at any time during the construction phase, and the intention is for appropriate accommodation to be sought and provided within the neighbouring towns.

The following construction activities have been considered to form part of the project scope of the Wind Energy Facility on the West Coast.

5.1.1. Conduct Surveys and Confirm Site Layout

Prior to initiating construction, a number of surveys will be required including, but not limited to:

» Geotechnical survey to provide information regarding subsurface characteristics for founding conditions and road building. This process will be required to be undertaken by a qualified geotechnical engineer.
» Wind energy facility site survey and confirmation (and pegging) of the turbine micro-siting footprints, laydown areas and access road routes. This micro-siting exercise will be required to be undertaken in conjunction with qualified heritage and vegetation specialists.
» Survey of substation site. This will be required to be undertaken in conjunction with qualified vegetation specialist.
» Survey and profiling of power line servitude to determine specific tower locations. This profiling exercise will be required to be undertaken in conjunction with qualified heritage, vegetation and avifauna specialists.

Eskom have utilised specialist software to assist in selecting the optimum position for each turbine (for optimum power generation). This site layout optimisation exercise revealed the best possible positions for the turbines, as well as the substation and other infrastructure from a technical perspective. The positioning/layout of all the components of this wind energy facility have a 90% confidence level, and will be confirmed through the results of the surveys mentioned above.

An east-west optimised layout is proposed to maximise the utilisation of the prevailing SSW winds. The site layout includes the 100 turbines in four rows which lie parallel and equidistant to one another. The first turbine row lies approximately 2 km inland from the coastline. Turbines will be sited up to 300 m apart from each other, with rows being approximately 650 m apart (refer Figure 5.1). This is to minimise wake effects and wind turbulence.

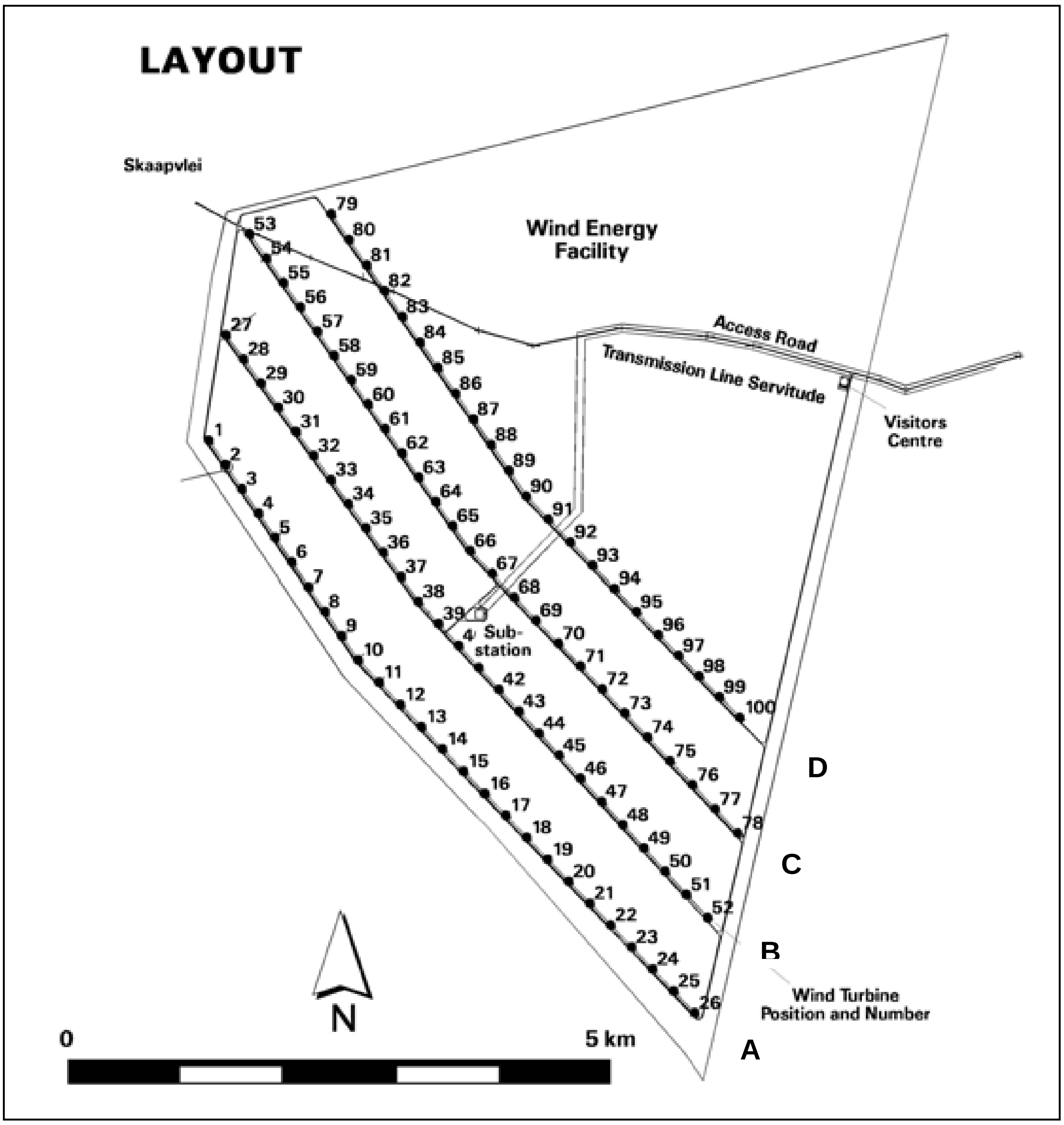


Figure 5.1: Diagrammatic representation of the proposed layout of the wind energy facility, illustrating the layout of the wind turbines and associated infrastructure

The wind resource drops across the site with distance from the coast, therefore the best positions for turbines (from an optimal operation perceptive) are the first 26 positions in Row A, as well as the second 26 positions in Row B. Rows A and B are proposed to be constructed as Phase 1. The remaining 48 turbines have been optimally located in Rows C and D, and would be constructed as Phase 2.

The substation is positioned in a central location between Rows B and C. This is to optimise the substation position between the Phase 1 and Phase 2 developments. In addition, the central location of the substation minimises energy losses between the turbine/generator and the substation by minimising the longest cable connection.

5.1.2. Upgrading of Access Road to the Site

The proposed site is in a remote location but has good access owing to the existing road network providing access to the farming and mining areas. The existing Divisional Road 2225 (known as Skaapvlei road) provides direct access to the site from the R363 main tarred road at Koekenaap. This road is, however, required to be upgraded to provide adequate access to the site (i.e. act as a haul road to accommodate abnormally loaded vehicles during the construction phase). Upgrading activities are likely to include road surface redesign to accommodate the traffic loads and move water off the road surface effectively; and resurfacing of the road with a suitable wearing course gravel to ensure an improved driving surface. When a detailed survey and analysis of the road is undertaken at the start of the construction phase, Eskom will be in a position to make a decision regarding the surface material required to ensure the longevity and endurance of the road throughout the construction period and beyond. A tarred road will only be considered should this be deemed economically viable.

Figure 5.2: Photograph indicating the existing gravel access road to the proposed site (i.e. the road to Skaapvlei from Koekenaap)

The upgrade to this access road will have to be completed in advance of any sizable components being delivered to site, and will be required to be of a good riding quality after the completion of the construction phase.

All borrow material required for the upgrade activities will be sourced from commercial sources and will not require the opening of borrow pits within the area.

The Skaapvlei road passes through the site, but will remain a proclaimed divisional road with fencing on both sides.

5.1.3. Establishment of Internal Access Roads on the Site

Internal access/haul roads within the site are required to be established to each turbine position as well as to the substation. No suitable vehicle tracks currently occur within demarcated the site for use. Therefore, access roads will be required to be established between the turbines to provide access and accommodate the abnormally loaded vehicles for construction purposes.

The access to the site will be off the Skaapvlei road. A compacted permanent roadway with a surface of 6 m in width will be required to be constructed on the site. The internal road needs to be designed to accommodate the swept path (i.e. the space required in the bends and corners so that the wheels remain on the roadway) and imposed loads of all the abnormal-load vehicles. These roads will be required to be maintained for the duration of the operation of the facility to provide suitable access for maintenance. The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines and substation position, and allow for circulation of vehicles on the site.

These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary.

Abnormal vehicles with 67 to 83 ton Nacelles and crawler crane components (or GVW = 132 000 kg) may require flatter grades on site. The geometric design specifications of the internal service roads will therefore be required to be confirmed in consultation with transportation companies prior to commencing with detailed design of the roads.

In order to accommodate the large crawler crane required for turbine assembly, a track of 12 m to 14 m in width is required to be established on the site to accommodate the passage of the fully rigged crawler crane. The total width of the crawler crane with 2 m wide caterpillar tracks is 10.8 m. In order for the crawler crane to travel fully rigged between turbine sites the roadway will need to be 12 m to 14 m wide designed to the required geometric specifications and with a pavement structure designed to support the crane tracks width and bearing pressure. To enable the assembled crawler crane to move around the site and around the base of the turbine, the gradient and crossfall can not exceed 1 degree or (1.7%). Where the proposed roads do not follow the contours, there will be gradients steeper than 1.7%, and cut and fill may be required (all borrow material required for the construction activities will be sourced from commercial sources and will not require the opening of borrow pits within the area). If the crawler crane cannot "walk" between turbine locations, it will need to be broken down and re-established at each location. Where the gradients are too steep to walk the crane fully rigged, the crane will need to be partially dismantled, booms removed and the superstructure can move to another location.

The worst case scenario is, therefore, a 14 m wide temporary roadway, with 6 m of this roadway permanently compacted and paved after the end of the construction period (to minimise maintenance requirements and erosion potential).

Approximately 35 km of internal roadway is required to adequately access site. Assuming that 6 m wide access roads will be constructed on the site, an area of permanent disturbance/alteration of approximately 210 000 m^2 (or 21 ha) in extent (excluding the already compacted and disturbed portion of the Skaapvlei road which bisects the site) will result. This is approximately 0.5% of the total 3 700 ha site. The additional track required for the crawler crane (at an average width of 14 m, i.e. 8 m additional to the 6 m permanent roadway) will be an area of temporary disturbance/alteration totalling approximately 280 000 m^2 (or 28 ha). This is approximately 0.75% of the total 3 700 ha site. On completion of the construction phase, this area can be rehabilitated (appropriate rehabilitation measures are detailed in the draft EMP included in Appendix S).

5.1.4. Undertake Site Preparation

Site preparation activities will include the establishment of internal access roads (as discussed in 5.1.3 above), clearance of vegetation and topsoil at the footprint of each turbine, establishment of laydown areas (refer to 5.1.5 below) and excavations for foundations (refer to 5.1.6 below). These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site. Figure 5.3 illustrates these areas.

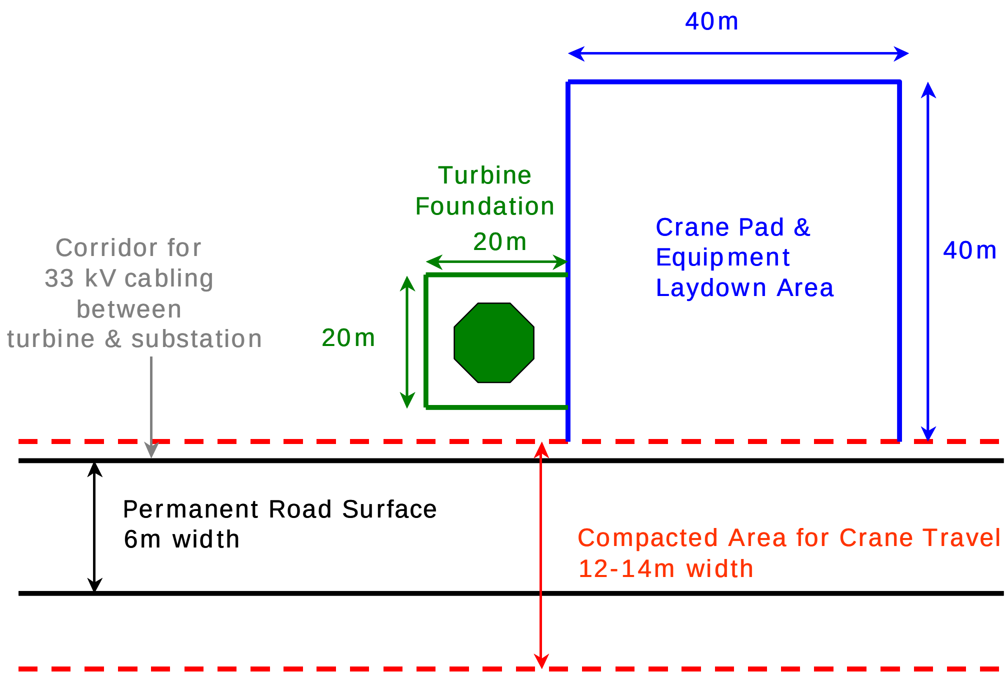


Figure 5.3: Diagrammatic representation of the proposed layout of the components

Site preparation will be undertaken in a systematic manner to reduce the risk of open ground to erosion. In addition, site preparation will include search and rescue of floral species of concern (where required), as well as identification and excavation of any sites of cultural/heritage value (where required).

5.1.5. Establishment of Lay Down Areas on Site

Lay down areas (40 m by 40 m in extent) will need to be established at each turbine position to accommodate the cranes required in tower/turbine assembly. In addition, this area will be used for the storage of the wind turbine components prior to turbine erection. Assuming that 40 m x 40 m laydown areas are required at each of the 100 turbine positions, an area of temporary disturbance/alteration of approximately 160 000 m^2 (or 16 ha) in extent will result. On completion of the construction phase, this area can be rehabilitated (appropriate rehabilitation measures are detailed in the draft EMP included in Appendix S).

Additional small lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.

Figure 5.4: Photograph illustrating the laydown areas required during the erection of one of the turbines at the Klipheuwel demonstration facility (photo courtesy of Eskom)

A large temporary lay down area (approximately 20 m wide x 150 m long) will be required where the main lifting crawler crane will be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. This area could potentially make use of part of an access road to avoid additional ground disturbance.

5.1.6. Construct Foundation

Concrete foundations will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 2 m. Concrete will be batched at an appropriate location off-site and brought to site as ready-mix when required via cement trucks. The reinforced concrete foundation of approximately 15 m x 15 m x 2 m will be poured and support a mounting ring. Therefore, for the 100 turbines, a total of 11 000 m^3 of cement is required. If it assumed that each ready-mix cement truck can carry 5,5 m^3, an approximate 20 trucks will be required per turbine foundation. It is estimated that approximately 2 570 ready-mix loads would be required for the total facility, i.e. including the cement required for the substation and visitors centre.

The foundations will be left up to a week to cure. If the geological conditions dictate, the use of alternative foundations will be considered (e.g. reinforced piles).

Figure 5.5: Photograph illustrating the construction of the foundation of one of the turbines at the Klipheuwel demonstration facility (photo courtesy of Eskom)

It is estimated that a footprint of 20 m x 20 m will be permanently disturbed/altered at each turbine position. Therefore an area of permanent disturbance/alteration of approximately 40 000 m^2 (or 4 ha) in extent will result for the 100 turbine positions. This is approximately 0.1% of the total 3 700 ha site)

5.1.7. Transport of Components and Equipment to Site

The wind turbine, including tower, will be brought to site by the supplier in sections on flatbed trucks. Turbine units which must be transported to site consist of:

» a tower comprised of 4 segments of approximately 20 m in length

» a nacelle weighing up to 80 tons (depending on the specific turbine type)
» three rotor blades (each of approximately 45 m in length).

The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989)[7] by virtue of the dimensional limitations (abnormal length of the 45 m blades) and load/weight limitations (i.e. the nacelle).

Figure 5.6: Photographs illustrating the equipment required for the transportation of turbine components to site (photographs courtesy of Eskom at during the construction of the Klipheuwel demonstration facility)

In addition, components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines and need to be transported to site.

In addition to the specialised lifting equipment, the normal civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, etc.). Once this equipment arrives on site it will remain on the site for the duration of its use.

[7] A permit will be required for the transportation of these loads on public roads.

Cement will be brought to the site as ready-mix in cement trucks. It is estimated that 2 570 cement truck trips will be required over the 2 year construction period to provide cement for use at the turbines, substation and visitor's centre.

The components required for the establishment of the substation (including transformers) as well as the power lines (including towers and cabling) will also be transported to site as required.

The dimensional requirements of the loads to be transported during the construction phase (length/height) may require alterations to the existing Provincial road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. A preliminary assessment of the transportation routes is provided within the transportation study (refer Appendix Q), and will be finalised through the completion of a detailed traffic assessment by the transport contactor appointed for the project.

5.1.8. Erect Turbines

A large lifting crane will be brought on site. It is required in order to lift the turbine sections into place. The nacelle, which contains the gearbox, generator and yawing mechanism, is required to be lifted and placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. The blades will then be lifted up to a height of 80 m to the nacelle and bolted in place. A small crane will likely be needed for the assembly of the rotor while a large crane will be needed to lift it into place. It will take approximately 2 days to erect the turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.

The wind turbine which will be utilised at the wind energy facility is likely to consist of a tower of approximately 78 m in height, a nacelle with hub height at approximately 80 m, and a rotor approximately 90 m in diameter.

The lifting cranes will be required to move between the turbine sites. The crawler crane is self-powered and can "crawl" between locations should the ground conditions allow. When assembled, the crawler crane has a track width of approximately 11 m, and would require a track of up to 14 m in width to move on.

Figure 5.7: Photograph illustrating the assembly of a turbine tower utilising a large lifting crane (photographs courtesy of Eskom taken during the construction of the Klipheuwel demonstration facility)

Figure 5.8: Photograph illustrating the assembly of a turbine (nacelle and blades) utilising a large lifting crane (photographs courtesy of Eskom from construction at the Klipheuwel demonstration facility)

5.1.9. Construct Substation

A substation will be constructed within the site. The turbines will be connected to the substation via underground 33 kV cabling (refer to 5.1.10 below). The position of the substation has been informed by the final micro-siting/positioning of the wind turbines. The optimum position for the construction of the substation is in a position central to the turbine field. This is key from a technical/system integration perspective as it is required to limit the longest cable length between the turbines and the substation so as to limit power losses. The substation will be constructed within a high-voltage (HV) yard footprint of up to 80 m x 80 m. This footprint of 6 400 m^2 will be permanently disturbed/altered. Associated laydown areas will be small and rehabilitated post-construction.

The substation will be a Gas Insulated Substation (known as a GIS substation). This technology is proven worldwide to be ideal for use in coastal and/or dusty environments.

The proposed substation would be constructed in the following simplified sequence:

Step 1: Survey of the site
Step 2: Site clearing and levelling and construction of access road to substation site
Step 3: Construction of terrace and substation foundation
Step 4: Assembly, erection and installation of equipment (including transformers)
Step 5: Connection of conductors to equipment
Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

5.1.10. Connection of Wind Turbines to the Substation

Each wind turbine will be connected to an optimally positioned substation by underground electrical cables (33 kV). The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. It will be a single disturbance of the ground followed by backfill and reinstatement. The underground cables will be laid alongside the internal access roads as far as possible in order to minimise linear disturbance on the site.

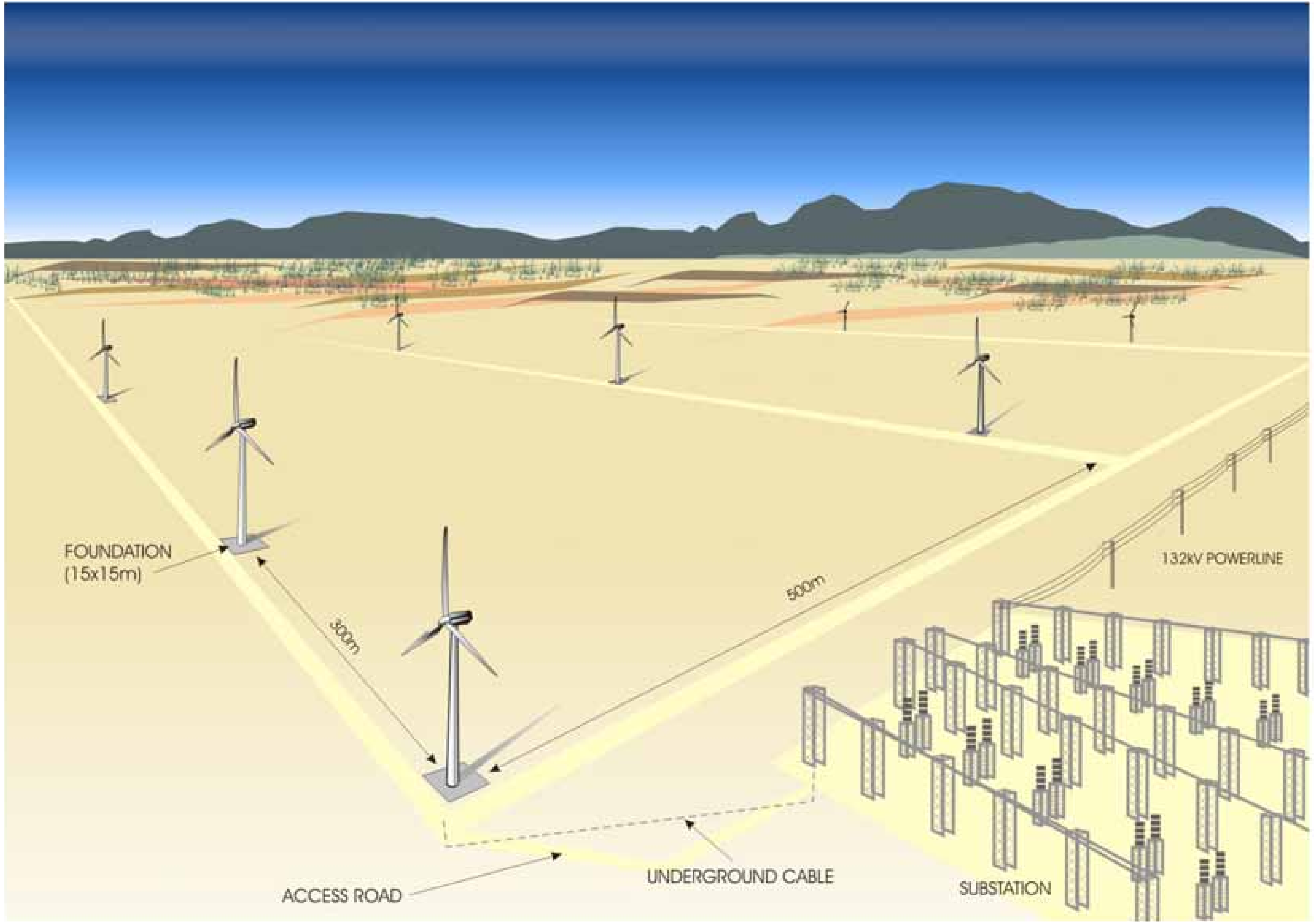


Figure 5.9: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

5.1.11. Connect Substation to power grid – construction of a power line

An overhead 132 kV power line will connect the substation at the wind energy facility site to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal). The connection point to the Eskom power grid has been confirmed through a network planning exercise. Alternative routes for the construction of the power line are assessed through this EIA. A preferred route will be surveyed, pegged, and then ground-truthed by vegetation, heritage and avifauna specialists (i.e. conduct walk-through surveys to confirm the alignment in terms of environmental sensitivities) prior to construction. The power line servitude will follow other existing linear infrastructure (including roads and or other power lines) as closely as possible to consolidate linear infrastructure in the area, and to minimise the need for additional points of access.

The power line will be constructed utilising a monopole structure/tower with stand-off insulators and will be approximately 25 m in height. The power line will be a double circuit power line (i.e. two 132 kV circuits carried by a single tower structure), and will require a servitude of approximately 32 m in width. Examples of the tower type proposed for use are illustrated in Figure 5.10 below.

Figure 5.10: Examples of the proposed 132 kV monopole double circuit power line tower type.

5.1.12. Commissioning

Due to the nature of the plant and the process of construction, it is proposed that the facility be constructed and commissioned in two phases. The first phase of the wind energy facility is proposed to comprise a generating capacity of approximately 100 MW (i.e. in the order of 50 industry-standard 2 MW turbines). The remainder of the turbines would be built and commissioned in a subsequent phase.

Prior to the start up of a wind turbine, a series of checks and tests will be carried out. This will include both static and dynamic tests to make sure the turbine is working within appropriate limits. Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. The schedule for this activity will be subject to site and weather conditions.

5.1.13. Establishment of Ancillary Infrastructure

A small office structure and visitors centre may also be constructed at the entrance to the wind energy facility. These structures would occupy a footprint of approximately 400 m^2 under roof, with additional areas for parking for visitors and Eskom employees This area will be permanently disturbed/altered. The establishment of these buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A small lay down area for building materials and equipment associated with these buildings will also be required, and will be an area of temporary disturbance/alteration.

A normal fence would be erected for access control purposes. The substation will be fenced off and have limited access only for safety and security reasons. Each turbine is secure, and would not require any fencing around a single turbine unit.

5.1.14. Undertake Site Remediation

As construction is completed in an area, and as all construction equipment is removed from the site, the site will be rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation. Due to the mobility of the sandy soils, and as rehabilitation and recovery of vegetation on the site will be slow, rehabilitation activities will (as far as possible) be carried out at each turbine location once construction of that particular turbine is completed. Appropriate rehabilitation measures are detailed in the draft Environmental Management Plan included in Appendix S.

5.2. Project Operation Phase

Once operational, the wind energy facility will be monitored remotely. It is estimated that the operational phase of the project will provide employment for approximately 6 skilled staff members, who will be responsible for monitoring and maintenance when required. No permanent staff will be required on-site for any extended period of time.

Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. The following operation/maintenance activities have been considered as forming part of the project scope of the Wind Energy Facility on the West Coast.

» The wind turbine will be subject to periodic maintenance and inspection.
» Periodic oil/grease/lubrication changes will be required.
» Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.

5.3. Decommissioning

The turbine infrastructure which will be utilised for the proposed wind energy facility on the West Coast is expected to have a lifespan of 20 to 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

The following decommissioning activities have been considered to form part of the project scope of the Wind Energy Facility on the West Coast.

5.3.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required abnormal load equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

5.3.2. Disassemble and Replace Existing Turbine

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable except for the blades.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This chapter of the Draft EIA Report provides a description of the environment that may be affected by the Wind Energy Facility proposed on a site to the north of the Olifants River on the West Coast of the Western Cape Province. This information is provided in order to assist the reader in understanding the possible effects of the proposed project on the environment. Aspects of the biophysical, social and economic environment that could directly or indirectly be affected by, or could affect the proposed development have been described. This information has been sourced from both existing information available for the area and proposed development site as well as collected field data, and aims to provide the context within which the environmental assessment has been conducted. A more detailed description of each aspect of the affected environment is included within the specialist scoping reports contained within Appendices G - Q.

6.1 Location of the Proposed Wind Energy Facility Development Area

The site for the proposed wind energy facility is located in the West Coast District Municipality (WCDM) of the Western Cape Province. The WCDM is bordered by the Northern Cape Province to the north, and the Cape Metro and Cape Winelands Districts to the south and south-east. The western border is formed by the Atlantic Ocean, which forms the basis of the district's large and established fishing sector. The district includes five local municipalities, namely Matzikama, Cederberg, Bergriver, Saldanha Bay and Swartland, as well as District Management Areas (DMAs) (refer to Figure 6.1).

In terms of its specific location, the study site falls on the boundary between the District Management Area WCMA01 and the Matzikama Local Municipality – that is, the northern portion of the site falls within the within the WCMA01, and the southern section of the site falls within the Matzikama Local Municipality (LM) area. Vredendal, the largest town in the region, is located approximately 40 km south-east of the site. Primary access to this region is by means of the N7 national road and the R363 provincial main road.

The demarcated study site (an area of approximately 37 km^2) comprises the following farms:

» Portion 5 of the farm Gravewaterkop 158 (known as Skaapvlei)
» A portion of Portion 620 of the farm Olifants River Settlement (known as Skilpadvlei)
» A portion of Portion 617 of the farm Olifants River Settlement (known as Nooitgedag)

Figure 6.1: West Coast District Municipality

The western perimeter of the proposed wind energy facility development site is ~2 km inland from the coastline (i.e. the high-water mark). The West Coast is characterised by a flat to gently rolling terrain. The terrain lies between 60 m - 110 m above mean sea level. The natural vegetation is predominantly Namaqualand Strandveld and Namaqualand Sand Fynbos. However, large portions of the site have been transformed by dry land agriculture and sheep grazing.

6.2. Climatic Conditions

The West Coast area is characterised by a semi-arid Mediterranean climate with maximum temperatures ranging from 20°C – 30°C, depending on the season. Extreme temperatures can be extremely harsh, with summer temperatures often exceeding 40°C. The climate is strongly influenced by the cold Benguela current and coastal berg wind conditions. Rainfall is between 100 mm to 200 mm per annum, with the majority of the precipitation occurring during the winter months. The rainfall is supplemented by coastal fog, which often occurs in the area during winter.

The prevailing winds are predominantly from the south west during summer (onshore wind) and from the north east during winter (berg wind). The desiccating, hot, north-easterly 'berg winds' occur throughout the year. The cold ocean and warmer land mass results in typical daily cycle of offshore breezes at night and onshore winds increasing in strength during the day.

Meteorological stations are present in Vredendal, Brand-se-Baai (both of which are monitored by Namakwa Sands) as well as on the farm De Punt (monitored by Eskom). Key climatic data measured from these meteorological stations is summarised in Table 6.1.

Table 6.1: Key climatic data measured for the region

Weather Station	Vredendal	Brand-Se-Baai	Eskom's De Punt
Period of record	1958 to 1980	1994 to 2004	2003 - 2007
Precipitation (mm)	144	147 (main rainfall months May to September)	Average humidity 80% (100% maximum less than 10% of the time)
Evaporation Symons Tank (mm) A Pan (mm)	 1748 2182	 Not measured Not measured (estimated 1750mm)	 Not measured Not measured
Temperature (^{o} C)	-	-8.3^{o}C to 46.3^{o}C Ave July minimum: 8.6^{o}C Ave Feb maximum 23.8^{o}C	Average 15°C (no freezing with maximum 35°C for less than 1% of the time)
Wind Direction Wind velocity (m/s)	NW 6.5	S, SW 4.4	S, SW 6.2

Other relevant measurements obtained from the Eskom meteorological station at De Punt include:

- Wind gust maximum 3 sec mean – 180 km/hr (50 m/s)
- Maximum wind speed 10 minute mean – 114 km/hr (40 m/s)
- Turbulence < 15% at 50 m.

Figure 6.2 provides a wind rose of actual measured data (from the Eskom meteorological station at De Punt), which illustrates the predominant wind direction experienced on the West Coast north of the Olifants River. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke. The wind direction is conventionally indicated from the periphery towards the centre of the graph, and not from the centre outwards.

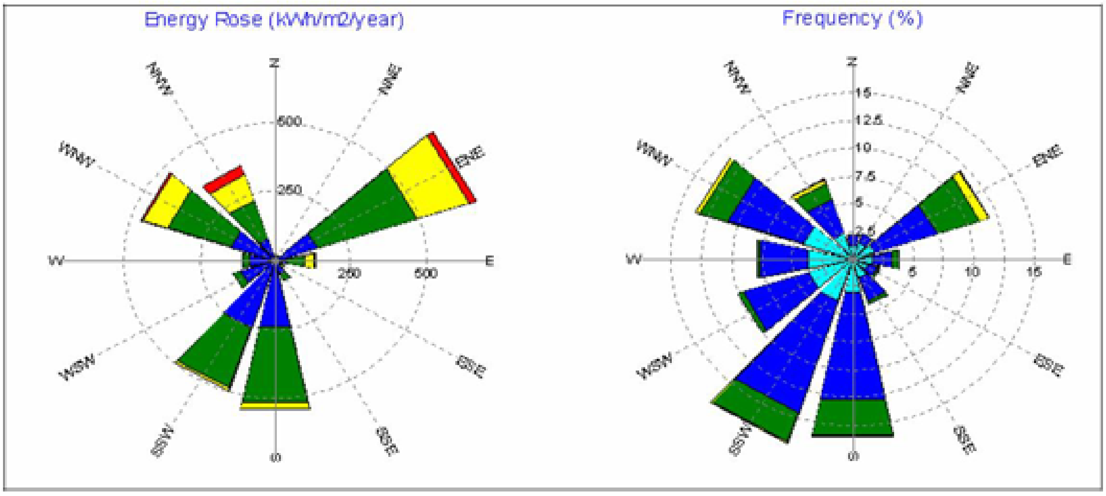


Figure 6.2: Wind Rose from measured data at the Eskom meteorological station at De Punt, indicating both wind energy as well as frequency of wind direction (% of time in a direction)

Figure 6.2 illustrates that the predominant wind direction is from the south and south west (i.e. percent of time in a direction). This is, however, not the strongest wind (or wind with most energy) experienced in this area, but the wind from the south west is experienced most frequently.

6.3. Regional Setting

The broader study area is an arid, sparsely populated area with less than 10 people per km^2 mostly concentrated within the small towns of the area. Large tracts of land within the study area are still in an untransformed state with varying degrees of degradation.

6.3.1. Ecological Profile

The site proposed for the development of the wind energy facility and associated power line falls within the Namaqualand coastal region of the Cape Floristic Region, and includes two biomes, i.e. the Fynbos biome, and the Succulent Karoo biome (Mucina & Rutherford 2006). These vegetation types are, due to the arid nature of this region, not very dense or tall in growth but rather scattered and low and represent a typical semi-desert environment. The Succulent Karoo is the only arid region recognised as a world biodiversity hotspot (Mittermeier *et al*., 2000).

More than 90% of the Succulent Karoo is used as natural grazing, a form of land use that is, at least in theory, not incompatible with the maintenance of biodiversity and ecosystem processes (Desmet, 1999). However, much of the remaining natural habitat is vulnerable to a wide range of other threats. These include (Desmet, 1999):

» The expansion of communally-owned land and the associated overgrazing and desertification
» Overgrazing of commercial (private-owned) rangelands
» Agriculture, especially in the valleys of perennial rivers
» Mining for diamonds, heavy minerals, gypsum, limestone, marble, monazite, kaolin, etc.
» Illegal collection of succulents and bulbs.

Namaqualand Strandveld is an extremely widespread vegetation type, especially in the context of the Cape Floristic Region, of which it is a part. This vegetation type extends from the Doringbaai area, some 20 km south of the Olifants River mouth, up the west coast for about 300 km, to the Hondeklipbaai area, and is therefore formally part of the Succulent Karoo biome. The vegetation type typically occurs in a band from 1 to 30 km inland, on deep sands, which are often grey, red, brown or orange. This vegetation type is regarded as a Least Threatened vegetation type in terms of the National Spatial Biodiversity Assessment (NSBA; Rouget *et al* 2004), with 92% of its original extent still intact. Significant habitat losses within this vegetation type have occurred in the recent past as a result of various mining activities along the west coast. Furthermore, Namaqualand Strandveld is significantly under-conserved in formal conservation areas, with less than 1% of the national target of 26% under some sort of conservation management, and it is therefore vulnerable to future transformation. A portion of this vegetation type will be protected within the proposed expansion of the Namaqua National Park in the area between the Groen and the Spoeg rivers.

There is significant variation within Namaqualand Strandveld in any one area, and it is possible to recognise a number of different forms or subtypes (plant communities), some of which are present in the study area.

Typical features of true Namaqualand Strandveld include a high percentage of succulents and leaf deciduous shrubs, moderate bulb diversity, and no Fynbos elements such as Ericaceae (heaths) and Proteaceae (proteas), with few Restionaceae (Cape reeds) and rare, range restricted and/or threatened plant species (more detail is included in Appendix G).

Figure 6.3: Photograph showing typical tall Namaqualand Strandveld, showing dominant succulent perennials

Namaqualand Sand Fynbos is part of an extensive belt, extending some 10 km to the east, 15 km southeast to the Doringbaai area, and over 200 km to the north. The vegetation type tends to occur on neutral to slightly acidic sands that are lighter in colour than Strandveld sands, and with a lower clay fraction. The unit is also listed as a Least Threatened vegetation type by the NSBA, but it is equally poorly conserved, with only 1% of its 29% (of original extent) target formally conserved (Rouget *et al*., 2004). True Namaqualand Sand Fynbos is characterised by the presence of particular specialist species (refer to Appendix G). This is one of the few vegetation types within Namaqualand that is formally regarded as part of the Fynbos biome, and it is also very unusual in that it appears to be the only Fynbos vegetation type that regenerates in the absence of fire (Mucina & Rutherford 2006). Fires in such arid areas are extremely rare, and most landowners cannot remember their Fynbos areas ever having burnt. The primary threats to Namaqualand Sand Fynbos are climate change and mining for heavy mineral sands.

Figure 6.4: Sand Fynbos in the foreground on a dune ridge (note paler sands), with yellow flowered Strandveld elements (*Othonna cylindrica*)

The topography of the broader study area is described as undulating plains with the coastline (or coastal forelands) to the west characterised by steep cliff faces (refer to Figure 6.5). Two major river valleys occur within the region, these being the Olifants River south of the site and the Klein Goerap River approximately 40 km north of the site. Moving inland the terrain becomes more undulating and hilly, and is characterised by hills and low mountains east of the R363.

The region is characterised by a surface cover comprising primarily of red aeolian sand of Tertiary to Quaternary age, overlying granite and gneiss of the Namaqualand Metamorphic Complex. These wind-blown sands frequently form low-relief, mobile bedforms that are blown over underlying harder calcareous soils. The dunes are able to form up and down the slopes of hills and valleys to reveal micro ‘climbing falling’ dune morphologies.

The soils reported to occur within the study area are generally deep and have a low agricultural potential. This low agricultural potential is due to a combination of:

- » excessive drainage due to the sandy texture
- » low fertility associated with the low clay content
- » a susceptibility to wind erosion if exposed, caused by the fine to medium grade of sand. This may be especially prevalent in dune areas.

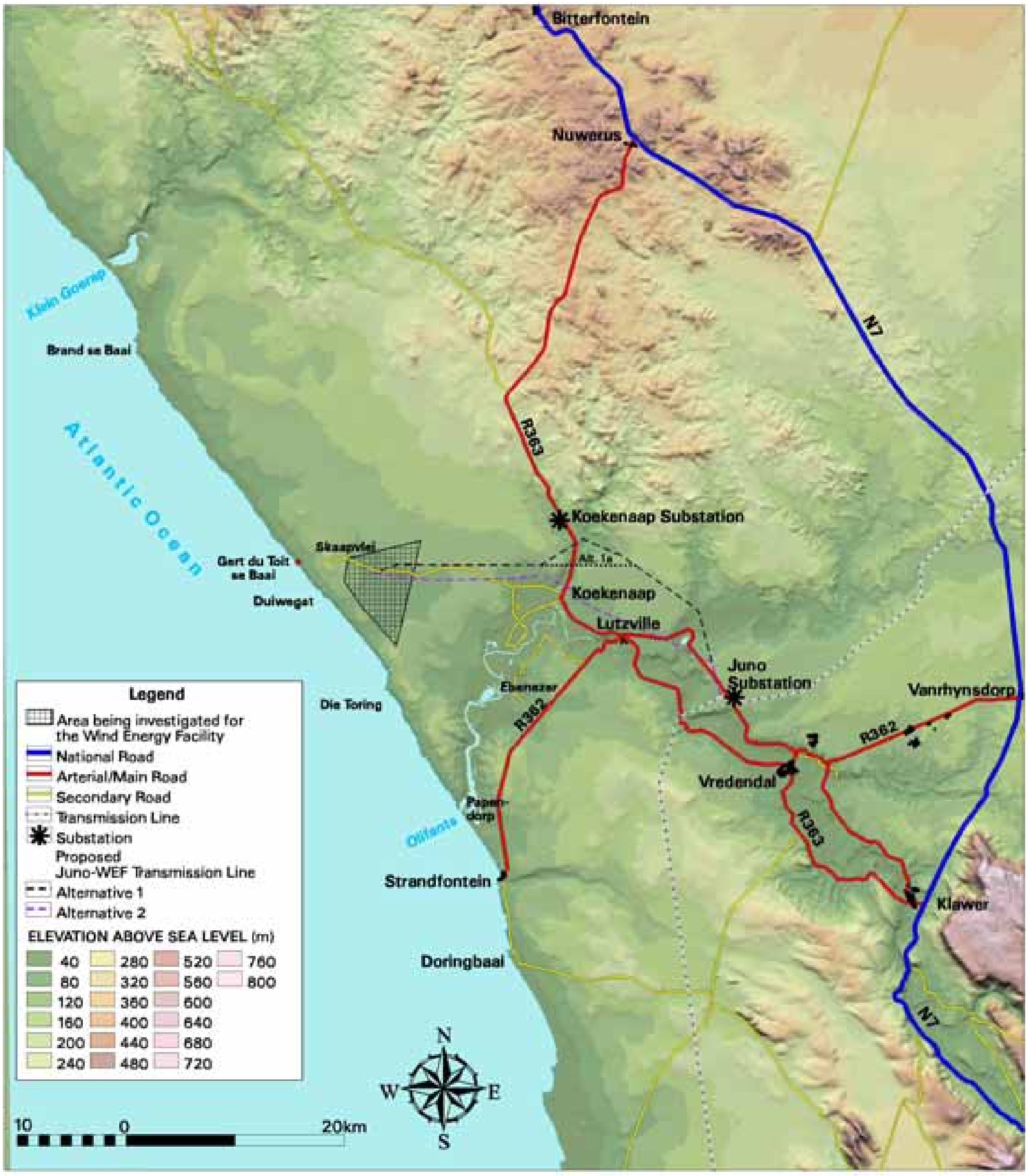


Figure 6.5: Shaded relief map (indicating topography and elevation above sea level) of the broader study area

The low agricultural potential of the soil, coupled with the low rainfall in the area means that there is little potential for arable agriculture in the area and that the soils are suited for extensive grazing at best. The grazing capacity of the area is low, around 10 ha per small stock unit (sheep/goats) (ARC-ISCW, 2004).

The Olifants River valley forms a distinct hydrological feature within the study area. It has to a large degree dictated the settlement patterns in this arid region by providing a source of perennial water for irrigated agriculture. Irrigated cultivation in close proximity to the river is the primary agricultural activity of this district, and has resulted in the alteration of the riparian vegetation along this river.

Four main faunal habitats were identified in the study area: i.e. coastal strip, rocky habitat, white coastal dunes, and inland Succulent Karoo (Namaqualand Sand Fynbos and Namaqualand Strandveld). The coastal strip is a mixture of alternating fine grain sandy beaches and rocky shoreline. At a few locations, rocks extend to well above the high water mark, constituting a distinct habitat for rock-dwelling animal species. The white coastal sand dunes include both vegetated and exposed ones. The inland areas feature low to moderate relief and short xeric Succulent Karoo vegetation on red aeolian sand. The area is not rich in endemic animal species. The emphasis is primarily on smaller animals, rather than on the larger, more obvious big game of other areas.

The insect fauna of the area is poorly known since the large number of species involved and the problem of seasonality imposes considerable limitations on insect surveys of short duration. The survey of Picker (1990) has not revealed the presence of any rare or threatened species of insect in the immediate vicinity of the Namakwa Sands mine site, which is approximately 30 km to the north of the study area.

Sixteen frog species occur in the broader area surrounding the study site (Minter *et al*., 2004). Of these, only three are Red Data species, i.e.

- » the Desert Rain Frog (*Breviceps macrops*) - listed as Vulnerable
- » the Namaqua Stream Frog (*Strongylopus springbokensis*) - listed as Vulnerable
- » the Karoo Caco (*Cacosternum karooicum*) - listed as Data Deficient and is endemic to the arid Karoo regions of the Western and Northern Cape Provinces.

At least 4 chelonian, 39 lizard and 22 snake species occur in the area. From available literature (Branch, 1998) and from previous sampling in the Namakwa Sands area at Brand-se-Baai (De Villiers, 1990; Mouton & Alblas, 2003), it is apparent that 44 reptile species may occur in the present smaller study area (more detail is included in Appendix H). Nine of these species are listed as Red Data species (Baard et al., 1999).

Rautenbach (1990) recorded 19 mammal species and confidently expects a further 16 species to occur in the Namakwa Sands mining area at Brand-se-Baai, 30 km to the north of the proposed site (refer to Appendix H). The species include insectivores, bats, hare/rabbit species, rodents, felid, canids, mustelid, viverrids, the dassie, and antelope species. At least four bat species are expected to frequent the study area (refer to Appendix H), none of which are of conservation importance.

Of the avian microhabitats within the area, the wetlands and Strandveld and Fynbos areas support, or partially support, the bulk of the local avian diversity (124 and 113 species respectively), as well as most of the Red-listed and endemic species of highest conservation priority (refer Appendix I). The Olifants River mouth and estuary is a sensitive area in terms of birds, and has been recognised as an Important Bird Area (Barnes, 1998). It is one of only four perennial estuaries on the west coast, making it an extremely attractive haven for many coastal bird species. Most of the bird species recorded there are water birds. Over 15 000 water birds occur regularly on the estuary.

Two nature reserves are located within the study area, i.e. the Lutzville Nature Reserve which is located approximately 20 km to the south-east of the proposed development site, and the Moedverloren Nature Reserve which is located approximately 25 km to the east of the proposed development site. The proposed Knersvlakte Biosphere Reserve, which has been identified as future Biosphere Reserve area within the West Coast region, incorporates the Moedverloren Nature Reserve.

The proposed site falls within the Knersvlakte Bioregion and is situated at least 30 km to the west of the Knersvlakte Biosphere Reserve 'core area'. Considering the six primary Spatial Planning Categories (SPCs)[8] detailed in the Knersvlakte Bioregion Spatial Plan, the area can currently be categorised as Category C: Agricultural Areas, constituting rural areas where extensive agriculture is practiced (that is, agricultural areas covered with natural vegetation providing for sustainable low-impact agriculture-related land-uses (e.g. stock-farming)). The proposed site is, however, indicated to lie on the periphery of the proposed 'buffer area' of the Knersvlakte Biosphere Reserve, which also includes Koekenaap as well as Transhex and Namakwa Sands mining areas. Currently, the area does not support a public or private conservation area, ecological corridor or rehabilitation area (as earmarked for the 'buffer area'), and would not have the potential to meet one of these land use planning goals while being utilised for extensive agricultural purposes.

6.3.2. Social Profile

The study site falls on the boundary between the District Management Area WCMA01 and the Matzikama Local Municipality (LM).

A number of communities are located in the Matzikama LM, the majority of which are located along the Olifants River. Vredendal is the largest town and functions

[8] The SPCs provide a framework to guide decision-making regarding land-use at all levels of planning, and they have been articulated in a spirit of creating and fostering an organised process that enables people to work together to achieve sustainable development in a coherent manner. The designation of SPCs does not change existing zoning or land-use regulations or legislation.

as the administrative centre of the Matzikama LM. Vredendal accounts for more than 32% of the total population of the Matzikama LM area, and is an advanced town with well-developed infrastructure, including an aerodrome. Other significant settlements within a 50 km radius of the proposed site include Lutzville, Koekenaap, Ebenhaeser, Papendorp (also known as Viswater), Strandfontein and Doringbaai. Between 2001 and 2006 the population within the Matzikama LM increased at an annual average growth rate of ~3.3%. This represents the highest growth rate in the West Coast District Municipality. Population growth is expected to slow down to an average annual rate of 2.5% between 2006 and 2010 (West Coast District, 2006).

Vredendal and Strandfontein have been identified as having high development potential (the Western Cape Growth Potential of Towns Study, 2004). The other towns in the area that are considered to have tourist potential are Doringbaai, Koekenaap, Ebenhaeser, Klawer, Lutzville and Vanrhynsdorp. The type of tourist potential is, however, not clearly defined. The proposed development site does not lie on any commonly used tourism route. However, the shoreline is frequented by people who regularly use the coast for recreational camping over the holiday season. Sites on the coast frequented by tourist include Strandfontein and Doringbaai, which are located along the Olifatnts River to the south of the study area and have formalised holiday accommodation, and Brand-se-Baai and Gert Du Toits-se-Baai, which are located to the north of the Olifants River (and north of the study area) and are frequented by campers.

The sub-regional economy in the area is traditionally based on primary sector activities such as dry land agriculture, livestock farming, fishing and mining, both in terms of employment provision and economic throughput. The agriculture, forestry and fishing sectors are the largest economic sectors in the Matzikama LM, with the agriculture and fisheries sectors providing only seasonal employment in the area.

The relatively deserted coastline is host to a number of mining developments, focussing mainly on diamond and heavy minerals mining. Of the mining activities in the area, the diamond mining operations of TransHex at Die Punt (in Matzikama LM) and the Namakwa Sands heavy minerals sand mining operations at Brand se Baai (in WCMA01) are the most significant. Other mining operations currently take place on the neighbouring farms Geelwal Karoo, Schaapvley Hills and Klipvlei Karoo Kop.

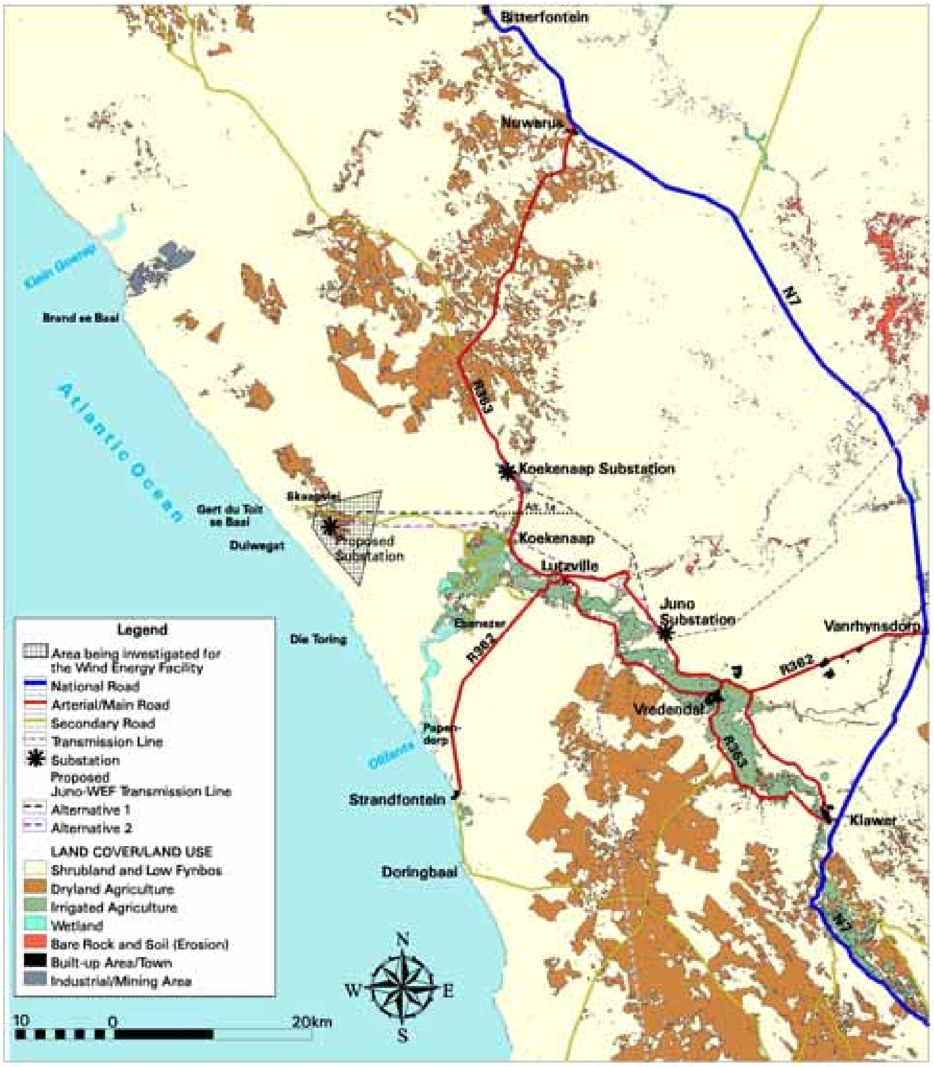


Figure 6.6: Land Cover/Land Use Map

Although unemployment rates of between 10% and 14% (as reported from the 2001 Census data) appear to be low when compared to the estimated June 2006 national employment rate (26.5%), the actual seasonal unemployment rates may be significantly higher due to the seasonal nature of the demand for labour associated with the fruit and vegetable cropping operations along the Olifants River valley. The unemployment rates out of season may, therefore, be significantly higher than the 2001 Census data indicates. In this regard a study undertaken for the WCDM in 2001 estimated that at least 50% of people employed in elementary work were effectively unemployed or underemployed. Youth unemployment is particularly high, with 70% of the unemployed being between the ages of 15 and 34 (West Coast District, 2006).

Based on the 2001 Census data, poverty rates in the area are considered to be high. Of the total number of households in the area, an estimated 30% - 38% had an income of R800 or less per month in 2001. Given the seasonal nature of the agriculture and fishing industry many of the people in the area do not have access to income throughout the year.

Archaeological sites, mainly shell middens, are known to be common close to the shoreline. These have, however, been disturbed extensively in some areas due to mining activity. The recent presence/occupation of humans in the area is limited to ephemeral traces of agriculture and various impacts resulting from alluvial diamond mining activities, which are also mostly restricted to the immediate coast. The cultural landscape qualities are that of a relatively undisturbed landscape imprinted over by the archaeological sites of late Stone Age hunter gatherers then within the last 2 000 years, transhumant Koekhoen pastoralists. Colonial occupation up to now is ephemeral and of very recent duration. It is understood from recent finds that parts of Namaqualand were occupied by people almost a million years ago, however the greatest amount of archaeological sites are those which relate to the ancestors of the San and Khoekhoen which have been radiocarbon dated to the last 5 000 years. These sites are densest along the immediate coastline but may be found further inland close to water sources or natural foci (dunefields, rock outcrops) on the landscape. Colonial period heritage sites, apart from those related to the relatively recent heritage of mining, are extremely scarce.

6.4. Local Environment: Description of the Proposed Wind Energy Facility Development Site and Associated Power Line Alternatives

The proposed wind energy facility development site lies on the coastal ridge overlooking the Atlantic Ocean at a height of 60 m - 110 m above mean sea level (amsl) and consists of flat to slightly undulating topography, with slopes of less than 4% (Figure 6.7). The routes followed by both power line alternatives lie below 150 m amsl.

The western perimeter of the proposed development site is ~2 km inland from the coastline (i.e. the high-water mark). The natural vegetation is mainly Namaqualand Strandveld and Namaqualand Sand Fynbos. Large portions of the site have been transformed by dry land agriculture and sheep grazing. Access to the site is via the gravel road known as the Skaapvlei road (Divisional Road DR2225).

Figure 6.7: Photograph at the proposed site looking west indicating the nature of the topography within the area

6.4.1. Ecological Profile

The site proposed for the development of the wind energy facility and associated power line is almost completely underlain by unconsolidated to weakly consolidated sediments comprising primarily of red aeolian sand of Tertiary to Quaternary age, overlying granite and gneiss of the Namaqualand Metamorphic Complex. Surface erosion is expected to occur in association with the larger rainfall events.

Vegetated relict dunes cover most of the area north of the access road (Skaapvlei road) which traverse the area selected for the siting of the turbines. These dunes are not expected to be mobile, although local wind transport of sediment and topographic alteration can be anticipated. A much smaller area is evident south of this road. Many of the more obvious linear elements within this dunefield are orientated in a north - south direction.

Numerous, round, enigmatic structures, approximately 20 m in diameter, are assumed to represent mounds created by Meerkats (*Suricata suricatta*) or Harvester Termites (*Microhodotermes viator*) and are present on the study site. These features are also widespread in the area traversed by power line corridor alternatives. No other significant landforms of biological origin are known to be present within the study area. Calcretised root casts can be expected to occur within the unconsolidated cover of aeolian sediments, although no landform is known to be the result of these features in the area proposed for the siting of the wind turbines.

Soils within the broader study area are typically deep, brown to orange to yellow sands, and range from fairly alkaline sands in the more coastal areas to neutral and even slightly acidic sands in the stabilised inland dunes. The soils in the central transitional areas are often loamy sands, with the additional clays coming from underlying clays which are exposed in various places. Exposed rock is rare, but can be found in some of the interdune slacks, with the biggest exposures (each of about six patches covering less than 0.5 ha) occurring in the southern parts of the site on farm Portion 620. These rocks appear to be a form of ferricrete, and may form a hardpan layer below the surface.

The closest significant regional drainage system to the proposed site is the perennial Olifants River, which flows in a south-westerly directly into the sea about 25 km south-east of the study area. No significant drainage lines are located within the site. A small number of drainage lines, erosion gullies and rivers (tributaries to the Olifants River) and associated floodplains are traversed by the two power line alternatives.

Boreholes in the subregion are typically deep (~100 m), exhibit a substantial median depth to groundwater rest level (~60 m), and support a comparatively low median yield (~0.4 L/s). In addition, the groundwater chemistry information indicates a poor overall quality of groundwater in the subregion.

The soil patterns on the site, together with distance from the coast largely determine the vegetation patterns in the area, which is typical of these coastal vegetation types, as fire is not an ecosystem driver in these arid areas (De Villiers, *et al* 2005). The site falls within the Namaqualand coastal region of the Cape Floristic Region, and is used primarily as a sheep grazing area, although there are old strip cultivation areas on about 600ha, which have not been cultivated for at least 12 years.

Two distinct vegetation types occur in the area, and where they meet a highly complex mosaic of both may be found (refer to Figure 6.8). Namaqualand Strandveld (Succulent Karoo biome) occupies the coastal parts of the site, is an extremely widespread vegetation type along the west coast, and is regarded as a Least Threatened vegetation type in terms of the NSBA (Rouget *et al*, 2004), with over 90% still intact, but with 0% formally conserved. At least two Red Data Book listed plant species occur in this area, in low numbers. Namaqualand Sand Fynbos (Fynbos biome) is found in the interior and lower parts of the site on a series of stabilised dunes and interdune slacks. Soils in this area are less alkaline, and about 60% of the species are the same as those found in the Strandveld. This vegetation type is also listed as Least Threatened in the NSBA, with 98% remaining, and a conservation target of 29% (1% currently conserved). At least one Red Data Book listed species was found in this area, in significant numbers, and the habitat is regarded as more sensitive than the Dune Strandveld area from an erosion and regional botanical point of view.

Sparsely vegetated clay areas are present, mainly in the south-eastern part of the site and on a hill at the western edge of the strip ploughed area (refer to Figure 6.8). These areas support a distinct plant community known as Short Strandveld vegetation that is not represented elsewhere on site (but which is very common in the Hardeveld to the north-east).

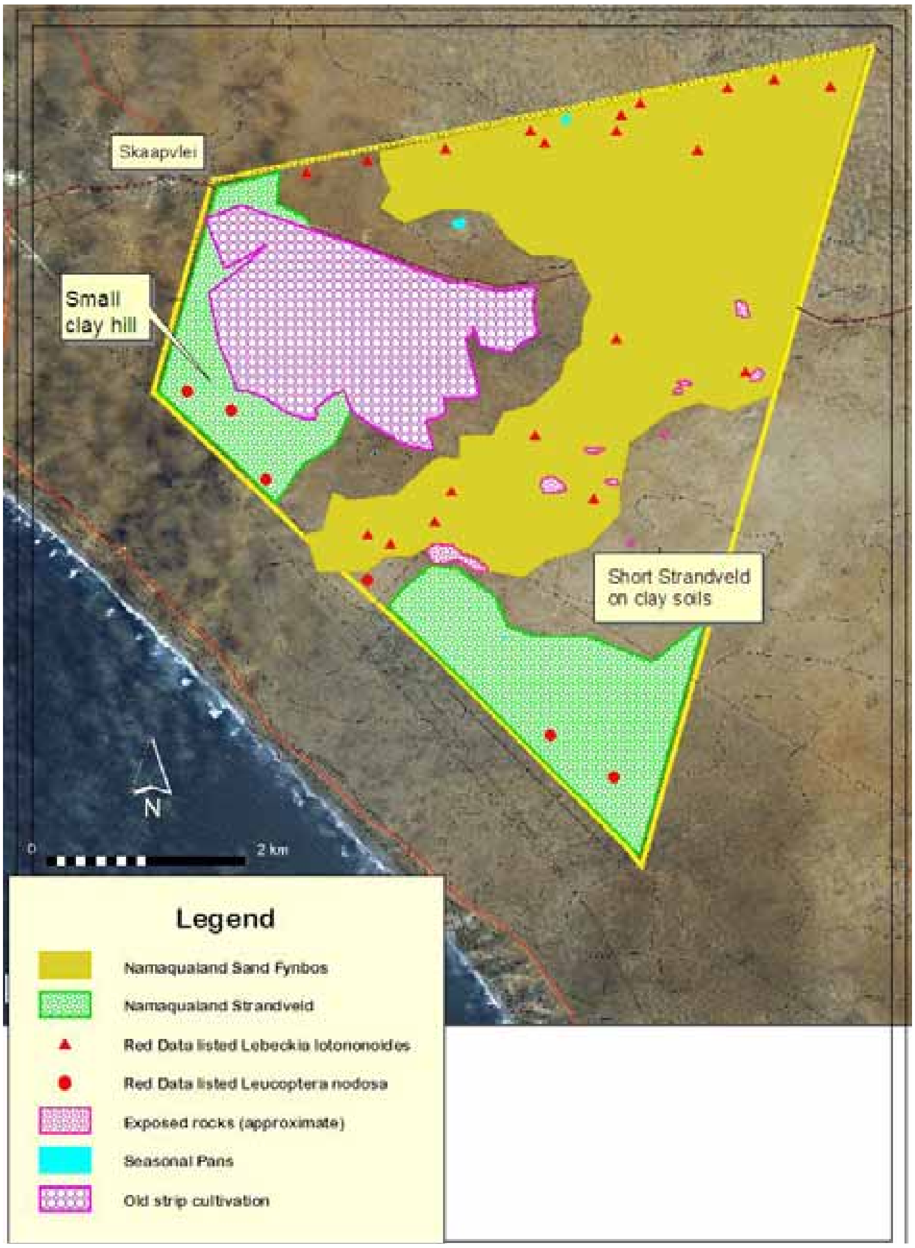


Figure 6.8: Satellite image of study area, showing key ecological & botanical features recorded. Unhatched areas within site are transitional mosaic areas with a mix of both Namaqualand Strandveld and Sand Fynbos. Red Data species locations are approximate only.

Several potentially sensitive plant species were recorded on the site within the various vegetation types:

» *Leucoptera nodosa*, a rare succulent shrub in the daisy family, was recorded in the western areas of the site. This species has recently been Red Data Book listed as Vulnerable. The species seems to occur on the site as scattered individual plants (refer to Figure 6.8), and is never common. The population on site could comprise up to 5% of the total population within a distance of 20 km of the site.
» *Hermannia* sp. *nov*. is possibly an undescribed (i.e. a "new" species) shrub recorded to be quite common on the proposed site. This 1 m tall, attractive shrub is widespread in the Namaqualand Strandveld from the Olifants River north to the Groen River, and is not threatened.
» *Lebeckia lotononoides* is a poorly known species that seems to be restricted to the Namaqualand Sand Fynbos. The sprawling species was recorded as being common on the proposed site (refer to Figure 6.9), mainly in the Sand Fynbos areas, but also in the ecotones. It is not currently Red Data listed, but is likely to be listed as Near Threatened in the forthcoming revision as some of its range is being impacted by mineral sand mining.
» The vygie *Vanzijlia annulata* is restricted to the coastal area from Doringbaai to the Groen River, but is not yet Red Data listed and is fairly common in many areas, including the proposed development site.
» *Ferraria foliosa* is a fairly wide ranging coastal endemic known from the area, and a few plants of a not yet flowering *Ferraria* were recorded on the proposed site, which are likely to be this species. This species is currently Red Data listed as Rare, but is due to be downlisted to Least Threatened.

There is a moderate possibility of other rare or localised plant species such as *Lebeckia lotononoides*, *Eriospermum arenosum*, *Babiana grandiflora* and *B. brachystachys* occurring on site. The Red Data Listed proteoid *Leucospermum rodolentum* is not present.

The sparsely vegetated clay areas support a distinct plant community that is not represented elsewhere on site, with species such as *Cephalophyllum* sp., *Drosanthemum* sp. (bead leaf vygie), *Salsola* sp. (gannabos), *Trachyandra involucrata*, *Bulbine praemorsa*, *Leipoldtia schultzei*, *Monilaria* sp., and *Psilocaulon junceum* (asbos). It is possible that some of these succulents could be regarded as threatened, or that rare geophytes are present in these patches.

The vegetation of the area is protected in terms of the Cape Nature and Environmental Conservation Ordinance (No 19 of 1974). This however provides little protection for the flora because the area is currently zoned for agriculture.

Portion 620 of the farm Olifants River Settlement seems to have been significantly more heavily grazed than the other areas on the proposed site. An estimated 600 ha on the farm Gravewaterkop 158 has been previously cultivated using strip cultivation, having been planted with winter cereals. Significant natural rehabilitation has occurred in the strips since they were last cultivated approximately 12 years ago. The cultivated areas occur primarily on the Fynbos / Strandveld ecotone, although the unploughed strips indicate that the primary vegetation type is Strandveld. It is evident that both the ploughed and unploughed strips have been quite heavily grazed over many years, as a number of the more sensitive species have disappeared, and diversity is significantly lower here than in the nearby Strandveld areas where no strips are located.

Vegetation types crossed by the proposed power line alternatives include Namaqualand Strandveld, Namaqualand Sand Fynbos, Namaqualand Riviere, Namaqualand Spinescent Grassland, Vanrhynsdorp Gannabosveld and a small portion of Knersvlakte Quartz Vygieveld. Of these, the only potentially sensitive vegetation type in terms of the NSBA analysis (Rouget *et al* 2004) is the Knersvlakte Quartz Vygieveld. Namaqualand Strandveld, Namaqualand Sand Fynbos, Namaqualand Riviere, Namaqualand Spinescent Grassland are not considered to be a threatened ecosystem, and all have large untransformed portions within the Knersvlakte or on the Namaqualand coastal plain.

The Knersvlakte Quartz Vygieveld crossed by the proposed power line Alternative 1 contains significant patches of vegetation consider to be of very high sensitivity. Typical white quartzite pebble patches are the main feature of importance, although there also some unusual outcrops of virtually black rock. The quartz patches support a very high density of rare, threatened and localised plant species, most of which are bulbs and dwarf succulents. From a distance the areas may look totally devoid of plant life, but actually this is a high diversity habitat, and one that it very sensitive to any form of disturbance at all, as the dwarf succulents are easily crushed. This habitat type is one of the two most important habitats with the Knersvlakte Biosphere Reserve, and supports well over 50% of the 225 or so Knersvlakte endemic plant species.

Seven areas of small (< 1 ha in extent) non-perennial pans occur on the proposed development site. The largest of the identified pans is located north of the Skaapvlei road. The pans occur in a matrix of sandy soils, but are formed where the underlying clays come to the surface. The pans on this site do not appear to support any significantly different natural vegetation, which may be partly a result of disturbance in the form of heavy grazing. However, they have high ecological value, as the only natural open water sources in the area. These pans usually contain water for limited periods, typically during winter and spring, and may support numerous invertebrates, which attract wading birds such as spoonbills, ducks, etc. Many other birds visit the pans when they contain water, but they are usually too saline for frogs.

Natural wildlife is common on the site, but species diversity is low – small and medium bovids (springbok, steenbok and duiker), small carnivores (meerkat and aardwolf) along with numerous rodents, birds and reptiles were observed during the course of this study. The presence of faunal species is dictated by the habitats present on and adjacent to the development site, and includes Strandveld, Sand Fynbos, permanent, seasonal and ephemeral pans, cultivated lands (including the old cultivated areas located on the farm Skaapvlei, and farmhouses, outbuildings and other rural infrastructure), and alien trees (mostly eucalypts and acacias in the areas crossed by both of the proposed routes for the power line running to the east of the proposed development site).

- » There is no known presence of any rare or threatened species of insect on the proposed development site.
- » Of the 16 frog species occurring in the broader study area, only the Namaqua Rain Frog (*Breviceps namaquensis*) and the Namaqua Caco (*Cacosternum namaquense*) potentially occur on the study site. The Karoo Toad (*Bufo gariepensis*) may be present further inland and therefore may occur in the area affected by the proposed power line. The Namaqua Rain Frog breeds terrestrially (i.e. there is no larval stage and no water body is required for breeding). The Namaqua Caco, on the other hand, needs at least a temporary water body for breeding. None of the three species potentially occurring in the study area are classified as Red Data species (Minter *et al*., 2004).
- » Nine of the possible 44 reptile species are listed as Red Data species, three being classified as Vulnerable (i.e. Lomi's Blind Legless Skink, Armadillo Girdled Lizard and the Namaqua Dwarf Adder), two are classified as Lower Risk (i.e. the Large-scaled Girdled Lizard and the Namaqua Plated Lizard) and four are listed as Data Deficient (i.e. Cuvier's Blind Legless Skink, Austen's Thick-toed Gecko, the Rough Thick-toed Gecko, and the Speckled Padloper tortoise).
- » An approximate 35 mammal species are anticipated to be present on the site, and inclued six insectivores, four bats, two hare/rabbit species, 10 rodents, one felid, three canids, one mustelid, five viverrids, the dassie, and two antelope species. Only two of the 11 Red Data species occurring in the broader study area, may be present in the study area, namely Grant's Golden Mole and the Namaqua Dune Mole-rat.
- » At least four bat species are expected to frequent the study area (refer to Appendix H), none of which are of conservation importance.
- » As many as 257 bird species could potentially be supported by the variety of avian microhabitats within the study area. Of these, 24 species are Red-listed, 66 species are regional endemics or near-endemics, and eight species

are Red-listed endemics (Barnes 2000, Hockey et al. 2005), of which two – Ludwig's Bustard and Black Harrier - are likely to occur regularly within the immediate footprint area of the wind energy facility.

» A total of 18 Red Data bird species were recorded across the study area, 6 of which are classified as Vulnerable and 12 as Near-threatened (details are provided in Appendix I).
» Bird species of conservation priority considered likely to occur in significant numbers within the area of the proposed wind energy facility site include Cape Spurfowl, South African Shelduck, Ludwig's Bustard, Southern Black Korhaan, Karoo Korhaan, Curlew Sandpiper, African Black Oystercatcher, Grey Plover, Common Ringed Plover, Chestnut-banded Plover, Caspian Tern, Swift Tern, African Marsh-Harrier, Black Harrier, Martial Eagle, Secretarybird, Lesser Kestrel, Lanner Falcon, Peregrine Falcon, White-breasted Cormorant, Cape Gannet, Crowned Cormorant, Bank Cormorant, Cape Cormorant, Greater Flamingo, Lesser Flamingo, Great White Pelican, Cape Bulbul, Layard's Tit-Babbler, Namaqua Warbler, Cape Clapper Lark, Karoo Lark, Cape Long-billed Lark, Sickle-winged Chat, and Black-headed Canary.

6.4.2. Social Profile

The study site and surrounds are sparsely populated. Human-made environment is limited to occasional wind pumps, fenced stock camps and off-road tracks which are only accessible with a four wheel drive vehicle. Much of the landscape, even within the site is undeveloped, being devoid of paths or tracks and is only accessible on foot. Ambient noise levels recorded in this area are considered to be equal to the acceptable day- and night-time noise rating levels for a rural residential district.

The closest farm homesteads or residences that might potentially be impacted upon by the proposed wind energy facility are located at Skaapvlei, Skilpadvlei and Nooitgedag (refer to Figure 6.9).

» The current operation on the farm Skaapvlei is comprised of a core flock of approximately 650 sheep. The average carrying capacity of Skaapvlei has been formally assessed at 7 ha/1 Standard Stock Unit (SSU) (Hansie Visser, pers. comm). One permanent labourer is associated with the operation. Two farmhouses are associated with Skaapvlei, with only one of the farmhouses permanently occupied. The second house is used as a second home utilised by the landowners. Two families currently reside on the property, one of which is the permanent worker on Skaapvlei. A number of outbuildings – including storage facilities for fodder – are also associated with Skaapvlei Farm.
» Skilpadvlei is currently utilised for grazing for approximately 500 sheep. The estimated average carrying capacity is 4 ha/1 SSU in good rainfall years, and

7 ha/1 SSU in dry years. One permanent labourer is associated with operations on Skilpadvlei. One farmhouse and a number of outside buildings are located on Skilpadvlei. One of the buildings is permanently occupied by the labourer and his family.

Figure 6.9: Locality map indicating the proposed wind energy facility site and proposed power line alternatives in relation to farm homesteads or residences and places of interest

» Nooitgedag and associated irrigation area smallholdings is currently utilised for sheep grazing. The property is currently being leased to Mr Samuel Agenbach. However, the landowner has indicated that he intends to develop the property for wilderness based tourism purposes in the future. Current activities include farming with a core flock of 600 sheep. The estimated average carrying capacity is 9 ha/1 SSU. Drought fodder for Nooitgedag is sourced from the irrigation area smallholdings. One farmhouse is located on Nooitgedag, but is currently unoccupied. Currently, one permanent and tenured farm worker is associated with Nooitgedag.

Skaapvlei road is a proclaimed public road (DR2225), and is approximately 24 km in length. The entire road is a gravel road and in many areas crosses unstable sandy areas. The local road users have indicated that erosion on the road surface is common and problematic, and that road maintenance is difficult. As a result the road only remains in good riding condition for a short period after it has undergone route maintenance. For the remainder of the time the road is in a poor condition, which is exacerbated by the use of the road by heavy vehicles associated with the current mining operations in the area.

A number of smallholdings near Koekenaap currently gain access from the Skaapvlei road. In addition, the road provides sole road access to five active farming operations. These are (from Koekenaap in the east to Skaapvley Hills in the west):

» Kommandokraal Farm (Mr De Klerk)
» Skilpadvlei (Mr De Waal)
» Skaapvlei (Mr Hansie and Hennie Visser)
» Elsie Erasmus Kloof (Mr Frits Visser)
» Geelwal Karoo (Mr Willem Agenbach).

Two permanently inhabited houses are located adjacent to the road on Kommandokraal, and one on Skaapvlei. In addition, a further two farm houses currently utilised as second homes, are located adjacent to the road on Skaapvlei and Elsie Erasmus Kloof, respectively. The Trans Hex housing node on Skaapvley Hills is located at the western terminus of the Skaapvlei road. The road provides sole road access to sixteen associated households.

Due to the relative inaccessibility of the area, most of the associated tourism use is on an ad hoc 'self-drive' basis. A 4x4 vehicle is generally required in order to make use of the available road infrastructure along the coast, and until recently access control exercised by TransHex prevented members of the general public from accessing the land south of Skaapvlei. The absence of ablution facilities and potable water infrastructure also acts as a deterrent. Very few tour operators currently make use of the area. The most notable exception is Mr. Wynand Wiggens, a local farmer and tour operator who has developed the Swart Tobie hiking trail. The trail is 92 km long, and stretches from Brand se Baai in the north to the Olifants river estuary in the south.

Colonial period heritage is extremely scarce in the study area and surrounding vicinity. There are no built structures close to, or within the study area apart from the provincial road, off-road tracks, stock drinking troughs, grazing camps and wind pump reservoirs. The nearest built settlement to the site is the Skaapvlei farm (just to the north of the site) and the Transhex mining camp a number of kilometres to the south of the site. Neither of these places can be considered to be significant heritage resources, although buildings and family graves at the Skaapvlei farm (not on the proposed development site) may be more than 60 years old.

Within the study area, the general patterning of pre-colonial occupation is very much in keeping with what would be expected in an arid area. Some 65 observations of archaeological material were recorded during the course of the study (refer to Appendix L). Many of these are ephemeral scatters which would not be impacted by the proposed development. The inland areas of the landscape are almost devoid of surface archaeological material, however ephemeral occurrences of mostly Middle Stone Age (MSA) material were noted associated with low ferricrete rafts, particularly in the central eastern part of the area. Almost every blowout/deflation that was inspected showed evidence of pre-colonial Late Stone Age occupation. These sites are generally ephemeral typically consisting of no more than 20-60 fragments of flaked quartz or silcrete with very little shell or bone.

A concentration of small shell middens was recorded at each of two dried springs that were once waterholes with potable water (Figure 6.10). The contents of the sites are varied – many are ephemeral limpet dominated shell scatters (Figure 6.11) that are visible in what was more recently ploughed land. These middens probably represent short duration camps. At least 3 of the sites are dense middens (even though they are some 3 km from the coast) and included fragments of animal bone. Stone artefacts are present on all sites. The raw materials used are wide ranging – notably quartz, crystal quartz, very high quality silcrete, hornfels, quartzite as well as cryptocrystalline silicates. The assemblages tend to be informal despite the high grades of raw material available. Ceramics are present on many of the waterhole-associated sites indicating that part of the occupation span took place within the last 2 000 years.

The value of the waterhole related sites is that they represent two complete systems of occupation which are of scientific value in terms of their potential to provide information about the cultural affinities of the people who lived there, and the time depth of their occupancy of the area.

Figure 6.10: A water hole which was the focus of settlement

Figure 6.11: One of the denser LSA middens found on the development site

The inspection of local existing borrow pits has revealed that the stratigraphy of surface sediments throughout the study area is similar. Typically the surface consists of red-yellow aeolian sands deposited over compacted and cemented sand, in places enriched by the presence of heavy minerals. The interface is commonly known as the Doorbank horizon – a hard crust of cemented material that is quite resistant to mechanical intrusion. Middle Stone Age material was noted eroding out of the interface between the recent sands and the underlying harder layers. The implication of this is that (as has been noted throughout the region) there is a generalised scatter of Early and Middle Stone age material dispersed throughout the study area on the Doorbank horizon where it has become conflated and concentrated by natural processes over thousands of years. Ephemeral occurrences of Middle Stone Age artefacts were noted within the study area associated with low outcrops of ferricrete, however none of these are considered significant. Many of these artefacts are probably in secondary context as it was noted that the outcrops had attracted burrow-digging animals. The material was probably unearthed from the hardpan crust (Pleistocene Doorbank horizon) that underlies the surface sands throughout the region.

Fossil bone-rich archaeological sites have been noted close to the shoreline near Cliff Point and at Brand Se Baai. Sites such as these are rare and considered to be extremely valuable heritage resources. There is a possibility that fossil-rich Pleistocene deposits do exist in the study area in the aeolian sand body lying above the Doorbank horizon, possibly in the part of the site which is situated back from the summit of the coastal ridge.

ASSESSMENT OF IMPACTS: PROPOSED WIND ENERGY FACILITY CHAPTER 7

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

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

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

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed site for the development of a wind energy facility, and to make recommendations for the management of these impacts for inclusion in the draft Environmental Management Plan (refer to Appendix S).

7.1. Methodology for the Assessment of Potential Impacts associated with the proposed Wind Energy Facility

In order to assess the impacts associated with the proposed wind energy facility, it was necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 37 km^2 was originally considered for the facility, with the anticipation that an area of ~25 km^2 would be required for the placement of the required infrastructure within this broader site. From the results of the facility layout determination exercise, it is now apparent that the effective area required to accommodate the infrastructure is in fact approximately 15.6 km^2 in extent. This amounts to approximately 42% of the total 37 km^2 site earmarked for development, and is illustrated in Figure 7.1 below.

Figure 7.1: Illustration of the wind energy facility layout and the effective area required to accommodate the bulk of the associated infrastructure.

The bulk of this effective area required for the wind energy facility footprint would not suffer any level of disturbance as a result of the required activities on site. Permanently affected areas comprise 100 turbine footprints (100 foundation areas of 15 m x 15 m in extent), access roads (6 m in width), a substation footprint (80 m x 80 m in extent) and a visitor's centre (~1 000 m^2 under roof and parking). The area of permanent disturbance is as follows:

Facility component - permanent	**Approximate area/extent (in m²)**
100 turbine footprints (each 15 m x 15 m)	40 000
Permanent access roads (excluding Skaapvlei road which is an existing permanent feature bisecting the site) and power line footprints (parallel to permanent access road)	210 000
Substation footprint (80 m x 80 m)	6 400
Visitor's centre building and parking areas	1 000
TOTAL	**257 400** (of a total area of 37 001 985) = 0.7% of site

Temporarily affected areas comprise laydown areas for turbines (each laydown area with a footprint of 40 m x 40 m) as well as a track of an additional 8 m in width for the crawler crane to move across the site (i.e. an additional 8 m width to the permanent road of 6 m in width). The 33 kV cabling to connect the turbines to the substation is to make use of the disturbed area travelled over by the crane. An approximately 1 m wide trench would be excavated, the cabling laid and the area rehabilitated. The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m²)**
100 turbine laydown areas	160 000
Temporary crane travel track (8m) adjacent to permanent access road PLUS trench for 33 kV cabling	280 000
TOTAL	**440 000** (of a total area of 37 001 985) = 1,2% of site

Therefore, a total area of 697 400 m^2 (i.e. almost 70 ha) can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to **less than 2%** of the total 3 700 ha area which will form part of the total wind energy facility site.

In order to assess the areas where impacts could occur on the site, a site layout optimisation exercise revealed the best possible positions for the turbines, substation and other infrastructure from a technical perspective. It was proposed that the 100 turbines are constructed in four rows (marked as rows A-D) which lie parallel and equidistant to one another. In order to accommodate some element of flexibility for the actual physical placement of the turbine on the ground (e.g. in order to avoid or mitigate an area of environmental sensitivity), the "turbine rows" were considered as "corridors" of disturbance. Each "corridor" would contain the turbines within the row together with other associated infrastructure such as the access road, laydown areas, cabling trench etc. There are, therefore, four "corridors" of disturbance across the site which were considered in detail through the specialist studies. These corridors were the focus of the studies, and in instances where ground-truthing was required, the corridors were investigated in more detail than the areas in between the corridors.

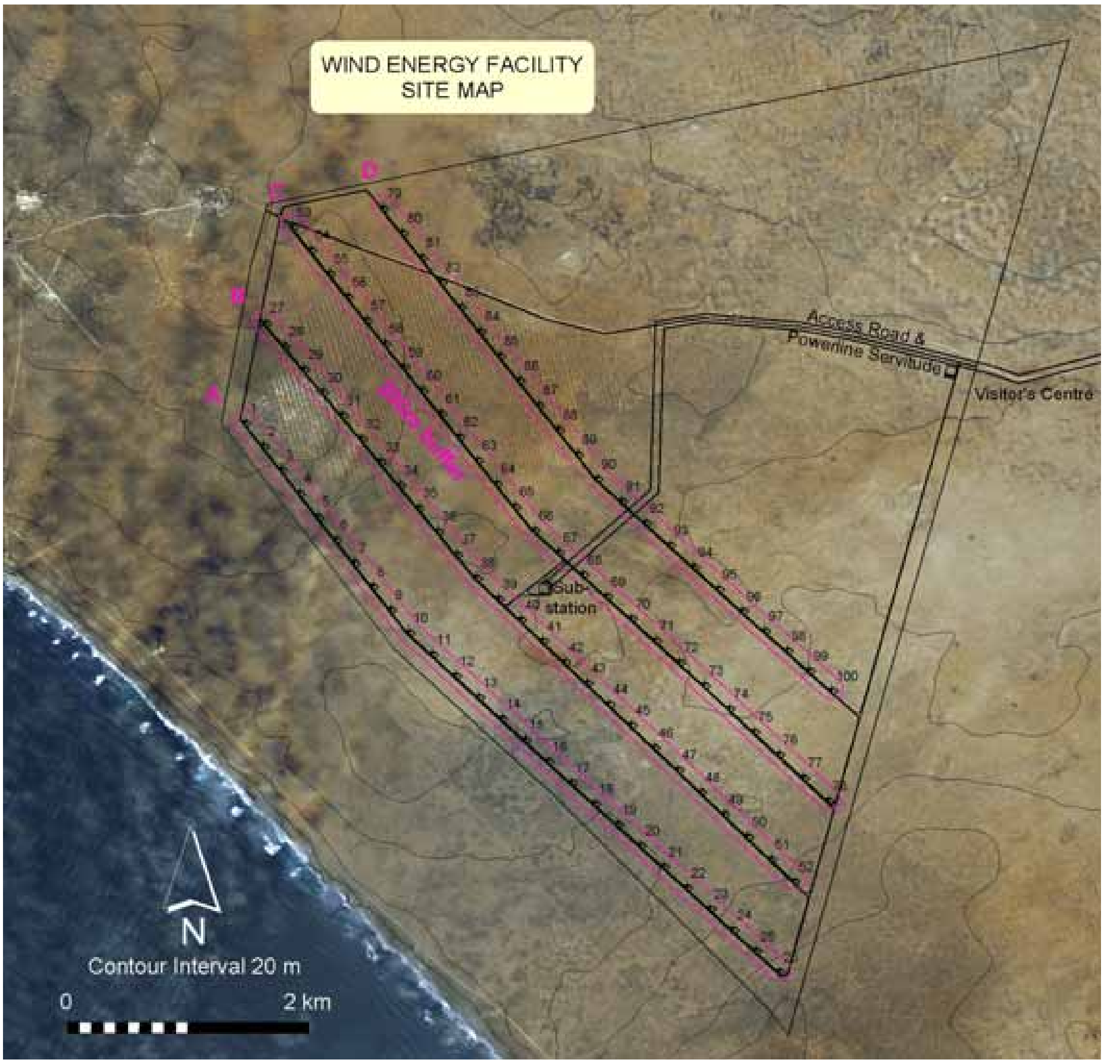


Figure 7.2: Illustration of the wind energy facility layout and the 200 m wide impact corridors identified for investigation.

For those specialists who were required to consider each turbine position as a separate/discrete "unit", the turbine positions provided were used as being 90% accurate.

A fifth disturbance corridor (not illustrated on the plan) also 200 m in width and equidistant from Row D was also investigated by those specialist investigations. This fifth corridor would effectively accommodate any turbines within rows A to D which cannot be constructed on its specific earmarked site due to an environmental constraint – that is, this turbine could then be replaced by a turbine in row E to keep the number at approximately 100 turbines. The fifth row would be considered as "spare" positions only, and because of the distance from the ocean would not be considered as optimally placed turbines.

The substation was placed in a central position between Rows B and C in order to facilitate reducing the length of the longest cable required. This was also considered practical as the facility will be built in the 2 phases, and one substation will therefore be able to service Phase 1 and Phase 2.

Therefore, to summarise, the assessment considered the facility as 100 turbine positions plus related infrastructure as "impact corridors" (Rows A-D plus E), plus the substation site and access road. The "impact corridor" considered was 200 m wide and would accommodate the turbine footprints, laydown areas and internal access roads and underground cabling.

7.2. Assessment of Potential Impacts associated with the Construction and Operation of the Proposed Wind Energy Facility on the Identified Site on the West Coast

The sections which follow provide a summary of the findings of the assessment undertaken for potential impacts associated with the construction and operation phases of the proposed wind energy facility on the identified site. Issues were assessed in terms of the criteria as detailed in Chapter 4 (with the scores as per the significance methodology provided in brackets). Potential direct and indirect impacts of the proposed wind energy facility are assessed, and recommendations are made regarding mitigation and management measures for potentially significant impacts.

7.2.1. Potential Impacts on Vegetation

Impacts on vegetation may be both direct and indirect, with the former occurring mostly at the construction stage and the latter mostly at the operational stage. As there are no obvious concentrations of rare species or any threatened habitats or vegetation types on site there are **no areas of regionally high or very high sensitivity**. The development footprints will not impact on any botanical "no go" habitats or areas. Overall the impact of the proposed wind energy facility on the vegetation on site is likely to have a medium local (site scale; 3 700 ha site) and low regional (southern Namaqualand coast; < 500 000 ha) impact. The primary negative impacts are direct, permanent loss of natural vegetation (30 ha to 70 ha) in development footprints, and direct, long-term loss of natural vegetation (30 ha to 70 ha) in areas that will be disturbed by heavy construction machinery, temporary dumping, etc. Most of these impacts cannot be avoided or mitigated in any significant way.

Indirect negative effects on the vegetation (disruption or change in ecological processes, shading, disturbance of wind flow, etc.) are likely to be minimal.

Impact table summarising the significance of impacts on vegetation (with and without mitigation)

Nature: Permanent loss of vegetation and habitat Direct permanent loss of vegetation in the development area (due to construction) is unlikely to amount to more than 20% (possibly no more than 15%) of the Strandveld, and 5% (possibly no more than 3%) of the Sand Fynbos on site. Approximately 25 km^2 of linear disturbance could be caused by the four turbine impact corridors and associated 6 m wide roads, and a further 20 ha of turbine bases and laydown areas, substation and visitors centre. It is estimated that less than 35 ha of vegetation will ultimately be *permanently* lost as a result of the establishment of the wind energy facility, which is less than 1% of the total 3 700 ha site.		
	Without mitigation	**With mitigation**
Extent	Local and regional (2)	Local and regional (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low – Medium (5)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium – High (60)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Not in direct building footprints (<50 ha), but possible in other disturbance areas (<80 ha), although will take many decades.	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Partially	
Nature: Long-term loss of vegetation and habitat Disturbance of the natural vegetation as a result of heavy machinery and cable excavation will occur in various areas. Disturbance will be long-term but temporary, as these areas should eventually recover to a significant degree (if natural vegetation is retained in the adjacent areas). But it could take at least 15 years (and possibly much longer if rainfall is below normal) in order to recover to a point where at least 80% of the original diversity is once again present. Certain species may not return for many additional years, due to changes in soil structure (compaction).		
	Without mitigation	**With mitigation**
Extent	Local and regional (2)	Local and regional (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Medium (5)	Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (45)**
Status (positive or	Negative	Negative

negative)		
Reversibility	Not in direct building footprints (<50 ha), but possible in other disturbance areas (<80 ha), although will take many decades.	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Partially	

Mitigation:

» In order to minimise direct impacts on the vegetation, the bulk of the infrastructure (such as the substation, construction camp and operations base) should be placed within the previously cultivated area, if possible.

» The high local sensitivity area (clay hill) at the western corner of the site should ideally not be developed, as this supports an unusual mix of species on heavier clay soils, including at least one Red Data Book listed species (*Leucoptera nodosa*). This is likely to affect the first three turbine positions (turbines 1-3). In terms of best practice, the suggested mitigation is to move the turbines which affect this area (best practice requires avoidance of impacts). Where total avoidance of the sensitive area is not feasible, a suitably qualified botanist should be contracted to position the turbines and infrastructure in this area with the least impact possible, and to plan a Search & Rescue program for any plants of concern that can be translocated.

» Search and Rescue should be undertaken by a suitably qualified botanist in order to locate any sensitive plants before development and remove them to secure areas.

» Search and Rescue of certain translocatable, selected succulents, shrubs and bulbs occurring in permanent, hard surface development footprints (i.e. all buildings, new roads, and turbine positions) should take place.

» All rescued species should be bagged (and cuttings taken where appropriate) and kept in an on-site nursery (if water can be provided; otherwise off site) and should be returned to site once all construction is completed and rehabilitation of disturbed areas is required.

» Roads should be kept to a minimum (as per draft layouts presented, with only one or two links between turbine rows) in order to limit direct vegetation loss and habitat fragmentation (indirect impact).

» Following construction, rehabilitation of all areas disturbed during the construction phase and that are not required for regular maintenance operations must be undertaken. The main areas thus requiring rehabilitation will be parts of the laydown areas next to the turbines, the crane tracks alongside the permanent 6m roads, any cable routings where these fall outside the above-mentioned areas, and disturbed areas around the planned visitor centre and substation.

» All livestock should be removed from the site in order to facilitate rehabilitation.

» Mitigation, management and rehabilitation measures as detailed in the EMP must be implemented (refer to Appendix S).

Cumulative impacts

» Regional negative impact.

» Impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Implications for Project Implementation

- As there are no obvious concentrations of rare species or any especially threatened habitats or vegetation types on site there are no areas of regionally high or very high sensitivity.
- The development footprints will not impact on any botanical "no go" habitats or areas.
- The high local sensitivity area (clay hill) at the western corner of the site should not be developed, as this supports an unusual mix of species on heavier clay soils, including at least one Red Data Book listed species (*Leucoptera nodosa*). This is likely to affect the first three turbine positions (WTG 1-3), and suggested mitigation is to move these three out of this area (best practice requires avoidance of impacts). If this is not done then a suitably qualified botanist should be contracted to position the turbines and infrastructure in this area with the least impact possible, and to plan a Search and Rescue program for any plants of concern that can be translocated.
- Search and Rescue of certain translocatable, selected succulents, shrubs and bulbs occurring in permanent, hard surface development footprints (i.e. all buildings, new roads, and turbine positions) should take place prior to construction within the entire development area.
- All livestock should be removed from the site in order to facilitate rehabilitation.

7.2.2. Potential Impacts on Terrestrial Fauna

A wide range of vertebrate species, including threatened lizard and mammal species, are expected to occur in the general area where development will take place. Of the four faunal habitats identified in the immediate area (i.e., coastal strip, coastal dunes, rock and inland Succulent Karoo vegetation), the wind energy facility will only impact on the inland Succulent Karoo habitat (Namaqualand Strandveld and Namaqualand Sand Fynbos). Due to its extent and homogenous nature, this habitat is the least sensitive of the four habitats, although at least two Red Data reptile and one Red Data mammal species may be associated with it.

Five risk sources are expected to be associated with the construction of a wind energy facility on the proposed site. These are direct mortality of animal species during construction, habitat destruction, increased road kills, the barrier effect of roads and fences, and bat collision fatality.

Impact tables summarising the significance of impacts on terrestrial fauna (with and without mitigation)

Nature: Direct mortality on terrestrial fauna during construction of the wind energy facility and associated infrastructure Those species that cannot flee from the affected areas by themselves during the construction phase of the wind energy facility could potentially suffer direct mortality. Birds, large snakes and medium-sized mammals would be able to flee from the affected areas at the start of site clearing and/or construction. Tortoises and many other reptiles, as well as amphibians and small mammals, will not be able to flee effectively, either because they are too slow or because they are predisposed to take shelter. These species could therefore suffer direct mortality due to site clearing and excavations. Several species potentially occurring in the areas to be affected, are fossorial and will also not be able to flee.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (20)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: Removal of animals from the affected areas before the start of site clearing/construction and relocating these to safe areas would only be a valid mitigation option in the case of tortoises. All other reptile and small mammal species are extremely difficult to catch and it would be a futile attempt to try and relocate them. Before site clearing, affected areas should be thoroughly searched for tortoises and meerkat colonies. Tortoises found must be released in adjacent unaffected areas. Meerkat colonies in affected areas should be dug up manually giving the animals a fair chance to escape before heavy machinery is sent in to do site clearing.		
Cumulative Impacts: » Impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.		

Nature: Loss of faunal habitats The construction of the wind energy facility, the erection of a transmission line and the upgrading of the access road will result in the loss of faunal habitat, which may impact on terrestrial fauna species.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)

Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	In many cases the impact will be irreversible	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

Instead of blanket site clearing for the erection of the wind turbines within the proposed site, the goal should be to keep as much as possible of the natural habitat within the site intact. By doing this, the significance rating of the impact could probably be lowered to *Low*.

Cumulative Impacts:

- Regional negative impacts on habitat loss and fragmentation.
- The impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Nature: Increased road kill rate

Two important impacts of the South African road system on terrestrial fauna in general are that of road kills and dispersal barriers. During the last three decades, collisions with vehicles probably overtook hunting as the leading direct human cause of vertebrate mortality on land (Forman & Alexander, 1998).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	Minor (2)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (12)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

During the construction phase, a speed limit of 80 kmph on the access road should be enforced. The access road should be cleared of tortoises in advance of heavy equipment being transported along the route in order to avoid unnecessary fatalities. Eskom will need to dedicate a resource to do this or it must be the clear responsibility of somebody on the site.

Cumulative Impacts:

- Regional negative impacts as a result of increased road infrastructure.
- Cumulative impacts as a result of increased numbers of vehicles (particularly heavy vehicles) moving in the area (other vehicles are typically associated with the mining activities, farming activities or tourism).

Nature: Barrier effect of roads and fencing

The barrier effect of roads impacts on lower vertebrates and invertebrates, which may find hard road surfaces impassable barriers. The barrier effect of roads and fencing will only impact on species in the long-term. The risk will therefore only be applicable to the operational phase of the wind energy facility.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

The effect of surface quality on the ability of small animals to cross hard surfaces is not known, but it is expected that gravel surfaces will be less daunting for them than asphalt ones.

Cumulative Impacts:

Regional negative impacts as a result of increased road infrastructure and development.

Nature: Bat collision fatalities

Bat mortality at wind energy plants has been reported world-wide (e.g., Johnson et al., 2003: Kerns & Kerlinger, 2004). Bats occurring in the area may potentially suffer mortality from the rotor blades of the turbines when these animals forage at night.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Not reversible	

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Partially	
Mitigation: Excessive lighting at the facility may attract flying insects and therefore also bats, which may lead to increased mortality. Excessive lighting at the facility should be avoided.		
Cumulative Impacts: None		

Implications for Project Implementation

» With the exception of habitat loss, the impacts on terrestrial fauna have all been rated as being of low significance. The impact of habitat loss is rated as being of medium significance.
» With the implementation of appropriate mitigation measures and the limitation of habitat destruction, all impacts on terrestrial fauna can be minimised to low significance.

7.2.3. Potential Impacts on Avifauna

The impact zone of the wind energy facility and its associated infrastructure is likely to support as many as 257 bird species, of which 24 species are Red-listed, 66 species are regional endemics or near-endemics, and eight species are Red-listed endemics (Barnes 2000, Hockey et al. 2005), of which two – Ludwig's Bustard and Black Harrier - are likely to occur regularly within the immediate footprint area of the facility site. Of the 6 avian microhabitats identified, the wetlands and pristine and degraded Strandveld and Fynbos areas support or partially support the bulk of the local avian diversity (124 and 113 species respectively), as well as most of the Red-listed and endemic species of highest conservation priority.

A shortlist of 35 priority species was selected to include the following groups of species on the following basis:

» All Red-listed species considered likely to occur in the area with some regularity, particularly including those recorded in SABAP data for the general area in at least four months of the year and with an overall average reporting rate of >5% of submitted records (Harrison et al. 1997), and/or those recorded during visits to the site.
» All fully endemic, biome- or range-restricted species (sensu Barnes 1998) considered likely to occur in the area in significant numbers, particularly including those recorded in SABAP data for the general area in at least eight months of the year and with an overall average reporting rate of >20% of

submitted records (Harrison et al. 1997), and/or those recorded in numbers during site visits.

» Those congregatory waterbird species regularly recorded in particularly high numbers at the Olifants River Estuary (Taylor et al. 1999), but not covered by the above criteria.

This exclusive suite of species is the core focus of the assessment of impacts on avifauna, and all potential impacts of the proposed wind energy facility, as well as all required mitigation, are deemed to be adequately covered by catering only for these species, as effective surrogates for the entire avian assemblage.

The proposed wind energy facility is likely to have limited negative impacts on the avifauna in the surrounding area. Impacts on avifauna associated with the proposed wind energy facility include:

» disturbance during construction, maintenance and operation
» disturbance to the presence and distribution of the resident avifauna, and on the movement patterns of birds commuting through the area as a result of the operating wind energy facility
» habitat destruction
» collision with the turbines.

The threat of collision with the turbine blades is probably the most concerning issue, but the real extent of this threat is not currently well understood within the South African context. Unlike more problematic wind energy facilities identified in other parts of the world, the proposed wind energy facility is not positioned overly close to any known avian fly-ways, and does not otherwise impose on a particularly bird-rich environment, so it is unlikely to result in significant numbers of avian casualties through collision with the turbine blades, or cause undue loss of habitat or disturbance to any locally, regionally or nationally important bird populations.

Impact tables summarising the significance of impacts on avifauna (with and without mitigation)

Nature: Habitat destruction A relatively small area of habitat for birds will be completely destroyed/lost in the construction process, and a larger quantity will be degraded or damaged by the process.		
	Without mitigation[9]	**With mitigation**
Extent	Local (1 - 2)[10]	Local (1 - 2)

[9] Dependent on species being impacted. Refer to Appendix 3 of the specialist study contained within Appendix I.

[10] Where a score of 1 being low – likely to affect a relatively small segment of a widespread population - and a score of 5 being high – likely to affect a relatively large segment of a localised population.

Duration	Permanent (5)	Permanent (5)
Magnitude	Small to low (0 – 4)	Small to low (0 – 4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low to Medium (24-44)**	**Low to Medium (24-44)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially	

Mitigation:

» Every effort should be made to minimise the development footprint and to rehabilitate the damaged vegetation to minimise the habitat losses to resident priority bird species.

» The specific sites of each of the turbines, and those allocated to the auxiliary structures of the wind energy facility, should be inspected immediately pre-construction as part of the monitoring programme to ensure that no critical avian micro-habitats are affected.

Cumulative Impacts:

» Regional negative impacts on habitat loss and fragmentation.

» The impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Nature: Disturbance

» Short-term disturbance issues arising from construction of the wind energy facility are likely to impact birds currently resident within the footprint area.

» Longer-term disturbance stemming from maintenance and operational activities at the site could occur as a result of human activity and noise around the facility.

» Disturbance to the presence and distribution of the resident avifauna, and on the movement patterns of birds commuting through the area as a result of the operating wind energy facility.

	Without mitigation[11]	**With mitigation**
Extent	Local (1 - 2)	Local (1 - 2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small to low (0 – 4)	Small to low (0 – 4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low to Medium (16-44)**	**Low to Medium (16-44)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources?	Yes	

[11] Dependent on species being impacted. Refer to Appendix 3 of the specialist study contained within Appendix I.

Can impacts be mitigated?	Partially	

Mitigation:

- In order to minimise impacts on bird species which may have active nests oin the immediate vicinity of the construction area, it may be necessary to (a) survey the construction area immediately before work commences, and (b) to work around any such nest sites located in this pre-construction survey.
- Should any important nest sites be located close to WEF in the pre-construction monitoring of the site, these should be given special consideration in the planning of all routine maintenance activities.
- The collection of quantitative information on the densities of key resident bird species in the area of the proposed wind energy facility will form a vital part of the survey and monitoring programme in order to determine potential disturbance impacts on these species.

Cumulative Impacts:

- Regional negative impacts as a result of increased development in the area.
- The impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Nature: Collision with the turbines

Collision with turbines could negatively affect a variety of collision prone species, most notably aggregations of waterfowl, flamingos, and possibly coastal seabirds, and individuals or loose flocks of Ludwig's Bustard, which might travel through the impact zone, especially when such movements occur during unfavourable weather conditions and/or at night, when visibility and control in flight are compromised. Also at risk of collision is the suite of both diurnal and nocturnal predatory birds present in the area, especially active pursuit hunters such as Peregrine Falcon and Lanner Falcon (*Falco biarmicus*), which may not account for the rotation of the turbine blades when chasing prey through the impact area of the wind energy facility.

	Without mitigation[12]	**With mitigation**[13]
Extent	Local (1 - 2)	Local (1 - 2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small to High (0 – 8)	Small to High (0 – 8)
Probability	Improbable to highly probable (2 – 4)	Improbable to probable (2 – 3)

[12] Dependent on species being impacted. Refer to Appendix 3 of the specialist study contained within Appendix I of the DEIA report.

[13] Confidence levels regarding effectiveness of mitigation for the South African context is low as little monitoring data in this regard exists.

Significance	**Low to High (12 – 60)**[14]	**Low to Moderate (12 – 45)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially, but must be informed by monitoring programme	
Mitigation: Any significant impacts of the wind energy facility on priority bird populations be detected by the monitoring scheme, required mitigation could include: » Painting the blades of selected, problem turbines. » Temporarily (at certain times and/or in certain weather conditions) or even permanently shutting down selected, problem turbines.		
Cumulative Impacts: The cumulative effects of collisions with turbines over time, especially when applied to large, long lived, slow reproducing species (many of which are collision-prone), may be of considerable conservation significance.		

Implications for Project Implementation

» The proposed wind energy facility is likely to have limited negative impacts on the avifauna in the surrounding area.
» The proposed facility is unlikely to result in significant numbers of avian casualties through collision with the turbine blades, or cause undue loss of habitat or disturbance to any locally, regionally or nationally important bird populations.
» Only one moderate-highly significant, taxon-specific impact (Ludwig's Bustard) and 25 moderately significant taxon-specific impacts have been identified to be associated with the proposed wind energy facility, all of which have effective mitigation available.
» The threat of collision with the turbine blades is probably the most concerning issue, but the real extent of this threat is not currently well understood. It is *essential* that the bird interactions which do take place with the establishment of the facility are fully documented through a long-term monitoring programme.

[14] Given (i) a current lack of quantitative data describing the nature, extent and timing of movements by priority bird species through the WEF area, and (ii) a general lack of locally-sourced information on the likely effects of commercially viable wind farms on South African avifauna, it is not possible at this stage to anticipate the possible scale and importance of this impact with confidence.

7.2.4. Potential Impacts on Geomorphology and Surface Processes

The most sensitive landscape elements for planning purposes in the study area were identified to be wetlands (e.g. pans) and drainage lines. In terms of the current wind energy facility layout, one turbine (turbine number 62) and associated access road are possibly located within 50 m of a wetland (Row C), while the access road within Row B of turbines may pass within 50 m of another wetland. However, it would appear that by shifting the turbine and access road (in the case of the former) and the access road (in the case of the latter) at least 20 m and 10 m respectively within the impact corridor, these concerns may be avoided.

Impact tables summarising the significance of impacts on geomorphology (with and without mitigation)

Nature: Impoundment of overland flows by roads

Roads constructed across slopes are likely to impound and/or divert overland flow. The nature of this impact will be dependant on *inter alia* the length of the slope above the road, its gradient, the composition of the substrate and the nature of the rainfall event.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (60)**	**Low (25)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» Use existing roads wherever possible.
» Ensure new roads have culverts placed in topographic lows.

Cumulative Impacts:

None

Nature: Increased runoff relative to the pre-disturbed state as a result of sealed surfaces (e.g. roads, roofs) Increased runoff from a sealed surface in relation to the reference state may be associated with a relative increase in sediment transport and hence erosion on a slope or within a channel.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Ensure roadside drainage ditches are sealed on steep slopes. » Ensure runoff from roofs is directed towards a rainwater tank.		
Cumulative Impacts: None		

Nature: Deposition of sediment by aeolian processes adjacent to or within infrastructure (e.g. substation or visitor's centre building) A localised decrease in wind velocity caused by an obstacle may be associated with the deposition of sediment.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (50)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Establish a drift fence or shrub barrier around susceptible structures in order to trap wind transported sediment.		

Cumulative Impacts: None

Nature: ***Accelerated aeolian sediment transport possibly leading to the development of deflation hollows*** A loss of vegetation (or other) cover will increase the susceptibility of sediments to wind erosion.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Re-vegetate areas where there has been a loss of vegetation as soon as is practically possible.		
Cumulative Impacts: None		

Nature: ***Accelerated fluvial sediment transport and hence erosion associated with overland flow*** A loss of vegetation cover may increase the susceptibility of a sediment surface to overland flow related erosion processes.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Low (25)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:
» Re-vegetate areas where there has been a loss of vegetation as soon as is practically possible.
Cumulative Impacts: None

Nature: Preferential aeolian erosion of sediment adjacent to structures and subsequent subsidence The winnowing affect associated with local flow modifications caused by structures may lead to subsidence if these structures are undercut.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Small (0)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Ensure a good indigenous vegetation cover is maintained adjacent to the concrete pad at the foot of a turbine.		
Cumulative Impacts: None		

Nature: Preferential fluvial erosion of sediment adjacent to structures and subsequent subsidence The winnowing affect associated with local flow modifications caused by structures may lead to subsidence if these structures are undercut.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Small (0)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Ensure runoff is deflected away from structures.		
Cumulative Impacts: None		

Nature: Excavation of foundations for wind turbines and other project related infrastructure (e.g. access roads, substation) Excavation of foundations for infrastructure will be associated with localised surface modification.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Do not spread displaced sediment over vegetation, but rather deposit it evenly in an area devoid or largely devoid of vegetation.		
Cumulative Impacts: None		

Nature: Sandblasting of structures leading to increased maintenance requirements Sandblasting may lead to the erosion of plaster/mortar and potentially damage painted surfaces.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low-Medium (30)**

Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Ensure a good indigenous vegetation cover is maintained adjacent to the concrete pad at the foot of a turbine.		
Cumulative Impacts: Additive impact.		

Nature: A reduction in the surface area of wetlands e.g. (pans) in the study area Construction of roads, tracks or other infrastructure in wetlands will lead to a loss of this habitat in the study area.		
	Without mitigation	**With mitigation**[15]
Extent	International (5)	-
Duration	Permanent (5)	-
Magnitude	Very high (10)	-
Probability	Very improbable (1)	-
Significance	**Low (20)**	**None**
Status (positive or negative)	Negative	-
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Avoid all pans and drainage lines and associated 50 m buffer zones, wherever possible for the siting of infrastructure, even if of a temporary nature.		
Cumulative Impacts: Regional loss of wetlands and pans.		

Implications for Project Implementation

» The majority of potential impacts on geomorphology and surface processes are rated as being of moderate significance. Impacts can be minimised through the use of existing roads, the minimisation of the development footprint and the rehabilitation of the site following construction.

[15] Assumption that mitigation will successfully avoid all wetlands and pans and their associated buffer areas, thus not requiring scoring here.

» The most sensitive landscape elements for planning purposes in the study area and within the power line corridor will be the presence of wetlands/pans. These features and associated buffer zones (viz. 50 m) should be excluded from any development footprint wherever possible.
» In terms of the current wind energy facility layout one turbine (turbine number 62) and associated access road are possibly located within 50 m of a wetland (Row C), while the access road within Row B of turbines may pass within 50 m of another wetland. These concerns may be avoided by shifting the turbine and access road (in the case of the former) and the access road (in the case of the latter) at least 20 m and 10 m respectively within the impact corridor.
» Ideally, unvegetated and poorly vegetated aeolian dunes and sediments, which represent a high erosion risk, should be avoided for the siting of infrastructure. However, as most of the area selected for the siting of the turbines is associated with such areas, the crests of dunes, which represent the most sensitive component of the landscape, should be avoided wherever possible.

7.2.5. Potential Impacts on Heritage Sites

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large-scale excavations will damage archaeological sites, as will road construction, building foundations and services.

The destruction of archaeological material is always considered to be a permanent and irreversible impact, although very often the intensity of an impact can be very low depending on the significance of the site in question.

Impact tables summarising the significance of impacts on heritage sites (with and without mitigation)

Nature: Impacts of turbine construction and related activities on Late Stone Age shell middens recorded on the site
Disturbance corridors as well as turbine construction areas and footings will potentially destroy archaeological material. Turbine Row B will directly affect an estimated 11 Late Stone Age shell middens and turbine Row C will affect a further 5 middens. The effect of the proposed activities will be the further lateral and vertical disturbance of midden material, destruction of artefactual material and bone and mixing of any preserved stratigraphy.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Moderate (3)
Probability	Probable (4)	Probable (3)
Significance	**High (62)**	**Medium-low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	None	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially	

Mitigation:

» The density of midden sites is such that options for moving the road alignments and turbine sites within the 200 m corridor are somewhat limited. Without shifting the entire turbine row (which will impact on the entire facility layout), the mitigation is to undertake sampling of sites that will be impacted by the proposed activity. Once this is done satisfactorily, a destruction permit for the affected sites will need to be applied for and obtained from Heritage Western Cape by Eskom.

» Any other sites close to the proposed activity will need to be identified and protected through flagging as no-go areas.

» It is estimated that the following sites will require sampling or protection: Cluster A Middens 42, 43, 44, 45, 46, 49, 52, 52, 55; Cluster B Middens 10, 8 9, 22.

» An archaeologist should accompany the survey team so that sites requiring sampling or flagging can be accurately identified and on-site decisions made with respect to sampling, flagging or even wind turbine position adjustment (if possible). All sampling should be done ahead of construction work.

» Eskom and the project archaeologist will need to apply for sampling permits from Heritage Western Cape for work on any archaeological sites identified as needing intervention – in other words any archaeological site that will be affected by the access road, crane track, laydown areas, turbine bases and cable trenches.

Cumulative Impacts:

Cumulative impacts are a concern in that middens were once common archaeological resources throughout the Western Cape but which have been impacted to the extent that well conserved middens are now cherished heritage resources. Intact middens are increasingly only found in either remote localities or conservation areas. While the middens that have been found in the study area are not particularly rich or dense and many have suffered some disturbance from past agriculture, it is important to be aware that each one of them has research potential and heritage value in terms of their group value – they are all components of a past settlement pattern which responded to the pressures of the natural and social environments of the times.

Nature: Impacts of turbine construction and related activities on Pleistocene archaeological material The 2 m deep excavations for each of the wind turbine bases will penetrate aeolian sands and may impact on the Doorbank horizon displacing any Middle or Early Stone Age archaeological material that may exist. This applies to all turbine bases, however greatest likelihood of a find is in Row A.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (3)	Low (2)
Probability	Probable (2)	Probable (2)
Significance	**Low (18)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially	
Mitigation: » Since the envisaged construction team is quite small, the most cost-effective mitigation would be to establish liaison with a responsible person on site who could photograph and report any finds to an archaeologist who would then arrange to mitigate/collect the find (if necessary). However this will only be successful with the full cooperation of contractors/site staff. » It would also be desirable that during the excavation phase for turbine bases, an archaeologist makes a visit to log exposed sections and check for the presence of any significant material. » If an important find is made, it may be necessary to divert plant to allow the necessary time to collect/record the find.		
Cumulative Impacts: » Regional loss of archaeological resources. » Controlling of impacts to buried archaeological material such as stone artefacts scatters on the Doorbank horizon will require the commitment of both site staff and archaeologists. However the resource is considered to be widespread and the cumulative impact is not excessive.		

Implications for Project Implementation

» In terms of historical and archaeological heritage the proposed activity is considered to be viable. Impacts are greater than initially expected, but are nevertheless controllable through with a program of archaeological sampling of Late Stone Age archaeological sites of site clusters A and B and where possible, micro adjustment of turbine and road positions (turbine numbers 29 and 30 in Row B; and turbine numbers 61 and 62 in Row C).

- » Controlling of impacts to buried archaeological material such as stone artefacts scatters on the Doorbank horizon will require the commitment of both site staff and archaeologists. However the resource is considered to be widespread and the cumulative impact is not excessive.
- » Eskom will need to apply for sampling permits from Heritage Western Cape for work on archaeological sites identified as needing intervention – i.e. any archaeological site that will be affected by the access road, crane track, laydown areas, turbine bases and cable trenches. The permit application will need to be accompanied by detailed specifications of which sites are to be sampled, how large the samples will be, and how and where the sampled material will be stored (the NHRA requires indefinite institutional storage of all archaeological remains). The turn around period for the issuing of permits is generally about 5 weeks and permits are usually valid for a period of a year but can be extended for a further 2 years if needs be. One the archaeological sampling is completed, a permit for destruction of any remaining archaeological material on any of the development sites must be obtained from Heritage Western Cape.
- » The construction of the site visitors centre, substation and access roads are unlikely to result in any impacts and therefore no further action is required other than to report un-anticipated finds.
- » Impacts to the natural cultural landscape qualities of the site are expected (refer to section 7.2.6). This may be mitigated by the fact the study area is set back from the scenic coastal escarpment (which is most frequently used by people) and the fact that the proposed wind turbines will need very little by way of support structures or staff facilities.

7.2.6. Potential Visual Impacts

Potential visual impacts associated with the construction phase

The construction phase of the wind energy facility is approximated at roughly two years (one week per turbine) should all 100 turbines be erected. This is obviously dependent on a number of external factors that may not always be controlled by either Eskom or the preferred contractors. During this time heavy vehicles will frequent the otherwise deserted roads and may cause, at the very least, a visual nuisance to other road users and land owners in the area.

Visual impacts associated with the construction phase, albeit temporary, should be managed according to the following principles:

- » Reduce the construction period through careful planning and productive implementation of resources.
- » Restrict the activities and movement of construction workers and vehicles to the immediate construction site.

» Ensure that the general appearance of construction activities, construction camps (if required) and lay-down areas are maintained by means of the timely removal of rubble and disused construction materials.
» Restrict construction activities to daylight hours (if possible) in order to negate or reduce the visual impacts associated with lighting.

Potential visual impacts associated with the operational phase

The result of the viewshed analyses for the proposed Wind Energy Facility is shown on Figure 7.3.

Figure 7.3: Potential visual exposure of the wind turbines and substation

This figure shows the core area (primary visual catchment) of potentially uninterrupted exposure of the facility as being greatly contained within the 25 km buffer zone. The majority of potentially uninterrupted exposure occurs within the 0 – 10 km zone. Visibility beyond the 25 km mark becomes scattered and broken and ultimately negligible as it nears a distance of 50 km distance. From such a distance, visibility, even on a perfectly clear day, could theoretically be possible although highly unlikely to constitute a negative visual impact. In practical terms this rationale implies that although the facility may potentially be visible (due to the flat terrain and the low visual absorption capacity of the natural vegetation) from sections of the N7 national road (50 km away), it would be difficult to distinguish the facility within the larger landscape.

The 0 – 25 km zone contains other areas and potential sensitive visual receptors (as discussed in Chapter 6) that would be exposed to the wind energy facility. Some of these include the towns of Koekenaap and Lutzville, sections of the R362 and R363 provincial roads, and other communities such as the Skaapvlei road smallholdings and Ebenezer Kolonie along the Olifants River. This zone further encompasses a number of homesteads and points of interest, as well as sections of the coastline. Visibility from the coastline would mainly be possible from the top of the cliffs and is unlikely from the beaches and rocky shore due to the sudden drop in topography (nearly 60 m) to sea level.

The substation will primarily be exposed to road users travelling along the Skaapvlei road, the Skaapvlei settlement and the Skilpadvlei homestead. It should, however, be noted that the substation will be placed centrally amongst the wind turbines and will be dwarfed by the large structures surrounding it. The wind turbines are expected to distract attention from the substation to a large degree.

Figure 7.4 provides an indication of the visual impact index associated with the wind energy facility. This is a combination of the results of the visual exposure, viewer incidence/perception and visual distance of the proposed wind energy facility (refer to Appendix M for more details). The index confirms the containment of the visual impact within a 25 km radius of the facility indicating possible exposure (beyond 25 km) to the facility at the lower end of the index. The area between 10 km and 25 km radius of the facility is predominantly low to medium with exceptions occurring at homesteads and access roads within this zone. Higher values occur along the R362 south of Lutzville and agricultural holdings and farmland adjacent to the Olifants River (including Ebenezer). These areas would, however, not have unobstructed views of the wind energy facility, as they all have their own visual clutter brought about by the land use activities and structural developments within these areas.

Figure 7.4: Visual impact index of the proposed wind energy facility

The core area of visual impact for the wind energy facility is indicated within the 10 km buffer radius of the facility. Even here, where the view of the facility is unobstructed, the majority of the zone (in terms of size) is indicated as medium on the index. This is due to the fact that this is a near vacant area, largely devoid of random observers. Exceptions occur along the secondary roads within this zone and specifically the Skaapvlei road. Other areas that appear highest on the visual impact index are specific homesteads (Skilpadvlei, Skaapvlei and Nooitgedag) and some sections of the coastline north of Gert du Toit se Baai and north of Die Toring.

The vegetation units present in the study area surrounding the wind energy facility range from 0.2 m to 2 m in height. This, coupled with the sparse distribution of the plant species and the dimensions of the facility, it was determined that the visual absorption capacity of the natural vegetation is low to negligible for virtually the entire study area.

» *The potential to mitigate visual impacts*
The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The potential for mitigation is therefore low or non-existent.

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an ongoing basis.

Impact tables summarising the significance of visual impacts (with and without mitigation)

Nature: Visual impact on users of major roads (R362, R363 and N7)		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (2)	N/A
Probability	Probable (R363 & R362)) (3) Improbable (N7) (2)	N/A
Significance	**Low (18-27)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on users of other roads (Skaapvlei road) Skaapvlei road functions as the primary connecting road between Vredendal and the coastal/mining areas.		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Very High (10)	N/A
Probability	Highly probable (4)	N/A
Significance	**High (72)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on users of other roads (secondary roads < 10km from facility)		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High (6)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (56)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on users of other roads (secondary roads > 10km from facility) The visual impact diminishes beyond the 10km and becomes medium and medium to low towards the 25km buffer radius.		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium-low (3)	N/A
Probability	Probable (3)	N/A
Significance	**Medium-low (36)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on major towns and settlements Major towns and settlements include Lutzville, Koekenaap and Papendorp.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (1)	N/A
Probability	Probable (3)	N/A
Significance	**Low (24)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines).		

» No other developments of a similar nature exist in the area.

Nature: Visual impact on agricultural areas and smallholdings (west of the Olifants River) Agricultural areas and smallholdings west of the Olifants River include the Skaapvlei road smallholdings. Visibility of the wind energy facility from these areas is highly unlikely.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium – high (6)	N/A
Probability	Probable (3)	N/A
Significance	**Medium (39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on agricultural areas and smallholdings (east of the Olifants River) Agricultural areas and smallholdings east of the river include Ebenezer). Visibility of the wind energy facility will be from a minimum distance of 10 km.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (2)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (18)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	

Mitigation: » N/A
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.

Nature: ***Visual impact on specific points of interest and individual homesteads (<10 km from facility)***

Homesteads within a 10 km radius of the facility include Skilpadvlei, Nooitgedag and Kommandokraal.

	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Very High (10)	N/A
Probability	Highly probable (4)	N/A
Significance	**High (72)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	

Mitigation:

» N/A

Cumulative Impacts:

» Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines).

» No other developments of a similar nature exist in the area.

Nature: ***Visual impact on specific points of interest and individual homesteads (> 10 km from the facility)***

Homesteads beyond 10km include Maurieskolk, Geluk, Geduld, Rooivlei, Graafwater and Baievlei.

	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High (6)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (56)**	N/A
Status (positive or negative)	Negative	N/A

Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on homesteads >10 km from the site and Rob-Eiland		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium –low (3)	N/A
Probability	Probable (3)	N/A
Significance	**Medium-low (33)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on Duiwe-gat, Die Toring, Gert du Toit se Baai		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High (7)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium - High (60)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on Brand se Baai		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (1)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (18)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on the Olifants and Klein Goerap Rivers		
	Without mitigation	**With mitigation**
Extent	Local (Olifants River) (4); Regional (Klein Goerap) (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (1)	N/A
Probability	Improbable (1)	N/A
Significance	**Low (8-10)**	N/A
Status (positive or negative)	Neutral	N/A
Reversibility	None	

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on the coastline (<10 km from the facility) Sections of the coastline that could be negatively influenced by the WEF and may experience a high to very high visual impact are situated within the 10km buffer radius from the facility. The visual impact is more likely to occur on top of the coastal cliff rather than at sea level. This is due to the sudden drop of the topography (roughly 60m) to sea level effectively blocking views to the facility from beaches and the rocky shoreline.		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	High - very high (8)	N/A
Probability	Highly probable (4)	N/A
Significance	**High (64)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on the coastline (>10 km from the facility) Sections of the coastline that could be negatively influenced by the WEF and may experience a high to very high visual impact are situated within the 10km buffer radius from the facility. The visual impact is more likely to occur on top of the coastal cliff rather than at sea level. This is due to the sudden drop of the topography (roughly 60m) to sea level effectively blocking views to the facility from beaches and the rocky shoreline.

	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium – high (6)	N/A
Probability	Probable (3)	N/A
Significance	**Medium (39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impact on nature reserves (Lutzille and Moedverloren nature reserves) Both nature reserves identified in the area are located relatively far from the proposed wind energy facility (Lutzville at ~20 km and Moedverloren beyond 25 km).		
	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (1)	N/A
Probability	Probable (3)	N/A
Significance	**Low (24)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impacts of lighting (glare) Impacts associated with security and after-hours operational lighting (flood lights and aircraft warning lights), in terms of light trespass and glare		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium (4)	N/A
Probability	Probable (3)	N/A
Significance	**Medium (36)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impacts of lighting (spill light)		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (2)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (20)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: » N/A		
Cumulative Impacts: » Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Visual impacts of lighting (sky glow)

Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow. The wind energy facility may contribute to the effect of sky glow in an otherwise dark environment.

	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Medium – low (4)	N/A
Probability	Probable (2)	N/A
Significance	**Low (22)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	

Mitigation:

» N/A

Cumulative Impacts:

» Impact ratings reflected above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines).

» No other developments of a similar nature exist in the area.

Implications for Project Implementation

» The placement of the wind energy facility and its associated infrastructure will have a visual impact on the natural scenic resources of the region. The natural and relatively unspoiled wide-open views surrounding the wind energy facility will be transformed for the entire operational lifespan (approximately 30 years) of the plant.

» The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts.

» The construction phase of the facility should be sensitive to potential observers in the vicinity of the construction site. The placement of lay-down areas and temporary construction camps should be carefully considered in order to not negatively influence the future perception of the facility.

» The facility would be visible for a large area that incorporates various sensitive visual receptors that should ideally not be exposed to industrial style structures.

- The facility has a novel and futuristic design that invokes a curiosity factor not present with other conventional power generating plants. The advantage being that the wind energy facility can become an attraction or a landmark within the region that people would actually want to come and see. As it is virtually impossible to hide the facility, the only option would be to promote it.
- A lighting engineer should be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass.
- The facility should be dismantled upon decommissioning and the site and surrounding area should be rehabilitated to its original (current) visual status.

7.2.7. Potential Noise Impacts

The land surrounding the proposed facility is primarily undeveloped, undisturbed farmland that is very sparsely populated. The closest farm homesteads or residences identified that might potentially be impacted upon by noise emanating from the wind turbines during operation are at Skaapvlei, Skilpadvlei and Nooitgedag. The distances between the proposed wind energy facility site and these residences are:

- Skaapvlei situated approximately 690 m west of the nearest turbine
- Nooitgedag situated approximately 2 816 m south east of the nearest turbine
- Skilpadvlei situated approximately 5 135 m east of the nearest turbine

Sound level contours were calculated in order to determine the potential noise impact on receivers. The resultant $L_{Req,T}$ contours are displayed in Figure 7.5. The contours are to be interpreted as the $L_{Req,T}$ at any point on the contour during meteorological conditions providing most favourable propagation of sound from the sound source to the listener.

The results of the assessment indicate that there would be no impact of outdoor noise emanating from the wind turbines at the nearest noise sensitive area, Skaapvlei, and at all other noise sensitive land. However, low-frequency noise emanating from the turbines might have a negative impact of low significance within dwellings at Skaapvlei.

On-site construction noise will not impact on any noise sensitive land other than in the vicinity of Skaapvlei. Traffic flow, particularly of heavy-duty vehicles, during construction would probably result in a noise impact on the residents of the agricultural smallholdings adjacent to the Skaapvlei Road who are situated close to the road. In order to minimise the noise of vehicular movement during the construction and operation of the facility it is recommended that the portion of the Skaapvlei road to the facility that passes these smallholdings consist of a low-noise road surface. Transportation of heavy equipment, such as the turbine nacelles, by slow moving, ultra-heavy-duty vehicles will result in a noise impact on communities along the entire route taken by the vehicles.

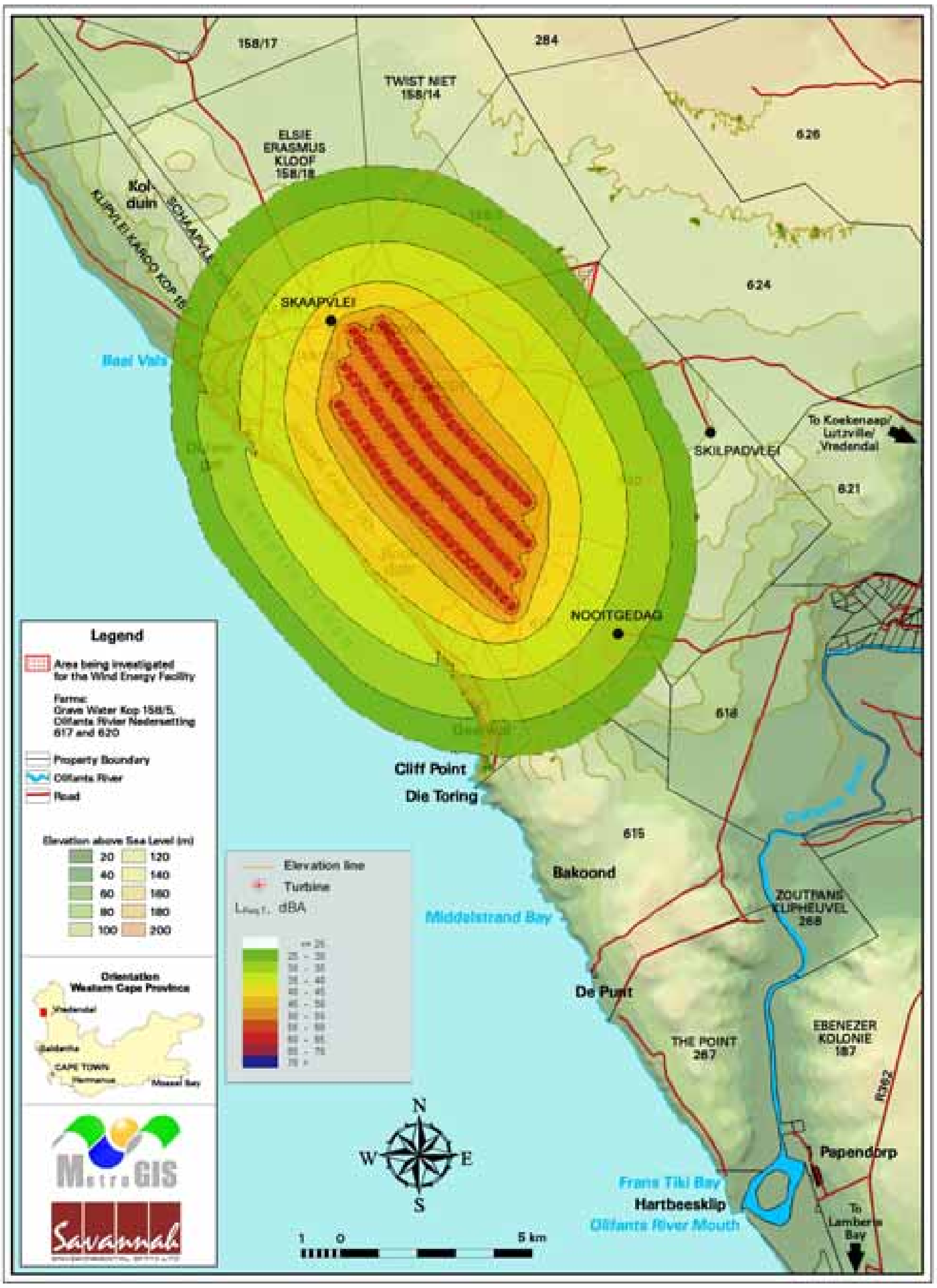


Figure 7.5: $L_{Req,T}$ contours for 100 wind turbines - maximum sound emission

Impact tables summarising the significance of noise impacts (with and without mitigation)

Nature: Noise impact on Skaapvlei residences (outdoors) The nearest noise sensitive site, Skaapvlei, lies between the 40 and 45 dBA contour lines.		
	Without mitigation	**With mitigation**
Extent	Within 1 km (1)	N/A
Duration	Long term (4)	N/A

Magnitude	No effect (0)	N/A
Probability	Very Improbable (1)	N/A
Significance	**Low (5)**	N/A
Status (positive or negative)	Neutral	N/A
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » None required.		
Cumulative Impacts: None		

Nature: Noise impact on Skaapvlei residences (low frequency sound indoors) The nearest noise sensitive site, Skaapvlei, lies between the 40 and 45 dBA contour lines.		
	Without mitigation	**With mitigation**
Extent	Within 1 km (1)	N/A
Duration	Long term (4)	N/A
Magnitude	Minor (2)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (14)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » None required.		
Cumulative Impacts: None		

Nature: Noise impact on other noise sensitive land (outdoors and low frequency indoor noise) At the other noise sensitive sites, Nooitgedag and Skilpadvlei, the $L_{Req,T}$ due to wind turbine noise would be less than 35 dBA and thus 10 dB or more below the 45 dBA expected at these sites during windy conditions.		
	Without mitigation	**With mitigation**
Extent	Beyond 1 km (1)	N/A
Duration	Long term (4)	N/A
Magnitude	No effect (0)	N/A

Probability	Very Improbable (1)	N/A
Significance	**Low (5)**	N/A
Status (positive or negative)	Neutral	N/A
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » None required.		
Cumulative Impacts: None		

Nature: Noise impacts from on-site construction activities Site and construction work (including operation of heavy earth moving equipment) on the proposed wind energy facility site could be audible at the nearest residences, particularly Skaapvlei.		
	Without mitigation	**With mitigation**
Extent	Within 1 km (1)	Within 1 km (1)
Duration	Short (2)	Short (2)
Magnitude	Low to Moderate (5)	Low to Moderate (4)
Probability	Highly probable (4)[16]	Highly probable (4)
Significance	**Medium (32)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » Determine of whether time or other constraints would need to be stipulated with regard to all construction related vehicular traffic along the Skaapvlei access road. » Monitoring of any limitations/constraints that might be imposed.		
Cumulative Impacts: None		

[16] Site and construction work at the north western part of the proposed wind energy facility site would be distinctly audible at Skaapvlei. During continuous operation of heavy earth moving equipment at that part of the site it anticipated that the daytime $L_{Req,d}$ would be exceeded by between 0 and 10 dB. Site and construction work at the south eastern part of the proposed WEF site would be barely audible at Nooitgedag above the ambient sound level on a wind still day and inaudible during the prevailing SSE wind. Site and construction work anywhere on the proposed facility site would be inaudible at Skilpadvlei and any other noise sensitive site further removed from the site.

Nature: Noise impacts from transport of components & equipment to site Noise impacts from construction and transportation vehicles to the site travelling through the towns of Vredendal and Lutzville along the R363, as well as on the smallholding community on the Skaapvlei Road.		
	Without mitigation	**With mitigation**
Extent	Nearest residential properties (1)	Nearest residential properties (1)
Duration	Short (2)	Short (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (36)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » The introduction of a low noise road surface along the section of Skaapvlei Road passing the smallholding community is recommended in order to reduce the impact.		
Cumulative Impacts: None		

Implications for Project Implementation

- » There will be no impact of outdoor noise emanating from the wind turbines at the nearest noise sensitive area, Skaapvlei, and at all other noise sensitive land.
- » Low-frequency noise emanating from the turbines might have a low negative impact of low significance within dwellings at Skaapvlei.
- » On-site construction noise would not impact on any noise sensitive land other than in the vicinity of Skaapvlei.
- » Traffic flow, particularly of heavy-duty vehicles, during construction would probably result in a noise impact on the residents of the agricultural small holdings adjacent to the Skaapvlei Road who are situated close to the road. In order to minimise the noise during vehicular movement during the construction and operation of the facility it is recommended that the portion of the Skaapvlei road to the facility that passes through these smallholdings consist of a low-noise road surface.
- » It is anticipated that transportation of heavy equipment, such as the turbine nacelles, by slow moving, ultra-heavy-duty vehicles would result in a noise impact on communities along the entire route taken by the vehicles.

7.2.8. Potential Impacts associated with Transportation, Access & Infrastructure

Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the wind energy facility and ancillary infrastructure) and works external works outside the site boundary (i.e. road reconstruction/rehabilitation (e.g. Skaapvlei Road), widening intersections, protection/accommodation of existing Eskom, Telkom and other municipal services, protection of existing road related structures etc. all within the existing road reserve).

During construction, the service road must be built to support 15 ton axle loads to support the abnormal loads delivering the nacelles, crawler crane and other components. The crawler crane when assembled has a tracked width of 11 m. Options to obtain suitable spoil material from sources such as the adjacent diamond mining concession area or from commercial sources (and transported to the site by trucks) are required to be investigated. It is assumed existing commercial quarries/mining permits have already been authorised and are available in the area. If not, an appropriate source of material (or borrow pit) will have to be located and mining rights established through the Department of Minerals and Energy (DME).

Impact tables summarising the significance of impacts associated with transportation and access (with and without mitigation)

Nature: Site access The driveway entrance area will need considerable splays in the fence line from the Skaapvlei Road and entrance to be considerably set back from the road edge to provide sufficient space for the swept path of the largest vehicle on approach to the new access gates. A 60m setback distance from the road edge is recommended. This will be a permanent feature due to the potential need to bring in replacement blades during the operational phase / life of the wind farm.		
	Without mitigation	**With mitigation**
Extent	Confined to the entrance area (1)	N/A
Duration	Permanent (5)	N/A
Magnitude	Minor (2)	N/A
Probability	Definite (5)	N/A
Significance	**Medium (40)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	No	
Irreplaceable loss of resources?	No	

Can impacts be mitigated?	N/A	
Mitigation: » All vegetation in the driveway will be cleared and replaced with an appropriate pavement structure and G4 gravel wearing course. The position of the access should be established early on in the project so that the alignment of the internal access roads can be sensitive to issues identified in other specialist studies. » The location of the driveway access has considerable scope to be adjusted to respond to local influences. The minimum area required to accommodate the turning abnormal vehicles should be taken into account. An area where the natural vegetation has already disturbed or is considerably sparse could also be selected to limit the impact on the existing environment.		
Cumulative Impacts: None.		

Nature: Service Road: Geometric Alignment A grid pattern of roads does not follow contours and may result in roads being too steep to accommodate abnormally loaded vehicles getting to the turbine sites. To achieve smooth 'flat' gradients may require significant cut and fill earthworks but this can only be quantified once the maximum longitudinal gradients have been established from the transport contractors and during the design phase. All vegetation in the service road will be cleared and replaced with an appropriate pavement structure and G4 gravel wearing course. A 14m wide surface is therefore only required between the turbines were it is intended to walk the crane between installations. Each walk would be approximately 350m.		
	Without mitigation	**With mitigation**
Extent	Confined to the internal study area (1)	N/A
Duration	Permanent (5)	N/A
Magnitude	Very high, although a small area is involved (8)	N/A
Probability	Definite (5)	N/A
Significance	**High (70)**	N/A
Status (positive or negative)	Negative, but the degree of impact can be mitigated by top-soiling and replanting the cut and fill slopes with seedlings	N/A
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » The power and ability of the transport vehicles to traverse various gradients with		

abnormal loads need to be determined prior to designing the alignment of the internal service roads.

- The crane lay down area, the operating platform and the service road area should be carefully planned and overlapped as much as practically possible.
- The lay down area is only required for the period it takes to establish and disestablish the crane. With careful programming of activities a significant portion of the lay down area could be the service road itself and or the 40m x 40m working platform area.

Cumulative Impacts:

None.

Nature: Material for Internal Road Pavement Structure

- Transporting materials from sources external to the site and mining concession areas will add direct and cumulative axle loading impacts onto the existing road network external to the site. On bituminous surfaced roads, and depending on the cause of failure, this is likely to manifest as surface failures, initially as 'crocodile cracking' of the bituminous surface followed by potholes and extensive 'crocodile cracking' in the wheel path. If the base course fails due to excessive loading, the failure is likely to manifest as longitudinal rutting in the wheel tracks of the road surface. Gravel roads will deteriorate faster, create significant dust, experience accelerated gravel loss and formation of corrugations.
- If the materials from the diamond mining tailings and commercial sources are not suitable or available, it may be necessary to identify and open new borrow pits. This requires a new mining permit/right application to DME and requires a separate EIA process.

	Without mitigation	**With mitigation**
Extent	Local (1)	N/A
Duration	Long-term to permanent (5)	N/A
Magnitude	Very low (1)	N/A
Probability	Probable (4)	N/A
Significance	**Low – Medium (30)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	

Mitigation:

- The additional construction traffic has the potential to lead to premature failure of the access roads, both surfaced and gravel, between the source and the site. The gravel roads may need regular grading to smooth out the surface, but may need to be re-gravelled after completion of the project to restore it to its former condition. It may be worth considering formalising the main local access to an asphalt surface, provided the existing pavement structure is adequate. This will require further investigation and a detailed pavement design.
- Re-using materials from old mine tailings should be investigated since the material has

already been disturbed and could be re-cycled for use in the project. The haul route will be to the west of the site and the impact on the external road network will be greatly reduced.
Cumulative Impacts: None.

Nature: Crawler Crane lay down area and Working Platform A large lay down area will be needed for the erection of the crawler crane, and would have to be compacted and levelled to accommodate the assembly crane. The assembly crane needs to access the main lifting crane from all sides and when the main lifting crane is fully assembled on the ground. The lay down area required at each crane re-establishment location will need to be approx. 20m wide x 150m long. It is assumed that the roadway being established on site could be used as part of this area. The crawler crane requires 'flat' gradients to move rigged across the site. To achieve smooth 'flat' gradients may require cut and fill earthworks. Areas of approximately 40 m x 40 m are required to be cleared, levelled and compacted at each turbine location resulting in disturbance to existing conditions. These disturbances associated with the crane are temporary in nature and can be rehabilitated post-construction.		
	Without mitigation	**With mitigation**
Extent	Confined to the internal study area but may result in extensive disturbance of the site (1)	N/A
Duration	Short-term (2-5 years) (2)[17]	N/A
Magnitude	Minor (2)	N/A
Probability	Probable (5)	N/A
Significance	**Medium (40)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » The crane lay down area, the operating platform and the service road area should be carefully planned and overlapped as much as practically possible.		
Cumulative Impacts: None.		

[17] If the lay down area is not retained for future establishment of the crane during the operational/maintenance phase.

Nature: Substation and underground power cables On the wind energy facility site, the 33 kV cables from each turbine to the substation will be buried in narrow trenches approximately 1m deep. It will be a single disturbance of the ground followed by backfill and reinstatement. It is proposed to install the wind farm substation at a central location within the facility to minimise cable lengths.		
	Without mitigation	**With mitigation**
Extent	Confined to the cable routes themselves (1)	N/A
Duration	Permanent (5)	N/A
Magnitude	Minor (2)	N/A
Probability	Probable (5)	N/A
Significance	**Medium (40)**	N/A
Status (positive or negative)	Neutral	Neutral
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » None required		
Cumulative Impacts: None.		

Nature: Transport/delivery of cement to site from off-site Concrete Batching Plant Each turbine installation requires a 15m x 15m x 2 to 3m deep concrete foundations. Whether concrete is transported from the batching plant external to the site, or the sand, stone and cement is brought to site and batched from Skaapvlei, the operation will add direct and cumulative axle loading impacts onto the existing road network. On bituminous surfaced roads, and depending on the cause of failure, this is likely to manifest as surface failures, initially as crocodile cracking of the bituminous surface followed by potholes and extensive crocodile cracking in the wheel path. If the base course fails due to excessive loading, the failure is likely to manifest as longitudinal rutting in the wheel tracks of the road surface. Gravel roads will deteriorate faster, create significant dust, experience accelerated gravel loss and formation of corrugations. A considerable quantity of water will be required in the production of the concrete, possibly an impact on available water resources.		
	Without mitigation	**With mitigation**
Extent	Local (1)[18]	N/A
Duration	Short-term (2-5 years) (2)	N/A
Magnitude	Minor (2)	N/A

[18] The additional construction traffic has the potential to lead to premature failure of the roads, both surfaced and gravel, between the source and the site.

Probability	Probable (5)	N/A
Significance	**Low (25)**	N/A
Status (positive or negative)	Neutral	Neutral
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» To mitigate the impact of construction traffic through the developed portion of Koekenaap, it is recommended that the first 800 m portion of the Skaapvlei Road (DR2225) be reconstructed to a bituminous surfaced road from the R363. By negotiation, the District Road Engineer may permit Eskom the use of material from established borrow pits in the area for the sole purpose of maintaining this road.

» This route will require constant monitoring, possibly regular watering (to reduce gravel, sand and dust losses) and periodic scraping (keep a 'smooth' riding surface) during the construction phase.

Cumulative Impacts:

None.

Nature: Impacts on Skaapvlei Road (DR2225)

The DR2225 is the un-surfaced gravel road to Skaapvlei and would be impacted upon by the abnormal wheel loads (specifically those with load limitations) and construction traffic. These vehicles will impart additional axle loading onto the existing road pavement structure. The local road users have indicated that the road surface can become very poor as the riding surface degrades under normal traffic.

	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Short-term (2-5 years) (2)	Short-term (2-5 years) (2)
Magnitude	Minor (2)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium (35)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	

Mitigation:

» DR2225 is the only un-surfaced portion of the route and a maintenance strategy will need to be submitted to the satisfaction of the Provincial Governments, District Roads Engineer (DRE).

» An economic analysis of a variety road construction/maintenance treatments should be undertaken for the Skaapvlei Road where the benefits and costs for each alternative

are analysed in terms of the "economic cost" (i.e. excluding taxes, subsidies and duties) and discounted over the expected design lives of the facilities. » A maintenance plan for the duration of the construction contract needs to be formulated for DR2225 in consultation with the District Roads Engineer (Ceres). » Eskom should investigate the extent of any upgrading required to form a durable haul route for the duration of the construction phase and leave the road in a similar (or better) condition upon completion. This upgrading could be limited to resolving existing localised problematic sections (horizontal, vertical alignment and drainage issues) and the possible re-gravelling (100-150 mm) of the route with a G4 gravel wearing course. » To mitigate the impact of construction traffic through the populated area/smallholdings on Skaapvlei road, it is recommended that the first 800 m portion of the Skaapvlei road (DR2225) be reconstructed to a bituminous surfaced road from the R363. By negotiation, the District Road Engineer may permit Eskom the use of material from established borrow pits in the area for the sole purpose of maintaining this road. » This route will require constant monitoring, possibly regular watering (to reduce gravel, sand and dust losses) and periodic scraping (keep a 'smooth' riding surface) during the construction phase.
Cumulative Impacts: » Local negative impacts as a result of increased use of and impact to road infrastructure. » Cumulative impacts as a result of increased numbers of vehicles (particularly heavy vehicles) utilising the local gravel roads (other vehicles are typically associated with the mining activities, farming activities or tourism), which could result in deterioration of the road infrastructure.

Implications for Project Implementation

» Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the wind energy facility and ancillary infrastructure) and works external works outside the site boundary (i.e. road reconstruction/rehabilitation (e.g. Skaapvlei Road), widening intersections, protection/accommodation of existing Eskom, Telkom and other municipal services, protection of existing road related structures etc.).

» Within the wind energy facility development area, the crane lay down area, the operating platform and the service road area should be carefully planned and overlapped as much as practically possible.

» The additional construction traffic has the potential to lead to premature failure of the access roads, both surfaced and gravel, between the source and the site. The gravel roads may need regular grading to smooth out the surface, but may need to be re-gravelled after completion of the project to restore it to its former condition. It may be worth considering formalising the main local access to an asphalt surface, provided the existing pavement structure is adequate. This will require further investigation and a detailed pavement design.

» A maintenance strategy will need to be submitted to the satisfaction of the Provincial Governments, District Roads Engineer (DRE) for Skaapvlei road (DR2225).
» To mitigate the impact of construction traffic through the populated area/smallholdings on Skaapvlei road, it is recommended that the first 800 m portion of the DR2225 be reconstructed to a bituminous surfaced road from the R363. By negotiation, the District Road Engineer may permit Eskom the use of material from established borrow pits in the area for the sole purpose of maintaining this road.
» Skaapvlei road (DR2225) will require constant monitoring, possibly regular watering (to reduce gravel, sand and dust losses) and periodic scraping (keep a 'smooth' riding surface) during the construction phase.
» Permits will be required for transporting all components. These permits are at the discretion of the Permit Issuing Authorities. The issue of these permits is a major consideration before addressing the physical capability of the transport companies to deliver these components.

7.2.9. Potential Impacts on Tourism Potential

Available tourism market trends indicate that the northern part of the West Coast receives between 5% and 10% of visitors to the Western Cape and that these are largely concentrated in the area to the south of the Olifants River mouth and Vredendal. There does not appear to be a marked trend of tourism growth in the area and the market size in the immediate vicinity of the study area is very limited. The area is outside of the West Coast tourism coastal development zones, which are located South of the Olifants River Mouth. The coastline in the vicinity off the proposed site has been severely damaged by mining activities. There are no significant beaches in the area and the topography is undulating with the shoreline mainly consisting of rocky outcrops and cliffs.

None of the national or regional tourism planning initiatives has identified the study area as a priority tourism development area and it is not foreseen that the proposed wind energy facility at a site west of Koekenaap will have any substantial effects on the execution of national or regional tourism frameworks. The study area is not expected to become a key tourism area within the foreseeable future. However, the construction of a major wind energy facility may well become a tourist attraction for the area, should it be accompanied by high quality interpretation facilities.

Three potential impacts on tourism as a result of the wind energy facility have been identified and assessed within the EIA, i.e.:

i) reduced tourism activity;
ii) loss of tourism related nature scenery; and

iii) tourism economic benefits of the development.

Impact tables summarising the significance of impacts associated with tourism (with and without mitigation)

Nature: Impacts on tourism activity

While the area is remote and not used as a general recreation or tourism area, some locals use sites such as Robeiland, Die Toring and Cliff Point for camping and angling purposes, mainly during peak holiday periods (Christmas/New Year Festive Period, Easter, etc.). The area is also used to a limited extent for organised hiking but this activity is very limited and occurs along the coastal zone.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Low (21)**
Status (positive or negative)	Negative	Negative
Reversibility	The impact cannot be reversed since it is caused by the visual and physical nature of the construction	
Irreplaceable loss of resources?	Very low	
Can impacts be mitigated?	Yes	

Mitigation:

» The overall experience of the broader area can potentially be enhanced through the contribution of Eskom to improvements for the area (especially if improvements have the intention to benefit the tourism-industry), largely offsetting potential negative impacts from a visual intrusion perspective. Eskom's Development Foundation is currently investigating opportunities for assisting the WCDM and the Matzikama Local Municipality in terms of realising some of the initiatives as specified in the District and Region's Integrated Development Plans.

Cumulative Impacts:

None

Nature: Impacts on the tourism-related nature and scenery

Nodes in the area of scenic and/or nature significance that could potential be impacted by the wind energy facility include:

» The Olifants River Mouth, which is currently a low-usage area but could grow in value and importance as a birding, camping and recreational tourism area. The wind energy facility location is approximately 15 km north of the Olifants River Mouth.
» The Olifants River Valley, Vredendal and surrounds, with most tourist activity concentrated in Vredendal and few visitors travelling to Lutzville and Koekenaap.

Travellers mainly visit the area for business purposes, as a touring stop-over along the N7 Route and/or to purchase wines and other fresh produce of the area. Nature and scenery are added benefits and not prime motivators for visiting the immediate surrounds of the study area. The site is 10-12 km away from the current town fringe.

	Without mitigation	**With mitigation**
Extent	Local (2)	N/A
Duration	Permanent (5)	N/A
Magnitude	Low (4)	N/A
Probability	Very improbable (1)	N/A
Significance	**Low (11)**	N/A
Status (positive or negative)	Negative	
Reversibility	The impact cannot be reversed since it is caused by the visual and physical nature of the construction	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	

Mitigation:

» N/A

Cumulative Impacts:

None, as this is the primary facility of this nature in the area.

Should the possibility of future expansion of wind energy facilities in the area become a reality, the cumulative impact of such developments would be required to be considered at that time. The coastline further to north of the proposed site, towards and beyond the Northern Cape boundary has areas which have not been impacted to a similar extent by mining activities. Any future expansion should be subject to additional tourism impact assessments and these should consider both the impacts of the specific proposals and the cumulative tourism impacts of multiple wind energy facilities along this section of coastline. Due consideration should then also be given to the possible expansion of the currently proposed facility (if authorised) as a first option in order to reduce the potential for wind energy turbines to be scattered along the coastline.

Nature: Positive impacts on the tourism economy of the area

Positive economic spin-offs for the area relate mainly to the wind energy facility becoming a tourism drawcard due to the substantial scale of the development and the general awareness global warming, the importance of renewable energy and the need for Eskom to keep up with the growing electricity demand.

	Without mitigation	**With optimisation**
Extent	Local and regional (3)	Local and regional (3)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	High (8)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Medium (42)**

Status (positive or negative)	Positive	Positive
Reversibility	The positive tourism impacts will not be reversed but it could be reduced significantly should Eskom decide not to provide a high quality interpretation facility	
Irreplaceable loss of resources?	It will add to the economic resource base of the area rather than causing losses	
Can impacts be mitigated?	Yes	
Mitigation: » Establishing a high quality interpretation facility. » Providing technical and/or financial support to the local tourism authorities for packaging the area as a tour circuit and preparing promotional materials in this regard.		
Cumulative Impacts: None		

Implications for Project Implementation

» The tourism component of the EIA focused on three potential tourism impacts of the wind energy facility, two of which are potentially negative at a local scale, namely i) reduced tourism activity and ii) loss of tourism related nature scenery; and one that could be positive at a regional scale, namely iii) tourism economic benefits of the development.
» The proposed wind energy facility could become a tourist attraction for the area, should it be accompanied by high quality interpretation facilities. Incorporating a high quality Renewable Energy Interpretation Centre as part of the overall project development is strongly recommended. Such a facility could play a positive role in highlighting Eskom's leadership role and forward thinking in the area of renewable energy generation, while at the same time leaving a tourism legacy and providing a much-needed major tourist attraction to the benefit of the area.

7.2.10. Potential Impacts on the Social Environment

The key social issues identified during the social impact assessment (SIA) can be divided into:

» Policy and planning related issues
» Local, site-specific issues

The local site-specific issues can in turn be divided into construction and operational related issues.

» *Policy and planning issues*
The review of the relevant planning and policy documents was undertaken as a part of the assessment. The findings of the review of the relevant policies and documents pertaining to the energy sector indicate that wind energy and the establishment of wind energy facilities are supported at both the national and provincial level. At a provincial level, the wind energy potential along the west coast of the Western Cape Province is recognised. The proposed Eskom wind energy facility is therefore supported by national and provincial energy policies and is located in an area that has been identified as having high wind energy potential. The fit with national and provincial policies and planning guidelines therefore supports the proposed site for the establishment of the wind energy facility.

» *Construction phase*
The key issues pertaining to the construction phase include:

* Presence of construction workers on the site, and the potential increase in stock theft, trespassing and illegal hunting.
* Impact on the natural vegetation.
* Impact on Skaapvlei Road due to heavy vehicle traffic.
* Impact on farm infrastructure.
* Creation of local employment and business opportunities.

» *Operational phase*
The key impacts identified during the operational phase include:

* Impact of the proposed wind energy facility on the current farming activities, specifically the potential loss of valuable grazing land.
* The visual impacts and the associated impact on future land uses and sense of place.
* Creation of additional tourist opportunities.
* The promotion of clean energy as an alternative energy source.

The potential impact of the proposed wind energy facility on the current farming activities, specifically the potential loss of valuable grazing land is regarded as a key issue. The visual impact and the associated impact on sense of place are also recognised as a significant impact.

Impact tables summarising the significance of impacts on the social environment (with and without mitigation)

Nature: Presence of construction workers on the site

The construction period for the first phase (50 wind turbines) is expected to last 12 months. In terms of the proposed activities small teams of between 6-15 skilled to semi-skilled workers will be deployed – sometimes more than one team of workers will be deployed on the site. However, at any given time the total number of construction workers on the site at any given time is therefore likely to be low. In addition, none of the construction workers will be housed in the nearby towns and not on the site.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (1)
Duration	Short (2)	Short (2)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status (positive or negative)	Negative	Negative (For those farmers who may be affected. It may not be possible to completely prevent potential stock losses or damage to infrastructure)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» Eskom should establish a liaison committee made up of representatives from Eskom, the contractors and adjacent landowners to devise a code of conduct for workers to address conflicts that may arise.
» Eskom should compensate farmers in full for any stock losses and or damage to farm infrastructure that can be positively linked/proven to be linked to construction workers. This should be contained in the agreement of good conduct to be signed between Eskom and the adjacent and neighbouring landowners.
» Eskom should ensure that all construction workers are appropriately informed of the consequences of stock theft, illegal hunting and trespassing on adjacent farms at the outset of the construction phase.
» Construction workers found guilty of stealing livestock, illegal hunting and or damaging farm infrastructure should be dismissed and charged.
» No open fires for cooking or heating should be allowed on the site during the construction phase.
» Fire fighting equipment should be provided on site for fighting veld fires and other fires that may develop on site.
» Fire fighting training should be provided to selected construction staff at the outset of the construction phase.

Cumulative Impacts:
None.

Nature: Impact on the natural vegetation

The impact on the natural vegetation associated with the construction phase is assessed in detail as part of the specialist vegetation study (refer to Section 7.1.1 and Appendix G). The SIA seeks to comment on the response of the local farmers to the loss of natural vegetation. In this regard the loss of natural vegetation is regarded as an emotional issue by farmers whose livelihoods are dependent upon the land.

	Without mitigation	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Medium (3)	Medium (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (27)**
Status (positive or negative)	Negative	Negative (For those farmers who may be affected. It may not be possible to completely prevent the loss of natural vegetation)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

- The mitigation measures identified in the specialist botanical study to minimise disturbances to the natural vegetation should be implemented.
- The construction area, including access roads, assembly areas etc should be clearly demarcated and fenced off during the construction phase.
- The movement of all construction related vehicles should be limited to the demarcated areas both on the site and on adjacent farms.
- Contractors that move beyond the demarcated areas should be fined and required to rehabilitate damaged areas. The issue of fines should be referred to in the Construction EMP.
- Eskom should compensate landowners for damage caused to natural vegetation during the construction phase.
- A rehabilitation programme should be implemented to rehabilitate all disturbed areas. The rehabilitation programme should be informed by the findings of the specialist botanical study.

Cumulative Impacts:

- Regional negative impact.
- Impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Nature: Impact on Skaapvlei Road (construction phase)

The major impacts on the road surface are linked to the weight of construction machinery (750 tonne main lift crawler crane) and components (the nacelle weighing approximately 83t). The option of establishing a cement bathing plant at Lutzville has also been mooted. If this is the case the transport of cement from the proposed batching plant will also impact on the road surface. Any further deterioration in the already poor quality of the road is regarded as a key issue. (Refer also to the access and transportation specialist study in Section 7.1.8 and Appendix Q)

	Without mitigation	**With mitigation**
Extent	Local and Regional (4)	Local and Regional (4)
Duration	Short (2)	Long Term (4) (if road is up-graded and or surfaced)
Magnitude	High (8) (Negative impact on system)	High (8) (Benefit to system)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (56)**	**High (64)**
Status (positive or negative)	Negative	Positive (If road is upgraded and or surfaced as part of the project)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» The findings of and recommended mitigation measures contained in the preliminary technical assessment undertaken by Eskom of the Skaapvlei road should be considered. However, it should be borne in mind that there is an expectation amongst some members of the community that the road will be tarred, and this expectation may need to be managed by Eskom.

Cumulative Impacts:

» Local negative impacts as a result of increased use of and impact to road infrastructure.
» Cumulative impacts as a result of increased numbers of vehicles (particularly heavy vehicles) utilising the local gravel roads (other vehicles are typically associated with the mining activities, farming activities or tourism), which could result in deterioration of the road infrastructure.

Nature: Impact on farm infrastructure (construction phase)

The area identified for the proposed Wind Energy Facility potentially impacts upon the farm infrastructure on all three of the potentially affected properties, namely Nooitgedacht, Skilpadvlei and Skaapvlei Farms.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short (4)	Very Short (1)

	(If damage is not repaired)	(If effective mitigation measures are implemented and or compensation is paid)
Magnitude	High (8) (if damage is not repaired)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Low (12)**
Status (positive or negative)	Negative	Neutral (If effective mitigation measures are implemented and or compensation is paid)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

- Eskom should liase with the local farmers to identify and map the location and condition of the farm infrastructure on the affected farms;
- Eskom should ensure that the location of all farm infrastructure on the affected farm is made available in map form to the contractors;
- Eskom should undertake to repair and replace any farm infrastructure damaged or destroyed as a result of the construction phase. In order to ensure that claims are legitimate it is recommended that Eskom in consultation with the affected farmers undertake an audit of farm infrastructure before the construction phase commences. The same should apply to the operational phase;
- Where critical components of the farm infrastructure will be disrupted, such as water supply, Eskom must liase with the affected farmer/s to ensure that the disruptions are minimised and agree on the timeframe for repairing the damage;
- Eskom should ensure that construction workers who are found guilty of damaging farm infrastructure are dismissed and charged.

Cumulative Impacts:

None

Nature: Creation of employment and business opportunities (construction phase)

The construction phase for phase 1 (50 turbines) is expected to last approximately 12 months. During this period the project will create a number of employment and business opportunities associated with the construction of the components of the wind turbines, the transport of the various components of the wind turbines to the site, the preparation of the site for establishment of the turbines and the actual process of establishing the wind turbines on site. In addition, employment and business opportunities will be created by the required upgrading of Skaapvlei Road and the installation of a 132 KV power line from the site to Juno Substation.

	Without mitigation	**With optimisation**
Extent	Local-Regional-National (3)	Local-Regional-National (3)
Duration	Short (2)	Short (2)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (33)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» Eskom should develop a database of local firms that qualify as potential service providers (construction companies, catering companies, waste collection companies etc) prior to the commencement of the tender process. These companies should be notified of Eskom's tender requirements, added to Eskom's database of suppliers and invited to bid for project related work.
» Where necessary, Eskom should assist local firms to fill in and submit the required tender forms.
» The local authorities, community organisations and leaders should be informed of the project and the potential job opportunities for locals.
» The employment selection process should seek to promote the employment of locals and the women wherever possible.

Cumulative Impacts:

None.

Nature: Impact on current farming activities (operational phase)

This issue relates to the potential long-term impact of the Wind Energy Facility on existing farming activities, specifically grazing available for sheep and other livestock. The loss of land to the facility may result in:

» Affected farming operations being reduced to sub-economic farming units due to reduction in size;
» Affected farming operations becoming uneconomic due to the loss of important grazing areas and or grazing rights.

In terms of the project the proposed study site currently impacts upon:

» Approximately 66 percent of the available summer grazing land on Nooitgedag Farm (leased by Mr. Agenbach);
» Approximately 25% of total area of Skilpadvlei Farm;
» Approximately 50% of the land owned by the Visser brothers (i.e. 5/158), and more than half the summer grazing area of the total land utilised by the Visser brothers.

	Without mitigation	**With mitigation**
Extent	Local (5)	Local (3)
Duration	Long term (4)	Short term (2)

		(If effective mitigation measures are implemented and or compensation is paid)
Magnitude	High to Very High (8-10)	Low-Moderate (4-6)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (68-76)**	**Low-Moderate (27-33)**
Status (positive or negative)	Negative	Neutral (If effective mitigation measures are implemented and or compensation is paid)
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

The option of granting grazing rights to the affected farmers should be considered by Eskom. However, given the long regeneration periods for disturbances to the natural vegetation it will take time for the areas disturbed by the construction activities to recover. This, combined with the low stock carrying capacity in the area (approximately 1 SSU/10 ha), will impact on the economic viability of the affected farms. However, in the absence of specialist agricultural assessment of the economic viability of the affected farms and until such time as the final footprint has been established it is not possible to comment with any degree of certainty as to how each of the affected farm owners will be affected. This issue will need to be assessed as part of Eskom's negotiation process with the affected farmers.

It is therefore recommended that an agricultural specialist be appointed once the final footprint for the proposed Wind Energy Facility has been finalised. The specialist should be involved in the negotiation process undertaken by Eskom with the affected farmers.

Cumulative Impacts:

None.

Nature: Visual impact and implications for future land uses and sense of place (operational phase)

Due to the number of wind turbines (100) and their size (80 m high towers with an additional 45 m in height added on by blades) it will impossible to screen the wind energy facility from the adjacent farms. The proposed development will therefore be highly visible. (Refer also to the visual impact assessment in Section 7.1.6 and Appendix M)

	Without mitigation	**With mitigation**
Extent	Local (5)	Local (5)
Duration	Long-term (4)	Long-term (4)
Magnitude	High to Very High (10)	High (8)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (76)**	**Moderate (51)**

Status (positive or negative)	Negative	Negative
Reversibility	No	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	No	
Mitigation: None possible		
Cumulative Impacts: » Impact ratings reflected in visual impact tables above are based on the visual impacts associated with the entire extent of the development (i.e. 100 turbines). » No other developments of a similar nature exist in the area.		

Nature: Creation of tourism opportunities (operational phase) The current tourist related activities in the area where the proposed Wind Energy Facility will be located are low. In this regard the establishment of a Wind Energy Facility does have the potential to attract additional tourists to the area. (Refer also to the tourism potential assessment in Section 7.1.9 and Appendix N)		
	Without mitigation	**With optimisation**
Extent	Local-Regional (2)	Local-Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (36)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Eskom should liaise with representatives from the Matzikama Local Authority and the local tourism sector to raise awareness of the proposed wind energy facility. » Eskom should establish a covered viewing site where passing visitors can stop and view the site. The viewing site should be equipped with information boards that provide visitors with information on the project and other relevant information, such as Eskom's policy with regard to renewable energy, South Africa's energy policy and needs, challenges associated with climate change and global warming etc. » In order to maximise the benefits of the information board to the broader community it is recommended that the information be presented in the three official languages of the Western Cape, namely English, Afrikaans and Xhosa. » A visitor centre and or information board will be established at the site. While the establishment of a visitor centre at the facility will benefit visitors to the site it is unlikely that the centre will, on its own, attract additional visitors to the area.		

Strategically located information boards linked to a viewing area located on the perimeter of the site would benefit passing visitors.
Cumulative Impacts: None.

Nature: Promotion of clean, renewable energy (operational phase)

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producer of carbon emissions in the world and Eskom, as an energy utility, has recently been identified as the world's second largest producer carbon emissions (Cape Times, 15 November 2007).

The establishment of a clean, renewable energy facility will therefore reduce, albeit minimally, South Africa's reliance on coal-generated energy and the generation of carbon emissions into the atmosphere.

	Without mitigation	**With optimisation**
Extent	Local-Regional-National (4)	Local-Regional-National (4)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Very High (10)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**High (68)**	**High (76)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

In order to maximise the benefits of the proposed project Eskom should:

» Use the project to promote and increase the contribution of renewable energy to the national energy supply;

» Maximise the public's exposure to the project via an extensive communication and advertising programme.

In addition the facility has the potential to provide power to local communities and farmers and the Matzikama region. The IDP Manager indicated that the region would benefit significantly if the facility could provide cheaper electricity to the Matzikama region (L. Phillips, pers. comm). Cheaper electricity would provide a stimulus for much-needed local agri-industrial and other development in the area as well as an attraction to outside investors.

Cumulative Impacts:

None.

Implications for Project Implementation

- Impacts on the social environment as a result of construction of the wind energy facility can all be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.
- Impacts during the operational phase relate mainly to the visual impact imposed by the facility on the local environment. The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts.
- Eskom should establish a liaison committee made up of representatives from Eskom, the contractors and adjacent landowners to devise a code of conduct for workers to address conflicts that may arise.
- The measures aimed at enhancing the employment and business opportunities and highlighting the projects contribution to clean, renewable energy should be implemented.
- The option of granting grazing rights to the affected farmers should be considered by Eskom. However, given the long regeneration periods for disturbances to the natural vegetation it will take time for the areas disturbed by the construction activities to recover. This, combined with the low stock carrying capacity in the area (approximately 1 SSU/10 ha), will impact on the economic viability of the affected farms. However, in the absence of specialist agricultural assessment of the economic viability of the affected farms and until such time as the final footprint has been established it is not possible to comment with any degree of certainty as to how each of the affected farm owners will be affected. This issue will need to be assessed as part of Eskom's negotiation process with the affected farmers. It is recommended that an agricultural specialist be appointed once the final footprint for the proposed Wind Energy Facility has been finalised. The specialist should be involved in the negotiation process undertaken by Eskom with the affected farmers.

7.2.11. Summary of Impacts

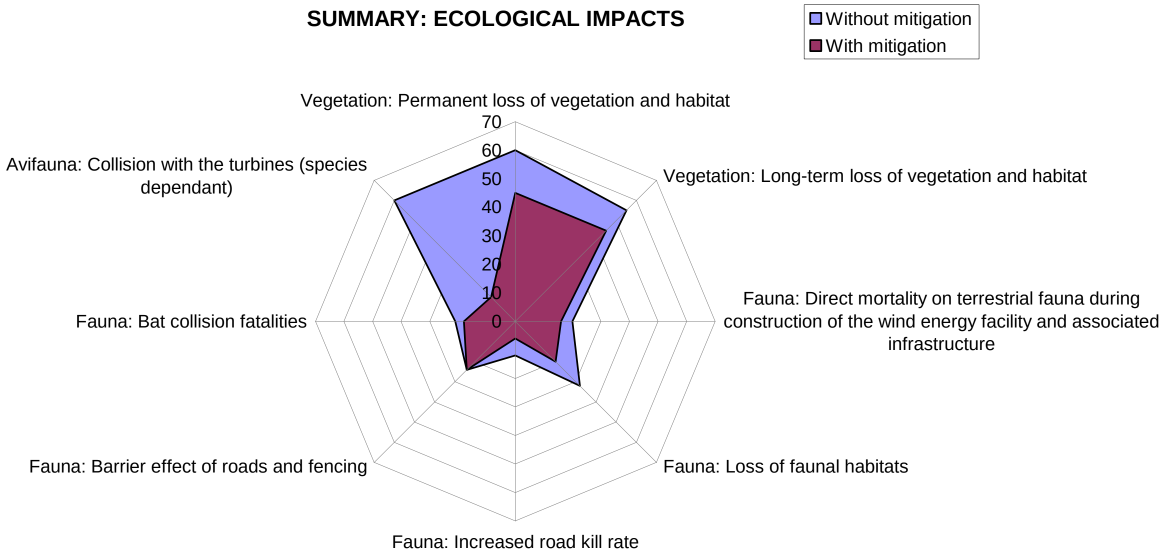
As a summary of the potential impacts identified and assessed through the EIA process, the following provide a diagrammatic representation of the significance ratings for the potential ecological, visual and social impacts.

As indicated in Chapter 4, the significance weightings for potential impact have been rated as follows:

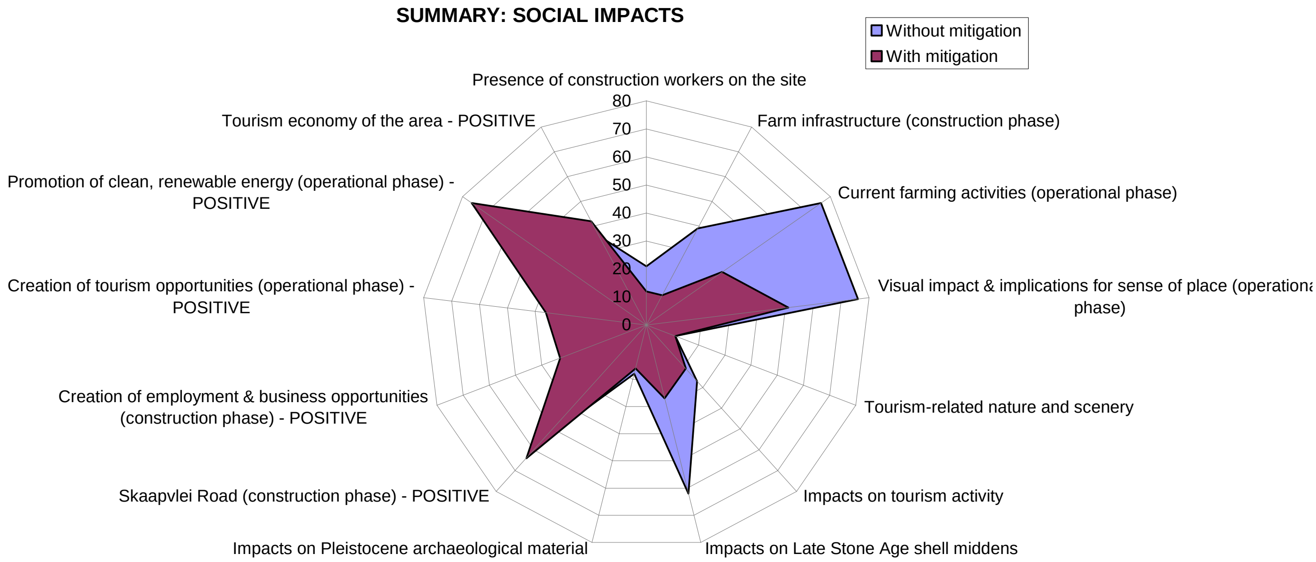
- **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)

» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

These ratings are illustrated on the axis of the graph. Impact ratings without mitigation are indicated in blue, and impact ratings with mitigation are indicated in purple.

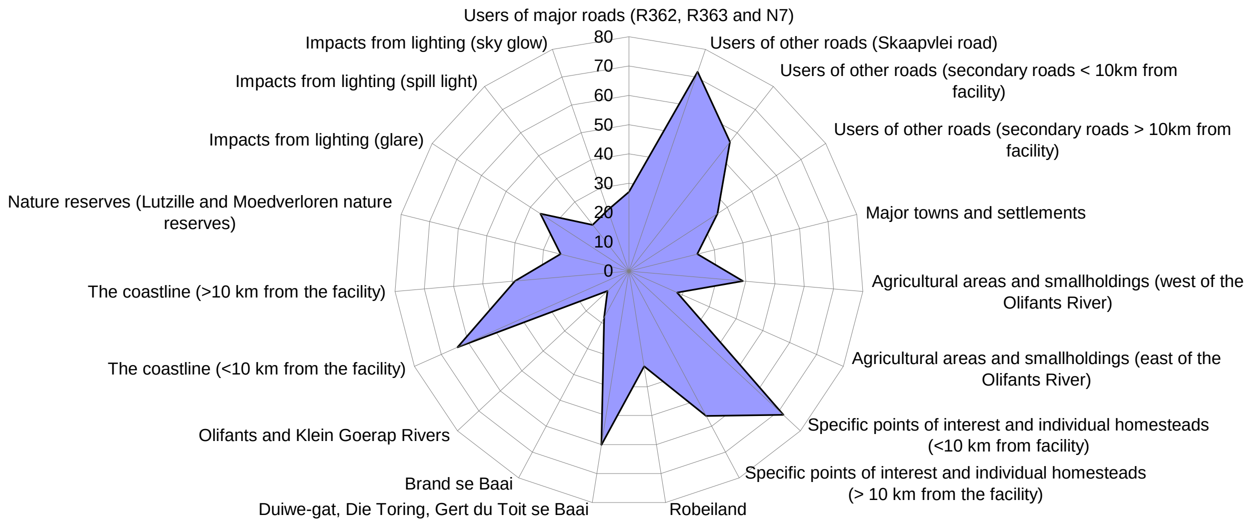


Ecological impacts are primarily of low to moderate significance without mitigation. With the implementation of recommended mitigation measures, the impacts are reduced. Impacts on avifauna cannot be determined with confidence through this assessment, and monitoring of the interaction of the various species with the wind energy facility will provide further insight.



Social impacts are primarily of low to moderate negative significance without mitigation. With the implementation of recommended mitigation measures, the impacts are reduced. High negative impacts relate to impacts on farming practices on the proposed site, as well as visual impacts (discussed below). Several positive impacts/benefits to the social environment can also be realised. These are indicated on the left side of the graph.

SUMMARY: VISUAL IMPACTS



Visual impacts are the primarily impact as a result of the proposed wind energy facility. The majority of impacts are of moderate significance. However, sensitive receptors in the immediate vicinity of the facility will experience impacts of high moderate negative significance. Mitigation is not possible for such a facility in an area of this nature, and not significance ratings are therefore provided with mitigation.

7.3. Assessment of Potential Cumulative Impacts associated with the proposed Wind Energy Facility

Cumulative impact, in relation to an activity, refers to the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area[19]. The cumulative impacts associated with the proposed wind energy facility can be viewed from two perspectives: 1) cumulative impacts associated with the scale of the project, i.e. that up to 100 turbines located on one site; and 2) cumulative impacts associated with other activities/developments in the area.

[19] Definition as provided by DEAT in the EIA regulations.

The potential *direct* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» Visual impact on the surrounding area – at a local level and driven primarily by the number of turbines proposed within the facility.

The potential *indirect* cumulative impacts as a result of the proposed project are expected to be associated predominantly with:

» Flora, fauna and ecological processes – at a regional level and driven primarily by the on-going negative effects of mining activities in the area.
» Increase grazing pressures (i.e. loss of land with grazing potential) - at a local and regional level.
» Increased pressure on road and other infrastructure (in particular Skaapvlei road).

Cumulative effects have been considered within the detailed specialist studies, where applicable (refer to Appendices G -Q) and are listed in the tables in section 7.2 above.

ASSESSMENT OF IMPACTS: PROJECT ALTERNATIVES CHAPTER 8

As a precursor to the commencement of the EIA process, Eskom embarked on a consultative process with DEAT and DEA&DP regarding the proposed wind energy facility project and the approach to undertaking an assessment for a facility of this nature in the Western Cape. It was determined, in consultation with DEAT and DEA&DP, that a site identification and selection process to determine areas along the West Coast coastline that are suitable for wind energy development should be undertaken for a larger area (at a regional level) using the methodology developed and recommended by DEA&DP for the siting of wind energy facilities in the Province[20].

Eskom then embarked on a regional site identification and selection process to determine and delineate areas north of the Olifants River as suitable sites for commercial wind energy development. Through the regional assessment site identification and selection process, Eskom were guided to site/locate their proposed wind energy facility within an area/zone of preference in terms of environmental and planning criteria (the site selection process undertaken is described in Chapter 4 of the Scoping Report). Eskom then delineated boundaries of a larger site with the best potential from a wind resource perspective coupled with the consideration of the results from the environmental and planning criteria.

The consideration of technical factors, such as the availability of wind resources[21], terrain, proximity to the electricity grid, and access requirements is considered important, as the technical drivers (and ultimately the technical viability of the project) are critical. Without considering this technical input, the areas identified through following the Regional Methodology are recognised as areas appropriate for development, and not specifically for development of a Wind Energy Facility. Therefore, these technical considerations were considered for this study area in parallel with the regional assessment.

This process was undertaken to ensure that the EIA process could commence with a viable and practical site for investigation (understanding the importance of the role played by the wind resource for a facility of this nature).

[20] *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006).
[21] Discussed further in Chapter 3.

A report detailing the outcomes of the regional assessment and technical considerations was submitted to DEAT and DEA&DP in June 2007. DEAT accepted the process followed, and advised that results of the study were considered to be acceptable. The proposed site was, therefore, accepted by DEAT and no **location/site alternatives** were required to be considered further within this EIA process. A scoping study was initiated for the demarcated site (an area of approximately 37 km^2) comprising the following farms:

» Portion 5 of the farm Gravewaterkop 158 (known as Skaapvlei)
» A portion of Portion 620 of the farm Olifants River Settlement (known as Skilpadvlei)
» A portion of Portion 617 of the farm Olifants River Settlement (known as Nooitgedag)

No absolute 'no-go' areas were identified within the site evaluated within the Scoping Study, although a number of issues requiring further study were highlighted. The EIA phase has considered site specific siting alternatives within the larger proposed wind energy facility site.

This Chapter provides an assessment of the feasible and reasonable project alternatives[22] considered through the EIA process.

1. The **'do nothing' alternative**: Eskom does not establish a wind energy facility in the Western Cape (maintain status quo).
2. **Site-specific alternatives**: Relating to actual turbine positions and positions of the associated infrastructure on the site (i.e. access roads, substation/s, visitors centre) over an area of less than 20 km^2.
3. **Alternative servitudes for power line routing**: A double circuit 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal). Alternative routes/corridors for the 132 kV power line have been assessed in the EIA.
4. **Transportation route alternatives:** Relating to the transportation of all the components associated with the project to the site. The various transportation options (harbour, rail, air, road), as well as the possible routes associated with these options were assessed through the transportation study (refer Appendix Q) and summarised in section 8.4.

The sections which follow provide a summary of the assessment of these project alternatives.

[22] As required in terms of the EIA Regulations.

8.1. The 'do nothing' alternative

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. The South African Government has set a 10-year cumulative target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This amounts to ~4% (1667 MW) of the total estimated electricity demand (41 539 MW) by 2013.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Eskom has a drive to establish renewable forms of energy generation capacity and contribute to the targets published in the Renewable Energy White Paper. Through research, the viability of a wind energy facility has been established, and Eskom propose that up to at least 200 MW can be realised from the proposed facility on the West Coast (based on turbine technology choice).

The 'do nothing' alternative translates to Eskom not establishing a wind energy facility on the demarcated site within the Western Cape (that is, maintaining the status quo). The following impacts would result:

» The project would not assist Eskom or the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good wind energy resources at the site north of the Olifants River would be lost.
» The National electricity grid would not benefit from the additional generated power (Eskom propose that up to at least 200 MW can be realised from the proposed facility on the West Coast (based on turbine technology choice).

This is, therefore, not a preferred alternative.

8.2. Site-specific Alternatives in terms of Turbine and other Infrastructure Positioning

A detailed site layout optimisation/'micro-siting' exercise has been undertaken by Eskom to effectively 'design' the wind energy facility within the proposed development site. The layout of the wind turbines and ancillary infrastructure (including access roads, laydown areas and the substation site) was planned primarily in terms of the wind resource in the area. The overall aim was to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts.

Specialist software was used to assist Eskom in selecting the optimum position (in terms of generating capacity) for each turbine. This micro-siting exercise revealed the best possible positions for the turbines, substation and other infrastructure from a technical perspective. It was proposed that the 100 turbines are constructed in four rows (marked as rows A-D) which lie parallel and equidistant to one another. In order to accommodate site-specific alternative turbine placements on the ground (e.g. in order to avoid or mitigate an area of environmental sensitivity), the “turbine rows” have been considered as 200 m wide “corridors” of disturbance. Each “corridor” would contain the turbines within the row together with other associated infrastructure such as the access road, laydown areas, cabling trench etc, and would allow for alternative positioning of infrastructure.

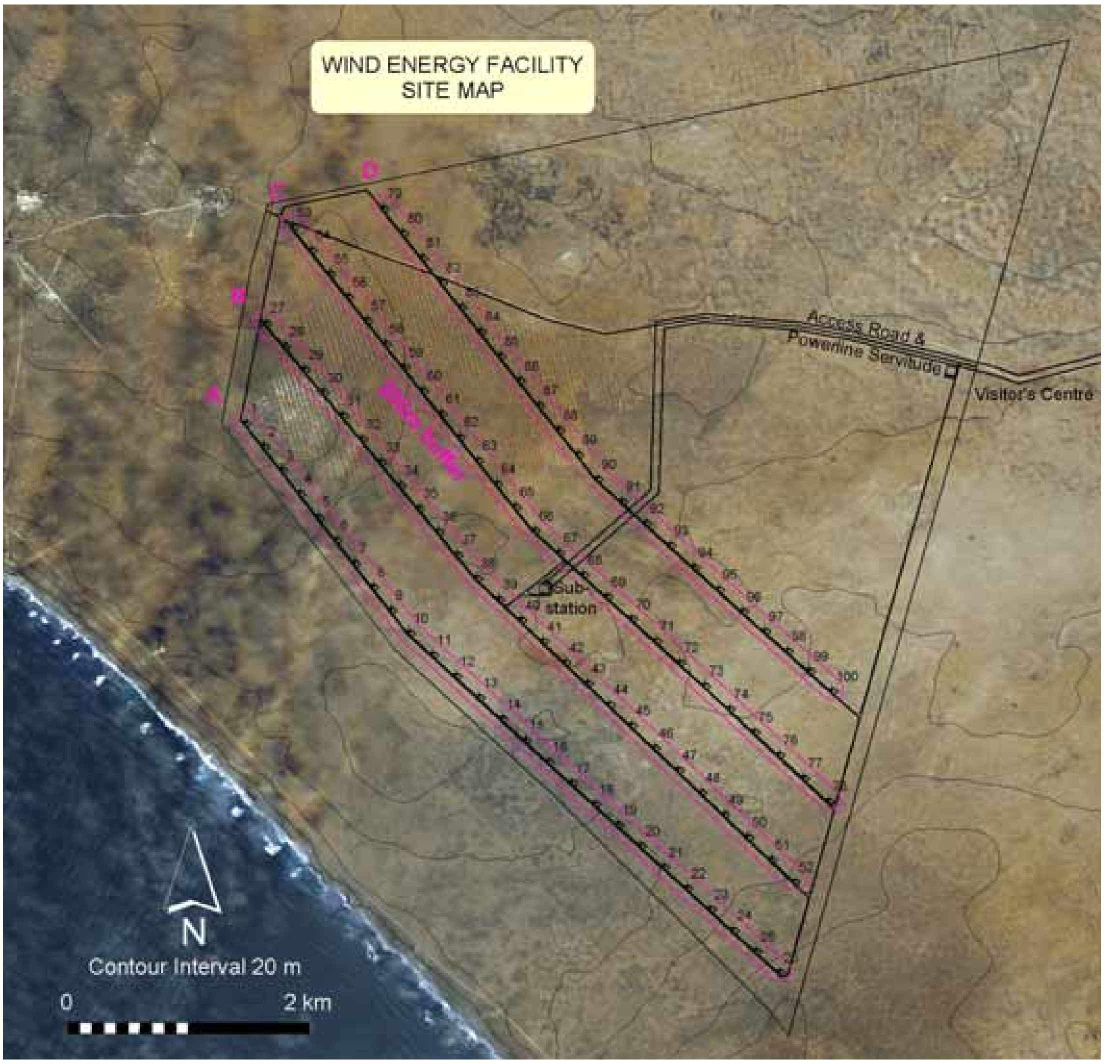


Figure 8.1: Illustration of the wind energy facility layout and the 200 m wide impact corridors identified for investigation.

This micro-siting information informed the specialist impact assessments undertaken at the EIA phase. The four “corridors” of disturbance have been considered in detail through the specialist studies and conclusions drawn as to where changes in site-specific footprints may be required (as discussed in Chapter 7 and Chapter 9).

8.3. Alternative Servitudes for Power Line Routing

Network integration studies and planning for the transmission of the power generated at the wind energy facility is being designed and will be finalised through the findings of the EIA process.

A double circuit 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal), a distance of approximately 40 km. The connection point to the Eskom power grid at the Juno Substation has been informed through an understanding of the local power requirements and the stability of the local electricity network.

The power line would be referred to as the Juno-Wind Farm 132 kV power line. Eskom's naming convention for power lines is based on the substations which a power line connects – in this case Juno Substation and the Wind Farm Substation - and these substations are referred to in alphabetical order (and not in the direction of current flow).

Alternative routes/corridors for the 132 kV power line have been identified and assessed in the EIA phase (refer to Figure 8.2). The power line servitude options are proposed to follow other existing linear infrastructure (including roads and or other power lines) as closely as possible in order to consolidate linear infrastructure in the area, and to minimise the need for additional points of access/access roads. The routes are as follows:

Alternative 1: From Juno Substation (near Vredendal), the alternative route crosses the R362 and follows the existing Juno-Koekenaap distribution power line for a total distance of 20km until it reaches the R363 (south of the Koekenaap Substation). At this point, the power line is proposed to cross this road and head west towards the wind energy facility, following the alignment of the Skaapvlei road. A sub-alternative (referred to as **Alternative 1a**) has been proposed to avoid an area of high botanical sensitivity, and follows the existing distribution line for about 15 km before heading due west across the R363 (north of the Keerweder settlement) towards the proposed wind energy facility. Alternative 1 is approximately 40 km in length. The sub-alternative Alternative 1a reduces the overall length of Alternative 1 by 1 km (i.e. 39 km total length).

Alternative 2: From Juno Substation (near Vredendal), the alternative route crosses the R362 and follows the existing Juno-Koekenaap distribution power line for a couple of kilometres. The route then crosses back over the R362 in a northwesterly direction. Where this road makes a loop around the open quarry, the alternative crosses over the same road again and continues north of Lutzville alongside the Vredendal-Bitterfontein railway line for approximately 13.5 km until it the vicinity of Koekenaap. The route passes east and north of Koekenaap, over the R363 and north of the Skaapvlei road agricultural holdings before heading west towards the wind energy facility. The route follows the alignment just to the south of the Skaapvlei road, skirting the Skilpadvlei and Kommandokraal homesteads. Alternative 2 is approximately 36km in length.

Alternative 1 follows an existing power line for about 40% of its length, with the remainder being a new routing. Alternative 2 is virtually all a new power line routing, but follows other linear infrastructure including the Vredendal-Bitterfontein railway line.

The two proposed route alternatives are mapped out as corridors of 200 m in width. A 30 m wide servitude will be required for the final route. Eskom propose to register a right of way along the eventual servitude, pay compensation for its use, but not to acquire ownership. Some leeway in the final siting of the power line (i.e. in response to existing conditions on the ground) is provided by the following factors:

» Lateral movement of the required 30 m servitude is possible within the wider 200 m corridor, and siting of the power line footings can be amended to avoid sensitive features or areas, such as homesteads or cultivated areas.
» The 200 m average distance between the power line towers can be increased or decreased in order to avoid sensitive features or areas, such as streams or cultivated areas. However, these increases will require heightening of towers for the relevant segment.

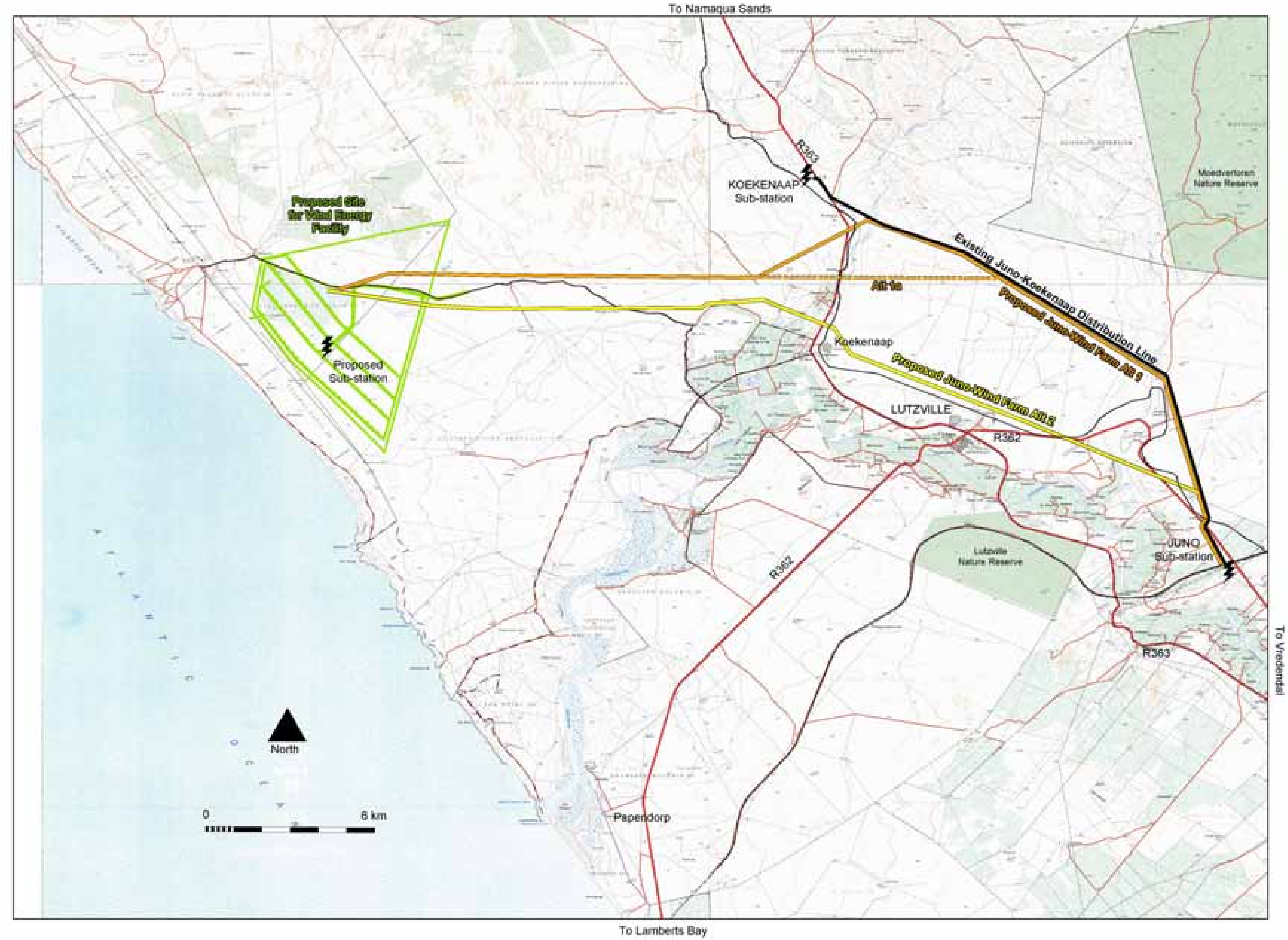


Figure 8.2: Alternative power line corridors 1 (and 1a) and 2 identified for consideration in the EIA process

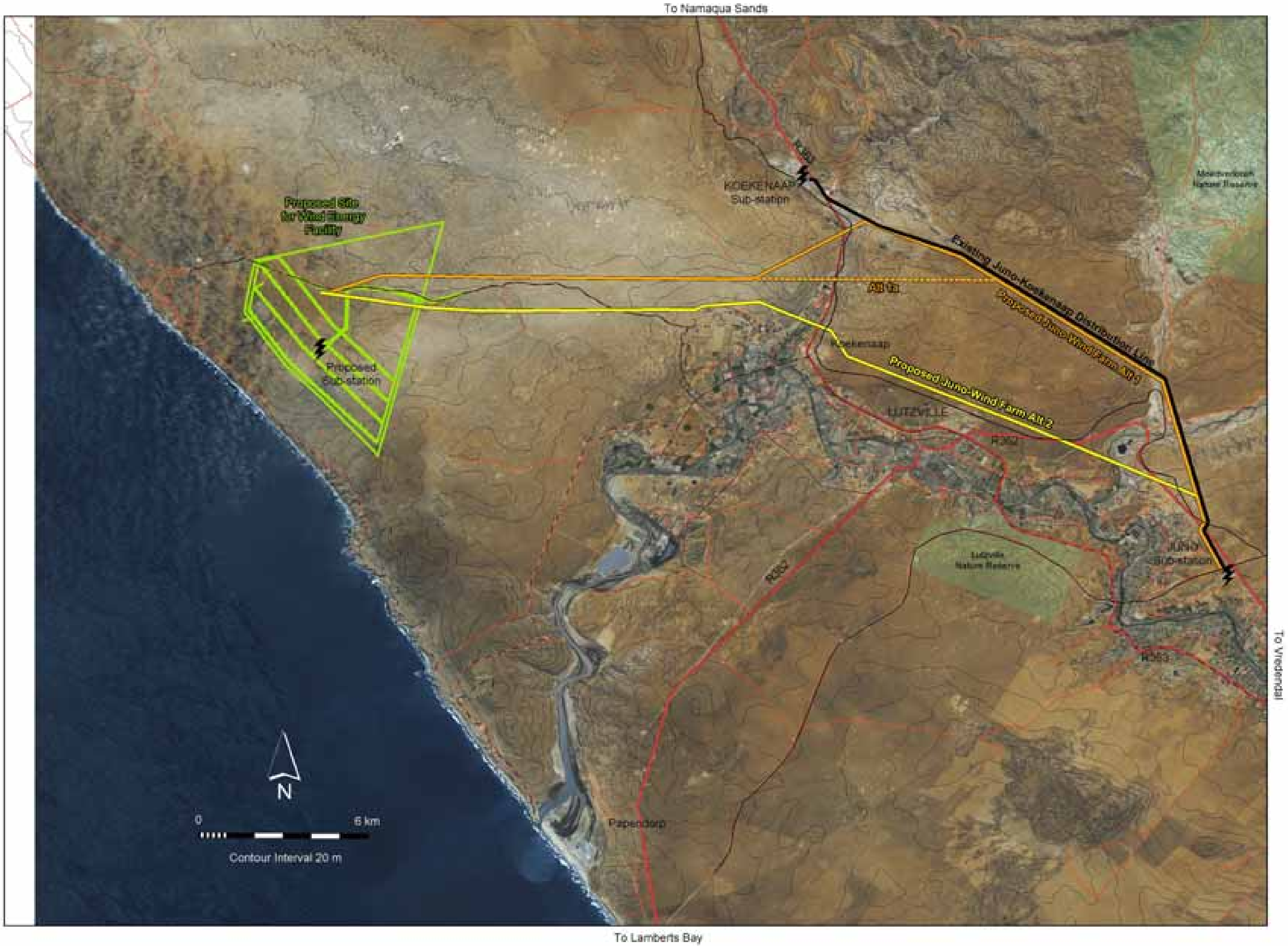


Figure 8.3: Alternative power line corridors 1 (and 1a) and 2 identified for consideration in the EIA process (illustrated on an aerial photo)

The sections which follow provide a comparative assessment of the identified power line alternatives.

8.3.1. Potential Impacts on Vegetation

One area of botanical sensitivity north of Koekenaap has been identified to be traversed by Alternative 1. In order to avoid this area of high sensitivity, a sub-alternative referred to as Alternative 1a has been considered. As indicated in Figure 8.4, there are significant patches of Very High sensitivity vegetation in this area, mostly in the form of Knersvlakte Quartz Vygieveld.

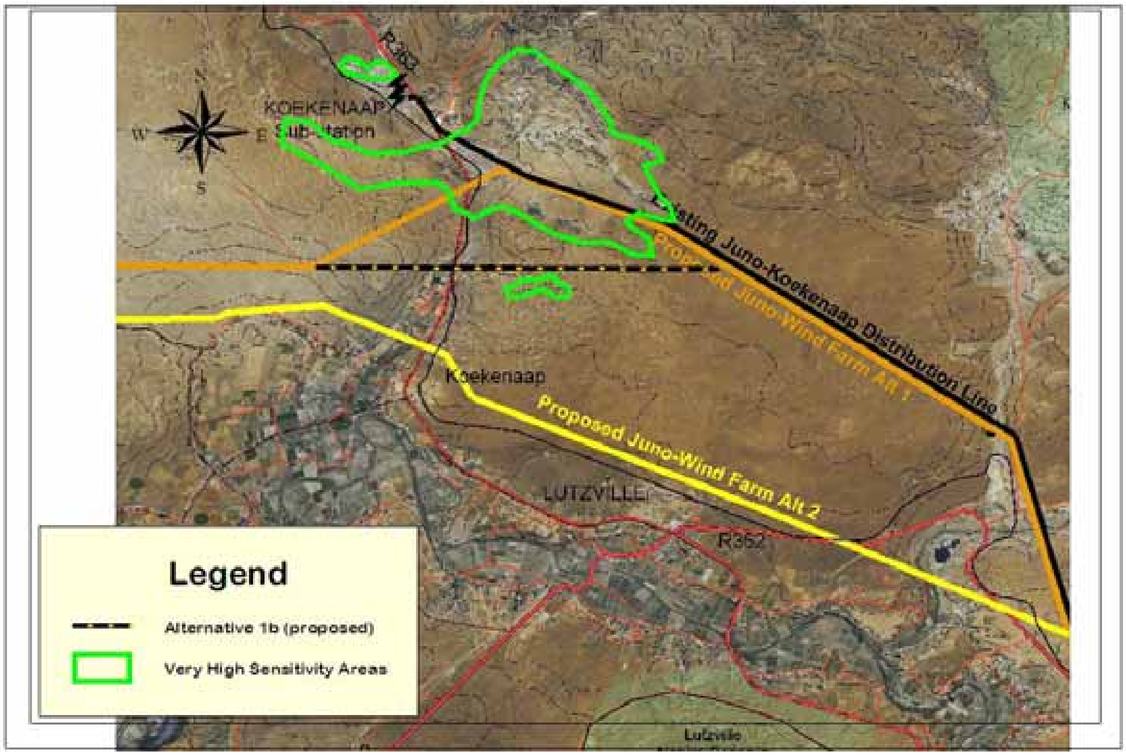


Figure 8.4: Proposed power line alternatives showing very high sensitivity areas in the Koekenaap and Lutzville area that should be avoided, and proposed Alternative 1a that is both shorter and crosses only lower sensitivity areas. No other high sensitivity botanical areas are crossed by either of the power line alternatives.

No other significant impacts on vegetation are anticipated to be associated with the proposed routes Alternative 1 and Alternative 2. Power lines usually have relatively small footprints and have little influence on the vegetation, especially in arid areas where there is no fire risk and the vegetation does not need to be bushcut beneath the line. Besides the Knersvlakte Quartz Vygieveld (which can be avoided by opting for Alternative 1a), none of the other vegetation types crossed by the proposed power line alternatives are considered to be a threatened ecosystem in terms of the NSBA analysis (Rouget, *et al*., 2004), and all have large untransformed portions within the Knersvlakte or on the

Namaqualand coastal plain. It is unlikely that any populations of threatened plants in these habitats will be impacted by the proposed power line.

The routing of the power line along Alternative 1a will entirely avoid the most sensitive habitats in the quartz patches near Koekenaap. Therefore, **Alternative 1 with sub-alternative 1a** is nominated as the preferred option.

Impact tables summarising the significance of impacts on vegetation (with and without mitigation) for power line Alternatives 1 & 2

Nature: Loss of vegetation and habitat: <u>Power line Alternative 1</u>

Long-term to permanent loss of vegetation and habitat in quartz patches near Koekenaap

A power line through the highly sensitive quartz patches would cause significant and permanent damage, in the form of plant loss due to crushing, and permanent habitat alteration. The fine covering of quartz pebbles is key to the habitat, and any heavy machinery severely disturbs this layer, effectively rendering the habitats unsuitable for these specialised plants for many decades thereafter. Given that the quartz patches are fairly small and localised on a landscape scale it is considered to be unacceptable to have infrastructure routed through them, when they are easy to avoid.

CapeNature does not support any activities that may negatively impact on the habitat/ecological functioning of habitats that may contain a unique signature of species, such as found in quartz patches.

Direct permanent loss of vegetation is expected in tower footprint areas. Disturbance of the natural vegetation as a result of construction will occur within the power line servitude. Disturbance will be long-term but temporary as these areas should eventually recover to a significant degree (if natural vegetation is retained in the adjacent areas), but could take at least 15 years (and possibly much longer if rainfall is below normal) in order to recover to a point where at least 80% of the original diversity is once again present. Certain species may not return for many additional years, due to changes in soil structure (compaction).

	Without mitigation	**With mitigation**
Extent	Local, regional and national (4)	Local (2)
Duration	Long term to permanent (5)	Short term to permanent (3)
Magnitude	Medium – High (6)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Very High (75)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Partly, but only over >100 yrs	Partly, but only over >10 yrs
Irreplaceable loss of resources?	Yes	No

Can impacts be mitigated?	Only by use of Alternative 1a	Not significantly
Mitigation: » Routing of the power line along Alternative 1a will entirely avoid the most sensitive habitats. » For remainder of route – minimise areas of disturbance for tower footings and during power line construction. » Utilise existing roads and points of access as far as possible to avoid the creation of new areas of disturbance.		
Cumulative Impacts: » Regional negative impact. » Impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.		

Nature: Loss of vegetation and habitat: Power line Alternative 2

Temporary to permanent loss of vegetation

Direct permanent loss of vegetation is expected in tower footprint areas. Disturbance of the natural vegetation as a result of construction will occur within the power line servitude. Disturbance will be long-term but temporary as these areas should eventually recover to a significant degree (if natural vegetation is retained in the adjacent areas), but could take at least 15 years (and possibly much longer if rainfall is below normal) in order to recover to a point where at least 80% of the original diversity is once again present. Certain species may not return for many additional years, due to changes in soil structure (compaction).

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term to permanent (3)	Short term to permanent (3)
Magnitude	Low (4)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Medium (45)**	**Medium (45)**
Status (positive or negative)	Negative	Negative
Reversibility	Partly, but only over >10 yrs	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not significantly	

Mitigation:

» Minimise areas of disturbance for tower footings and during power line construction.
» Utilise existing roads and points of access as far as possible to avoid the creation of new areas of disturbance.

Cumulative Impacts:

» Regional negative impact.
» Impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Comparative Assessment Statement

The routing of the power line along Alternative 1a will entirely avoid the most sensitive habitats in the quartz patches near Koekenaap. Therefore, **Alternative 1 with sub-alternative 1a** is nominated as the preferred option.

8.3.2. Potential Impacts on Terrestrial Fauna

Potential impacts associated with the construction of the proposed power line between the Wind Farm Substation and the Juno Substation relate mainly to direct mortality of animal species during construction, habitat destruction, increased road kills, and the barrier effect of roads and fences.

The two alternative routes (and sub-alternative) for the Juno-Wind Farm power line do not differ in any significant way as far as faunal habitat which they will traverse is concerned. Therefore, there is **no significant difference** in the potential impacts on terrestrial fauna associated with the erection of a power line along any of the routes identified. Therefore, the impacts for the two alternatives are not comparatively assessed in the tables below.

Impact tables summarising the significance of impacts on terrestrial fauna (with and without mitigation) for power line Alternatives 1 & 2 *(no comparative assessment required as similar for both alternatives)*

Nature: Direct mortality on terrestrial fauna during construction of the power line: Power line Alternative 1 (and 1a) and Power line Alternative 2 Those species that cannot flee from the affected areas by themselves during the construction phase of the power line could potentially suffer direct mortality. These species could therefore suffer direct mortality due to site clearing and excavations at tower footprints, site clearing and excavations along service/access roads, and use of service roads.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short-term (1)	Short-term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (20)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Not applicable	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:
» Removal of animals from the affected areas before the start of site clearing/construction and relocating these to safe areas would only be a valid mitigation option in the case of tortoises. All other reptile and small mammal species are extremely difficult to catch and it would be a futile attempt to try and relocate them. » Minimise areas of disturbance for tower footings and during power line construction. » Utilise existing roads and points of access as far as possible to avoid the creation of new areas of disturbance.
Cumulative Impacts:
None. The impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.

Nature: ***Loss of faunal habitats: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>*** The construction of the power line and the use/establishment of an access road will result in the loss of faunal habitat, which may impact on terrestrial fauna species.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	In many cases the impact will be irreversible	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Instead of blanket site clearing for the erection of the power line towers, under the power line for stringing purposes, or for gaining access, the goal should be to keep as much as possible of the natural habitat intact. By doing this, the significance rating of the impact could be lowered to *Low*. » Minimise areas of disturbance for tower footings and during power line construction. » Utilise existing roads and points of access as far as possible to avoid the creation of new areas of disturbance.		
Cumulative Impacts: » Regional negative impacts on habitat loss and fragmentation. » The impacts of this type of development will be significantly less than for various existing and proposed mining operations in the region.		

Comparative Assessment Statement

There is no significant difference in the potential impacts on terrestrial fauna associated with the erection of a power line along the routes identified. Therefore, there is **no preference** between the alternatives power line routes.

8.3.3. Potential Impacts on Avifauna

Alternative 1 follows existing power line infrastructure for approximately 18 km of its length. This provides a distinct advantage in terms of reducing collision risk for birds. By bringing multiple power lines into a single, narrow corridor, the combined assemblage is significantly more visible to overflying birds, and the likelihood of collisions occurring with any one of the aggregated lines is reduced. The new Juno-Wind Farm 132 kV power line is likely to stand taller than the existing line, so once the new line is marked with diverters on the earthwire in key areas, this will have the additional benefit of reducing any collision risk already associated with existing line (which is currently unmarked). Alternative 1a also involves approximately 12 km of the new line running adjacent and parallel to the existing line, providing a similar advantage to Alternative 1.

In terms of the habitats traversed by the alignment options, they all include similar distances of open Strandveld (where Ludwig's Bustards and Secretarybirds are most likely to occur), and they all involve two crossings of relatively major watercourses (which might function as all-purpose avian flyways). Therefore, the inherent collision risk of the alternatives is otherwise very similar.

Overall, **Alternative 1** is nominated as the preferred option. Alternative 1 with sub-alternative 1a is acceptable. Alternative 2 is least favoured.

Impact tables summarising the significance of collision impacts on avifauna (with and without mitigation) for power line Alternatives 1 & 2

Nature: Collision with the overhead power line: <u>Power line Alternative 1 (or 1a)</u>
Birds may collide with the overhead cabling of the new power line. Collisions are one of the biggest single threats posed by overhead power lines to birds in southern Africa. Many collision sensitive birds are also long-lived, slow-reproducing species, demographically poorly equipped to absorb unnaturally inflated rates of adult mortality, and some of these species are now Red-listed, at least partly because of the long-term effects of collision casualties associated with power lines. The most important collision-prone species within the impact zone of the proposed power line are Ludwig's Bustard and Secretarybird.

	Without mitigation[23]	**With mitigation**
Extent[24]	Local – Regional (1-3)	Local – Regional (1-3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small to High (0-8)	Small to Moderate (0-6)
Probability	Probable to highly probable (3-4)	Probable (3)
Significance	**Low – High (16-60)**	**Low – Medium (15-42)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially (use of Alternative 1 or 1a)	

Nature: Collision with the overhead power line: <u>Power line Alternative 2</u>

Birds may collide with the overhead cabling of the new power line. Collisions are one of the biggest single threats posed by overhead power lines to birds in southern Africa (van Rooyen 2004). Many collision sensitive birds are also long-lived, slow-reproducing species, demographically poorly equipped to absorb unnaturally inflated rates of adult mortality, and some of these species are now Red-listed, at least partly because of the long-term effects of collision casualties associated with power lines. The most important collision-prone species within the impact zone of the proposed power line are Ludwig's Bustard and Secretarybird.

	Without mitigation	**With mitigation**
Extent	Local – Regional (1-3)	Local – Regional (1-3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small to High (0-8)	Small to High (0-8)
Probability	Probable to highly probable (3-4)	Probable to highly probable (3-4)
Significance	**Low – High (16-60)**	**Low – High (16-60)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially	

Mitigation:

» Reduce the likelihood of collisions by bringing multiple power lines into a single, narrow corridor (i.e. through the adoption of Alternative 1 or 1a).

» All sections of the power line crossing open, relatively flat country frequented by both

[23] Dependent on species being impacted. Refer to Appendix 3 of the specialist study contained within Appendix I.

[24] Where a score of 1 is low – likely to affect a relatively small segment of a widespread population - and a score of 5 is high – likely to affect a relatively large segment of a localised population.

the Ludwig's Bustard and Secretarybird should be marked on the earthwire with a suitable marking device. » Any points where the power line crosses a watercourse, which might constitute a general flyway for local birds, should also be marked. » The final selection of sections of the power line to be fitted with marking devices should be identified after the pole positions have been pegged, by way of a walk-through conducted jointly by Eskom and a suitably qualified ornithologist. » A section of this power line should be regularly surveyed for collision casualties as part of the monitoring programme suggested for the wind energy facility itself, to evaluate the efficacy of the marking devices used, and to ensure that unmarked sections of line where casualties are recorded are subsequently marked.
Cumulative Impacts: » Positive impacts: By bringing multiple power lines into a single, narrow corridor, the combined assemblage is significantly more visible to overflying birds, and the likelihood of collisions occurring with any one of the aggregated lines is reduced. » Negative impacts: Increased numbers of power lines in various locations/positions within an area increases the risk of collisions.

In terms of impacts arising from electrocution or disturbance, there is **no significant difference** in the potential impacts on avifauna associated with the alternatives. Therefore, the impacts for the two alternatives are not comparatively assessed in the tables below.

Impact tables summarising the significance of impacts on avifauna (with and without mitigation) for power line Alternatives 1 & 2 *(no comparative assessment required as similar for both alternatives)*

Nature: ***Electrocution: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>*** Birds may be electrocuted when perching, or attempting to perch on the pylons supporting the new power line, by bridging the air gap between live components and/or live and earthed components (van Rooyen, 2004) and causing a short circuit. The electrocution risk of the proposed 132 kV power line will be entirely dependent on the design of the tower structures used. The raptor fauna of the area are those most likely to suffer electrocution on the proposed line, with the larger species – Martial Eagle, Black-chested Snake Eagle and possibly others most at risk.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (33)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	

Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially through careful tower selection/design	

Mitigation:

» The mono-pole tower structures currently favoured to support the power line are a good option in terms reducing of avian electrocution risk, provided that the clearances all-around are in excess of 2 m.
» Ideally, a section of this line should be regularly surveyed for electrocution casualties as part of the monitoring programme suggested for the wind energy facility itself, to verify that the selected tower design is a low electrocution risk option, and to ensure that should any electrocution casualties be picked up, the offending structures are accordingly fitted with bird guards in the appropriate places.

Cumulative Impacts:
None.

Nature: ***Disturbance: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>***

During the construction and maintenance of power lines some habitat alteration will inevitably take place with the construction of access roads, and the clearing of servitudes. These activities may have an impact on birds breeding, foraging and roosting in or in close proximity to the servitude. Construction and maintenance activities on the line may disturb resident and breeding species of birds.

	Without mitigation[25]	**With mitigation**
Extent	Local (1 - 2)	Local (1 - 2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Small to low (0 – 4)	Small to very low (0 – 2)
Probability	Highly probable (4)	Probable (3)
Significance	**Low to Medium (24-44)**	**Low (18-27)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	Partially	

Mitigation:

» All construction and maintenance activities should be carried out according to generally accepted environmental best practice, and the temporal and spatial footprint of the power line should be kept to a minimum.
» In particular, care should be taken in the construction of the power line in the vicinity of the river crossings, and existing roads must be used as far as possible for access

[25] Dependent on species being impacted. Refer to Appendix 3 of the specialist study contained within Appendix I.

during construction. » In order to minimise impacts on bird species which may have active nests on the immediate vicinity of the construction area, it may be necessary to (a) survey the construction area immediately before work commences, and (b) to work around any such nest sites located in this pre-construction survey. » Should any important nest sites be located close to the power line servitude in the pre-construction monitoring of the site, these should be given special consideration in the planning of all routine maintenance activities. » Reduce the extent of habitat destruction through the consolidation of power line infrastructure thus enabling the use of existing service/access roads during construction and maintenance activities. » Ideally, a pre-construction walk-through of the selected power line alignment should be done by an experienced ornithologist to check key areas for nests of threatened species. » Any bird nests that are found subsequently should be reported to the EWT to allow expert advice on how to deal with the situation.
Cumulative Impacts: Positive impacts: By bringing multiple power lines into a single, narrow corridor, the: » need for additional service/access roads is reduced, thereby reducing the extent of disturbance » extent of disturbance in the region can be minimised as maintenance activities on the parallel lines can be synchronised as far as possible.

Comparative Assessment Statement

Alternative 1 is nominated as the preferred option with regards to reducing collision-risk associated with a power line. Alternative 1 with sub-alternative 1a is acceptable. Alternative 2 is least favoured.

In terms of impacts arising from electrocution or disturbance, there is **no significant difference** in the potential impacts on avifauna associated with the alternatives.

Impact of birds on quality of supply on 132 kV line

Birds may cause electrical faults on power lines. This can happen in various ways, and the higher the number of faults recorded, the lower the quality of electricity supplied to end-users.

'Bird streamer' induced faulting is caused when a large bird produces a stream of faeces long enough to constitute an air gap intrusion between the conductor and the earthed structure, creating a short circuit. Bird pollution is a form of pre-deposit pollution. A flashover occurs when the insulator string gets coated with pollution, which compromises the insulation properties of the string. When the layer of pollution is dampened by rain or high humidity, the coating becomes conductive, insulation breakdown occurs and a flashover results. Bird's nests may also cause faults when nesting material protrudes into the air gap. Crows in particular often incorporate wire and other conductive material into their nests.

Streamer-, pollution- and nest-related faults could occur when birds regularly perch or nest on pylons or towers, directly above live conductors. The risk of bird-related faulting will be dependent on the design of the tower structures used. (Species implicated: Herons, ibises, eagles and crows).

The favoured tower designs are poorly suited to use as nesting substrates by most bird species, and the perching areas are generally situated in areas either off-set or well away from the conductors, so the likelihood of birds having a significant negative impact on quality of supply is much reduced. However, any incidents of line faulting attributed to avian activities on the line should be reported to the EWT and will then be managed on a case-by-case basis.

8.3.4. Potential Impacts on Geomorphology and Surface Processes

A number of areas or landforms regarded as sensitive to development have been identified along the proposed power line alternative routes. These include erosion gully networks, floodplains, gullys, pans, potential headwater of drainage lines, eroded areas, incised drainage lines and drainage lines. The location of these in relation to each alternative considered is detailed in the specialist study contained within Appendix J.

As Alternative 2 is shorter (hence potentially less cumulative impact of the service road on the landscape), has fewer sensitive areas located along its length and is only associated with two floodplain traverses (as opposed to three associated with Alternative 1), **Alternative 2** is the preferred option from a geomorphological and surface processes perspective. This does not imply that Alternative 1 or Alternative 1a are unsuitable, and these alternatives are also considered to be acceptable.

In terms of impacts arising from geomorphological and surface processes, there is **no significant difference** in the potential impacts associated with the alternatives (except for the number of features potentially traversed). Therefore, the impacts for the two alternatives are not comparatively assessed in the tables below.

Impact tables summarising the significance of impacts on geomorphology and surface processes (with and without mitigation) for power line Alternatives 1 & 2 *(no comparative assessment required as similar for both alternatives)*

Nature: Excavation of foundations for power line towers and access roads: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u> Excavation of foundations for power line towers or the establishment of access roads will be associated with localised surface modification.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Very short term (1)	Very short term (1)
Magnitude	Moderate (6)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (40)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	High	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Minimise extent of modified areas and keep each area of disturbance to a minimum. » Rehabilitate as soon as possible post-disturbance. » Do not spread displaced sediment over vegetation.		
Cumulative Impacts: None		

Nature: Accelerated aeolian sediment transport possibly leading to the development of deflation hollows: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u> A loss of vegetation (or other) cover will increase the susceptibility of sediments to wind erosion.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Small (0)
Probability	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	

Can impacts be mitigated?	Yes	

Mitigation:

- Minimise extent of modified areas and keep each area of disturbance to a minimum.
- Revegetate areas where there has been a loss of vegetation as soon as is practically possible.
- Do not spread displaced sediment over vegetation.

Cumulative Impacts:

None

Nature: Preferential aeolian erosion of sediment adjacent to structures and subsequent subsidence: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>

The winnowing affect associated with local flow modifications caused by structures may lead to subsidence if these structures are undercut.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Small (0)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

- Ensure a good indigenous vegetation cover is maintained adjacent to the tower footing.

Cumulative Impacts:

None

Nature: A reduction in the surface area of wetlands e.g. (pans) in the study area: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>

Construction of roads, tracks or other infrastructure in wetlands will lead to a loss of this habitat in the study area.

	Without mitigation	**With mitigation[26]**
Extent	International (5)	
Duration	Permanent (5)	

[26] Assumption that mitigation is successfully avoiding all wetlands and pans and their associated buffer areas.

Magnitude	Very high (10)	
Probability	Very improbable (1)	
Significance	**Low (20)**	**None**
Status (positive or negative)	Negative	
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» Avoid all pans and drainage lines and associated 50 m buffer zones, wherever possible for the siting of infrastructure, even if of a temporary nature.

Cumulative Impacts:

Regional loss of wetlands and pans.

Nature: Accelerated fluvial sediment transport and hence erosion associated with channelised/concentrated flow: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>

Erosion may be accentuated in flow concentration zones (e.g. culverts, roadside drainage ditches).

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Low (2)
Probability	Definite (5)	Probable (3)
Significance	**Medium-High (60)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	

Mitigation:

» Use existing roads wherever possible.
» With new roads, ensure culverts are suitably sized and roadside drainage ditches on steep sections are sealed.
» Construct mitre drains at regular intervals.

Cumulative Impacts:

None

Nature: Accelerated fluvial sediment transport and hence erosion associated with overland flow: Power line Alternative 1 (and 1a) and Power line Alternative 2 A loss of vegetation cover may increase the susceptibility of a sediment surface to overland flow related erosion processes.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Low (25)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Yes	
Mitigation: » Revegetate areas where there has been a loss of vegetation as soon as is practically possible.		
Cumulative Impacts: None		

Comparative Assessment Statement

In terms of impacts arising from geomorphological and surface processes, there is **no significant difference** in the potential impacts associated with the alternatives (except for the number of features potentially traversed). **Alternative 2** is nominated as a preferred option due to fewer features potentially traversed. However, Alternative 1 or sub-Alternative 1a are also considered to be acceptable.

8.3.5. Potential Impacts on Heritage Sites

The main cause of impacts to archaeological sites is physical disturbance of the material itself and its context. The heritage and scientific potential of an archaeological site is highly dependent on its geological and spatial context. This means that even though, for example a deep excavation may expose archaeological artefacts, the artefacts are relatively meaningless once removed from the area in which they were found. Large-scale excavations will damage archaeological sites, as will road construction, building foundations and services. The destruction of archaeological material is always considered to be a permanent and irreversible impact, although very often the intensity of an impact can be very low depending on the significance of the site in question.

Inspection of borrow pits and easily accessible deflation hollows along the routes proposed as Alternative 1 (and 1a) and Alternative 2 have shown that unless there is a specific resource focus on the landscape that would attract pre-colonial occupation, the likelihood of significant material of heritage value is very low. Furthermore, the footprint of each tower is limited. This together with the fact that all identified alternatives traverse a landscape where heritage material is very sparse, results in a very low potential for impacts. All alternatives are expected to have similar archaeological/heritage impacts. However, **Alternative 1 (or Alternative 1 with sub-alternative 1a)** is nominated as the preferred option as it is preferable to confine any impacts that may occur to an existing impact corridor, and secondly the greater distance of these alternatives from the Olifants River reduces the possibility of impacting archaeological material. Alternative 2 is least preferred.

Therefore, there is **no significant difference** in the potential impacts on heritage sites associated with the erection of a power line along any of the routes identified. Therefore, the impacts for the two alternatives are not comparatively assessed in the tables below.

Impact tables summarising the significance of impacts on heritage sites (with and without mitigation) for power line Alternatives 1 & 2 *(no comparative assessment required as similar for both alternatives)*

Nature:	***Impacts on heritage sites associated with the construction of 132kV power line: <u>Power line Alternative 1 (and 1a) and Power line Alternative 2</u>***	
	Without mitigation	**With mitigation[27]**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (1)	Low (1)
Probability	Improbable (1)	Improbable (1)
Significance	**Low (6)**	**Low (6)**
Status (positive or negative)	Neutral	Neutral
Reversibility	No	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	No	

[27] Assumption that mitigation is successfully avoiding all wetlands and pans and their associated buffer areas.

Mitigation:
» N/A
Cumulative Impacts:
Regional loss of heritage resources.

Comparative Assessment Statement

All alternatives are expected to have similar archaeological/heritage impacts. However, **Alternative 1 (or Alternative 1 with sub-alternative 1a)** is nominated as the preferred option as it is preferable to confine any impacts that may occur to an existing impact corridor, and secondly the greater distance of these alternatives from the Olifants River reduces the possibility of impacting archaeological material. Alternative 2 is least preferred.

8.3.6. Potential Visual Impacts

The results of the viewshed analyses for the proposed power line alternatives are shown on Figure 8.5 and 8.6.

The visual exposure of Alternative 1 and Alternative 1a (Figure 8.5) virtually covers the whole 5 km buffer radius. This is largely due to the flat nature of the terrain and the low growth of the natural vegetation. The power line will be exposed to observers travelling along the R362 and R363. It will also not be exposed to any major populated places due to the power line traversing near vacant rural land for the largest part of its alignment.

A similar pattern of visual exposure is encountered when viewing the result of the visibility analysis of Alternative 2. The exposure of this alternative, however, occurs within a closer proximity to built-up areas and settlements such as Lutzville, Koekenaap, the Skaapvlei road agricultural holdings and the farm Skilpadvlei. This alternative will furthermore be more visible from the R362 as it crosses the road three times as opposed to only once for Alternative 1.

Figure 8.5: Potential visual exposure of the proposed power line Alternative 1 and 1a

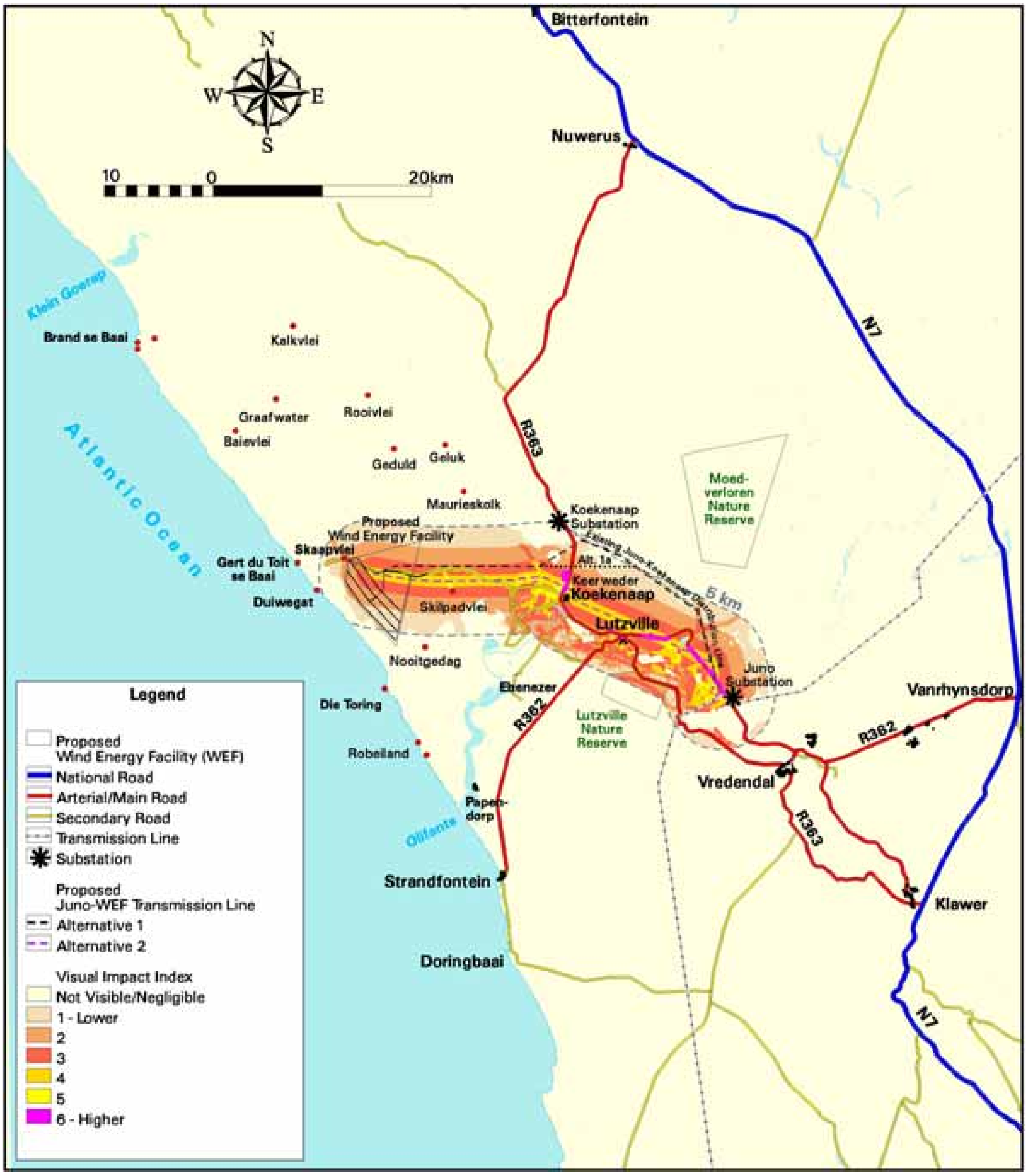


Figure 8.6: Potential visual exposure of the proposed power line Alternative 2

The visual impact index for the proposed transmission line Alternative 1 is shown in Figure 8.7. The higher areas of visual impact are indicated within the immediate vicinity of the power line (i.e. within a 500 m buffer zone). Approximately 20 km of the power line is situated adjacent to the existing Juno-Koekenaap distribution line, whilst most of the line traverses near vacant land with a low viewer frequency. The highest visual impact indicated on the index occurs where the proposed line crosses the R362 near Juno substation and R363 near the Koekenaap Substation.

Alternative 1a traverses the R363 in close proximity to the Keerweder populated area (within 1 km north of the settlement) and could potentially have a visual impact on this community.

Figure 8.7: Visual impact index of the proposed power line Alternative 1 and Alternative 1a

The visual impact index for the proposed power line Alternative 2 (Figure 8.8) displays a similar pattern to Alternative 1 (i.e. a higher visual impact within a 500 m radius of the line). Alternative 2 is, however, located closer to built-up and residential areas (Koekenaap and the Skaapvlei road smallholdings) and therefore has additional areas of high impact in these areas. It further has a higher visual exposure where it crosses the R362 three times where it will be exposed to road users for a greater length of time than is the case for Alternative 1. This proposed alternative alignment also traverses adjacent to and across the Skaapvlei road and has the potential to visually impact on road users and other homesteads (Kommandokraal) located in close proximity to this road.

Figure 8.8: Visual impact index of the proposed power line Alternative 2

The visual impacts associated with the construction of a 132 kV power line to the Juno substation occur at a local level. This is due to the less visually intrusive nature of the proposed monopole power line towers suggested for this line. These structures are less obtrusive than the more commonly used lattice structures that are more bulky in appearance and therefore more visible. The visual exposure (within a 5 km radius) of the identified alternatives indicated a similar pattern due to the homogeneous nature of the topography and the low visual absorption capacity of the natural vegetation (refer to impact tables below).

The determination of the potential visual impact and selection of the preferred alternative for the transmission line was based on the following comparative criteria:

- The length of the alignment
- The proximity and exposure to major roads (based on the number of road crossings)
- The proximity and exposure to populated places
- The consolidation of existing linear infrastructure (existing power line servitudes, access roads, etc.)

A comparative table indicates a summary of the above criteria. Positive values were awarded for opportunities and negatives where constraints were identified.

Power line Alternatives Visual Assessment Comparison

Alter-native	Length (Total)	Proximity to major roads	Proximity to populated places	Consolidation of existing infrastructure	Total Value
1	40km (-1)	2 crossings (-2)	Remote (+1)	High potential (up to 20km) (+2)	(0) Preferred
1a	39km (0)	2 crossings (-2)	Close proximity to Keerweder (-1)	Average potential (15km) (+1)	(-2) Accept-able
2	36km (+1)	4 crossings (-4)	Close proximity to Koekenaap, Skaapvlei Rd. smallholdings, Skilpadvlei & Kommando-kraal (-4)	Low potential (less than 3.5km) (-1)	(-5) Not preferred

Impact tables summarising the significance of visual impacts (with and without mitigation) for power line Alternatives 1 & 2

Nature: Visual impact associated with power line Alternative 1		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long-term (4)	N/A
Magnitude	Medium (5)	N/A
Probability	Probable (3)	N/A

Significance	**Medium (39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not easily. The primary visual impact, namely the appearance and dimensions of the power line is not possible to mitigate. The functional design of the structures and the dimensions of the power line cannot be changed in order to reduce visual impacts.	
Mitigation: Not possible to mitigate to any significant extent due to the nature of the towers and the nature of relief of the area.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Juno-Koekenaap power line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Nature: Visual impact associated with power line <u>Alternative 1a</u>		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long-term (4)	N/A
Magnitude	Medium – high (7)	N/A
Probability	Highly probable (5)	N/A
Significance	**High (75)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not easily. The primary visual impact, namely the appearance and dimensions of the power line is not possible to mitigate. The functional design of the structures and the dimensions of the power line cannot be changed in order to reduce visual impacts.	

Mitigation:
N/A
Cumulative Impacts:
Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Juno-Koekenaap power line for part of its length and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.

***Nature:* Visual impact associated with power line Alternative 2**		
	Without mitigation	**With mitigation**
Extent	Local (4)	N/A
Duration	Long-term (4)	N/A
Magnitude	High (8)	N/A
Probability	Highly probable (5)	N/A
Significance	**High (80)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	None	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	Not easily. The primary visual impact, namely the appearance and dimensions of the power line is not possible to mitigate. The functional design of the structures and the dimensions of the power line cannot be changed in order to reduce visual impacts.	
Mitigation: N/A		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Vredendal-Bitterfontein railway line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Comparative Assessment Statement

Alternative 1 is nominated as the preferred option with regards to reducing visual impact associated with a power line. Alternative 1 with sub-alternative 1a is acceptable. Alternative 2 is least favoured.

8.3.7. Potential Impacts on Tourism Potential

Available tourism market trends indicate that the northern part of the West Coast receives between 5% and 10% of visitors to the Western Cape and that these are largely concentrated in the area to the south of the Olifants River mouth and Vredendal. There does not appear to be a marked trend of tourism growth in the area and the market size in the immediate vicinity of the study area is very limited. The area is outside of the West Coast tourism coastal development zones, which are located South of the Olifants River Mouth.

While the study area is not known as an area of outstanding natural and scenic value and visitors are not expected to visit the area specifically for its scenic qualities, the broader region and the N7 Cape-to-Namibia route are promoted as a scenic nature area due to the variety of landscapes and the expansive, undeveloped countryside along the route.

The key concern regarding impacts on tourism-related nature and scenery relates to potential impacts of the Juno-Wind Farm 132 kV power line structures on views from the main roads and towns in the area. The routing of the power line will be particularly important. From a tourism perspective the urban areas and main travel routes should be avoided.

Alternative 1 is preferred since it crosses the R363 at a right angle and then routes away from the road to link up with the existing Juno-Koekenaap power line. This routing avoids a parallel routing along the road, valley and urban areas with travellers being able to see the power line towers along or at regular intervals along the route, as will be the case with Alternative 2.

Impact tables summarising the significance of impacts on tourism potential (with and without mitigation) for power line Alternatives 1 & 2

Nature: ***Impacts on the tourism-related nature and scenery: <u>Power line Alternative 1 (and 1a)</u>***		
	Without mitigation	**With mitigation**
Extent	Local (2)	N/A
Duration	Permanent (5)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (22)**	N/A
Status (positive or negative)	Negative	
Reversibility	The impact cannot be reversed since it is caused by the visual and physical	

	nature of the construction	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To some degree, if the route is away from sensitive tourist receptors. The visual impact cannot be mitigated easily due to the appearance and dimensions of the power line.	
Mitigation: » Route the power line away from sensitive tourist receptors.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Juno-Koekenaap power line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Nature: ***Impacts on the tourism-related nature and scenery: <u>Power line Alternative 2</u>***		
	Without mitigation	**With mitigation**
Extent	Local (2)	N/A
Duration	Permanent (5)	N/A
Magnitude	Low (4)	N/A
Probability	Highly probable (4)	N/A
Significance	**Medium (44)**	N/A
Status (positive or negative)	Negative	
Reversibility	The impact cannot be reversed since it is caused by the visual and physical nature of the construction	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To some degree, if the route is away from sensitive tourist receptors. The visual impact cannot be mitigated easily due to the appearance and dimensions of the power line.	
Mitigation: » Route the power line away from sensitive tourist receptors or out of the line of sight where possible.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Vredendal-Bitterfontein railway line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Comparative Assessment Statement

Alternative 1 is nominated as the preferred option with regards to reducing tourism-related nature and scenery impacts as a result of visual impacts associated with a power line. Alternative 1 with sub-alternative 1a is acceptable. Alternative 2 is least favoured.

8.3.8. Potential Impacts on the Social Environment

All alternatives traverse privately-owned land. The majority of these properties are utilised for small livestock grazing or cultivation activities.

The closest dwellings to Alternative 1 are located approximately 2 km from the proposed route (Skilpadvlei and Kommandokraal). The closest settlement is Koekenaap (approximately 3 km). In addition to the properties affected by Alternative 1, sub-Alternative 1a traverses cultivated land on (an) agricultural smallholding(s) immediately north of Keerweder.

The number of directly affected landowners associated with Alternative 2 is considerably more than Alternative 1 as the properties are typically smaller in extent closer to the towns, settlements and the Olifants River floodplain. Alternative 2 passes close to smallholdings on the Skaapvlei road, the town of Koekenaap, and also cuts across a number of smallholdings and farms along the 15 km stretch between Koekenaap and Liebendal railway station. Alternative 2 also traverses land (in three places) that is either currently under cultivation, or has been under cultivation in the recent past. The total linear distance of the affected lands is in the region of ~3 km. Alternative 2 also passes within 800 m of the Koekenaap settlement and 500 m (or less) of the Uitkyk (Lutzville) residential area, and also passes in close proximity of an existing airstrip. It is not known whether the airstrip facility is registered and or currently in use.

The comparative assessment of Alternative 1 and 2 considers the following socio-economic factors:

- » **Number of properties and owners affected**. This has direct implications with regard to the number of people which may be adversely affected, as well as for the process required to negotiate compensation.
- » **The potential impacts on arable land and land under cultivation**. In this regard arable land and land under cultivation should were possible be avoided. Arable land is scarce in the study area and as such more valuable than grazing land. In addition, irrigation networks on cultivated land parcels may be disrupted, and the presence of power line infrastructure (towers) may impact on the movement of farm equipment. In comparison, impacts on land used for grazing will be minimal. The impact on grazing land will be further

reduced by the small width of the servitude (32 m) and ability to use the servitude after the natural vegetation has recovered from construction phase disturbances. The proponent, as part of their negotiations with landowners to purchase property, will undertake evaluation of the affected property by independent valuators.

» **Dwellings and residential areas** should be avoided as far as possible, mainly as a result of negative visual impacts. In addition, a power line is not permitted to pass over such infrastructure.

Power line Alternatives Social Impact Assessment Comparison

Criteria	**Alternative 1**	**Alternative 1a**	**Alternative 2**
Distance from dwellings	2km+ from dwellings on 2 properties	Passes within approximately 300 m of cluster of farm buildings – number of inhabited dwellings unknown	<1km from Skilpadvlei farmstead; Across Kommandokraal farmstead (2 inhabited dwellings)
Distance from settlements	~3km from Koekenaap	~2km from Koekenaap	<1km from Koekenaap; <500 m from Uitkyk
Arable/ cultivated land	Crosses none	Traverses approximately 500 m linear stretch of cultivated land north of Keerweder	Traverses approximately linear total of ~3 km in 3 distinct places
Impacts on private infrastructure	No significant	Potential impacts on irrigation infrastructure	In close proximity to private airstrip; Potential impacts on irrigation infrastructure

From the comparative assessment table above, it is concluded that **Alternative 1** is the preferred route from a social perspective, followed by Alternative 1a with Alternative 2 being the least preferred. In this regard Alternative 1 affects fewer properties, is located further away from farmhouses and settlements and impacts on land that is of lower value and supports less labour.

Nature: Impacts on the social environment: <u>Power line Alternative 1 (and 1a)</u>		
	Without mitigation	**With mitigation**
Extent	Local-Regional (4)	Local-Regional (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	

Can impacts be mitigated?	To a limited degree	
Mitigation: » Route the power line away from sensitive tourist receptors. » Final location of the power line within the 200m corridor and the location of the 30m wide servitude should be negotiated with the affected landowners.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Juno-Koekenaap power line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Nature: Impacts on the social environment: <u>Power line Alternative 1a</u>		
	Without mitigation	**With mitigation**
Extent	Local-Regional (4)	Local-Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To a limited extent	
Mitigation: » Route the power line away from sensitive tourist receptors. » Final location of the power line within the 200m corridor and the location of the 30m wide servitude should be negotiated with the affected landowners.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Juno-Koekenaap power line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

Nature: Impacts on the social environment: <u>Power line Alternative 2</u>		
	Without mitigation	**With mitigation**
Extent	Local-Regional (4)	Local-Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (4)	Minor (3)
Probability	Probable (3)	Probable (3)
Significance	**Medium (39)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	

Irreplaceable loss of resources?	No	
Can impacts be mitigated?	To a limited extent	
Mitigation: » Route the power line away from sensitive tourist receptors. » Final location of the power line within the 200m corridor and the location of the 30m wide servitude should be negotiated with the affected landowners.		
Cumulative Impacts: Impacts are likely, as the power line is associated with other linear infrastructure (i.e. the existing Vredendal-Bitterfontein railway line and Skaapvlei road) – this can be viewed as positive or negative, depending on the perspective of the viewer.		

The following mitigation measures should be considered for all alternatives under consideration:

» Minimal disturbance of natural vegetation during construction phase
» Consultation with affected land owners with regard to actual siting of servitude, power line towers and access routes (construction and maintenance)
» Consultation with affected land owners with regard to compensation mechanisms
» Consultation with affected land owners with regard to procedures to ensure that farming operations are not affected by maintenance visits (e.g. farm gates and gates between camps).

Comparative Assessment Statement

Alternative 1 is the preferred option from a social perspective. Alternative 1 affects fewer properties, is located further away from farmhouses and settlements and impacts on land that is of lower value and supports less labour. Alternative 1 with sub-alternative 1a is acceptable. Alternative 2 is least favoured.

8.3.9. Nomination of a Preferred Power Line Alternative

From the results of the specialist investigations, Alternative 1 is nominated as the preferred power line alternative by the majority of specialist findings. Alternative 1a is also considered to be acceptable, with Alternative 2 being the least preferred.

With the implementation of Alternative 1, an impact of very high significance on vegetation is anticipated in the area to the north of Koekenaap due to long-term to permanent loss of vegetation and habitat in quartz patches in this area. A power line through these highly sensitive quartz patches would cause significant and permanent damage in the form of plant loss due to crushing, and permanent habitat alteration. The fine covering of quartz pebbles is key to the habitat, and any heavy machinery severely disturbs this layer, effectively rendering the habitats unsuitable for these specialised plants for many decades after disturbance. Given that the quartz patches are fairly small and localised on a landscape scale, it is not considered acceptable to have infrastructure routed through them when they can be relatively easy to avoid. The significance of this impact is not off-set by the fact that an existing disturbance occurs in the form of the existing power line. New impacts would develop with the introduction of new power line infrastructure.

Therefore, in order to avoid the only Very High impact associated with the construction of the Juno-Wind Farm power line, it is proposed that **Alternative 1a** is nominated as the preferred alternative. This alternative still meets the acceptance level for environmental impacts, and will ensure that impacts are minimised to an acceptable level which can be managed through the implementation of an Environmental Management Plan.

8.4. Transportation Route Alternatives: for transportation of all components associated with the project to the site

The various transportation options (harbour, rail, air, road), as well as the possible routes associated with these options were assessed through the transportation study (refer Appendix Q).

At the time of writing this report, it is understood that majority of the wind turbine components (i.e. nacelles, towers and blades) will be imported. There is a possibility that some tower components may be manufactured 'locally' in the Western Cape, however this is yet to be determined. The transport routes between a "local" manufacturer and the transport routes included in this assessment report are unknown and cannot be assessed at this stage. The various transportation routes, location of harbours and airfields are depicted regionally in Figure 8.9.

From an assessment of the alternative transportation options, it has been concluded that only **road transport** is considered feasible for the transportation of wind turbine components. Certain construction plant and equipment could be transported by rail to Koekenaap and transported to site on low bed trucks or driven under own power. A summary of the assessment of transportation options is provided below (refer also to Appendix Q).

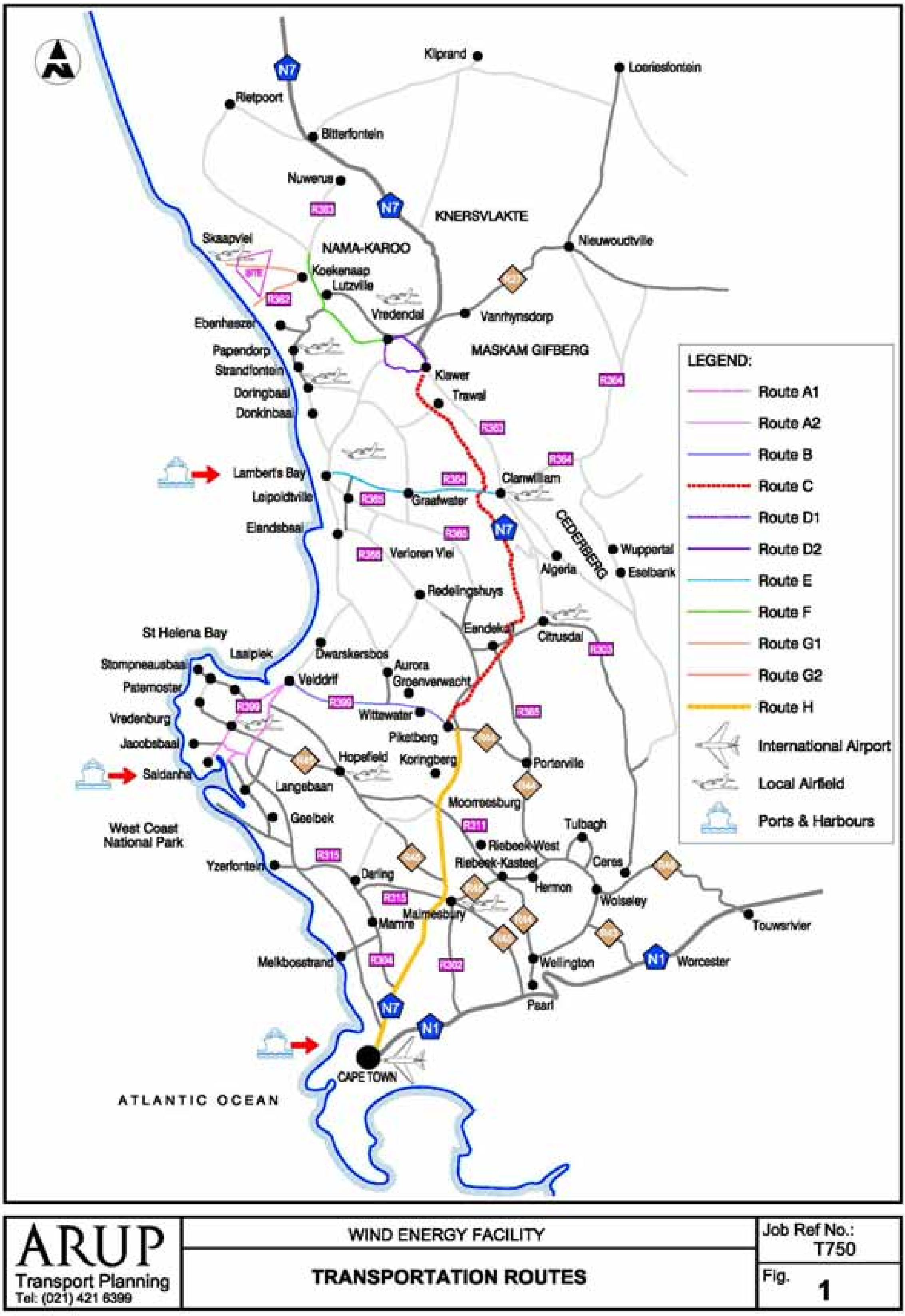


Figure 8.9: Transportation route map illustrating alternatives for the transportation of components to the facility site

8.4.1. Harbours

Three harbours were identified as possible entry points for the imported wind turbine components, namely Cape Town, Saldanha Bay and the fishing harbour at Lamberts Bay. Cape Town and Saldanha are both deep-water ports with heavy lifting equipment on the quayside. There has been no consultation with the port authorities regarding capacity during this assessment. Lamberts Bay would require further investigation to determine draught clearance on entry to the port and whether the lifting equipment within the harbour has the capacity to transfer the larger loads to road based transport vehicles. Abnormal vehicle access and the adequacy of the access roads to the harbour and the road network would also require careful evaluation by Eskom/transport contractor. For the purpose of this report, all harbours are assumed possible entry points and transport routes have been assessed between them and the proposed wind energy facility site.

8.4.2. Rail Transport

At a regional level, a rail network does exist between Cape Town, Saldanha Bay, Koekenaap, ending at Bitterfontein. The Saldanha - Sishen Iron Ore railway line runs from the Iron Ore terminal at Saldanha Bay, past Velddrif and follows the coastline until Standfontein where it swings north-east passing south of Lutzville on a north-east alignment. This is a purpose-built facility for transporting iron ore from the mines in Sishen to the export terminal at Saldanha Bay with no connection to the “local” rail network.

Spoornet[28] have revealed that the maximum load width is 3,302 m and maximum load height is 2,896 m. There is no rolling stock that can accommodate rigid 45 m long blade containers, the 20 m tower sections or the nacelles and hence rail cannot be used to transport wind turbine components. Certain construction plant and equipment could, however, be transported by rail to Koekenaap and transported to site on low bed tracks or driven under own power.

8.4.3. Air Fields and Air Transport

At a regional level, local airfields were identified from travel maps as well as the 1:50 000 topographical sheets. They are indicated at Skaapvlei (now disused), Vredendal, Papendorp, Dooringbaai, Lamberts Bay, Clanwilliam, Citrusdal, Malmesbury, Vredenburg, Langebaan AFB, Ysterplaat AFB, as well as Cape Town International Airport.

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[28] Telephonic consultation with Mr Dennis Shaw, a Spoornet official involved in authorising rail route clearances.

The possibility of a ship to shore load transfer of the wind turbine components between a bulk cargo carrier moored off-shore and the individual turbine sites was briefly explored. This benefit of this option, if feasible, would be to reduce the abnormal load impact on the road network. However the Sikorsky S-92 "Multi – Mission Helicopter", one of the largest commercial helicopters in the Sikorsky range can only lift a maximum of 4 536 kg external load. This capacity is far too small to be considered of any use in the transportation of wind turbine components. This is therefore not considered to be a feasible option.

8.4.4. Road Transport

The major components of the wind turbines are to be imported and will need to be transported from the port of entry to the site. All major road routes (including Trunk Roads, Proclaimed Main, Divisional Roads and the Saldanha-Sishen Railway line service/toll road) between the major harbours and the proposed site were driven and assessed visually for possible use as a haul routes for the transportation of the wind energy facility components.

» *Routes assessed in the Scoping Phase:*

  A comprehensive route assessment was undertaken for roads that would be preferred by the National, Provincial and Local Road Authorities. These routes are generally of a high standard and many of the structures have already been assessed for load bearing capacity and are already recognised transport routes for abnormal (heavy) loads.

  - N7 (Cape Town to Klawer)
  - R27 (West Coast Road, Cape Town to Velddrif), with possibly a diversion along Boundary Road – Koeberg Road and Blaauwberg Road in the Milnerton / Table View area for an super-load (GVM > 125 Ton)
  - R399 (Saldanha Bay to Picketburg)
  - R362 and/or R363 (Klawer to Vredendal)
  - R363 (Vredendal to Koekenaap)
  - Koekenaap to the site along the existing local surfaced and gravel access roads.

  Constraints and challenges (such as intersections, problematic geometric horizontal and vertical road alignment, cattle grids, level (road/rail) crossings, road related structures (portal culverts, structures over canals, bridges, retaining walls etc.) and low overhead services etc.) that may occur along the transport routes were identified from a desk-top assessment and from aerial photos. Specific authority requirements regarding the transportation of abnormal loads and any structures that may require further investigation along the proposed transport routes were identified through consultation with relevant officials of the South African National Roads Agency (SANRAL), Provincial Administration: Western Cape (Bridge Engineer and District

Engineer – Ceres), West Coast District Municipality and the City of Cape Town. These requirements and issue(s) requiring further investigation by Eskom (and the Companies tasked with the transportation of turbine components and construction plant and equipment) during the detailed design phase should that route be selected and permitted as the final haul route (or routes) are summarised within the specialist transportation report contained within Appendix Q. The Permit Issuing Authority for abnormal loads is the Provincial Administration: Western Cape.

» *Other Transportation Routes Assessed:*
During the public participation phase of the project, a number of concerns were raised regarding the significant number of large slow moving abnormal loads that will be necessary along the N7 during the construction phase of the project. There was a concern about the narrow section of N7, which has an approximately 6 m to 7 m wide asphalt surface between Citrusdal and Clanwilliam, and the difficulty motorists will experience passing these vehicles. For example, it is estimated that for each of the 50 wind turbine installations (Phase 1) there will be 6 abnormal load trips (4 trips for the ~20 m tower sections, 1 trip for the nacelle and 1 trip for the 3 x 45 m blades). These trips will be phased over the proposed 12 month construction phase which averages at approximately 1 load per day.

A visual assessment of other transportation route options parallel and to the west of the N7 was undertaken with the purpose of identifying whether alternative routes offer a viable alternative. A summary of the information gathered is provided in the specialist transportation report contained within Appendix Q. The routes considered within this study are generally deemed unsuitable for the hauling of abnormal loads and therefore no further detailed assessment was completed. Routes which could potentially be used do not form a logical link in the routing between origin and destination.

» *Conclusions and Recommendations*
Routes A, B, C, D (Option 1), F and G1 or Routes H, C, D (Option 1), F and G1 (refer to Figure 8.9) are the preferred transportation routes for the transport of components and equipment between Saldanha Bay and the site for a number of reasons.

* They are generally established abnormal load routes and the road pavements structures, bridges and culverts etc. have to some extent been designed to accommodate the abnormal loads. Using the other routes assessed are an option, but it will require an extensive investigation into the structural capacity of the pavement structure and numerous bridges and culverts, invoke numerous complaints from

residents along these routes, possibly already dealing with gravel roads in poor condition.

* These routes are generally all surfaced roads and in relatively good condition. The good riding quality of smooth surfaced roads (as opposed to uneven and corrugated surfaces of gravel roads) will ensure reduced wear and tear on the transport vehicles as well as ensure the wind energy facility components do not get damaged in transit.
* The transportation of the components will be phased over the construction period, estimated to be 24 months for the full facility and very dependant on the regularity of supply of the wind farm components (blades and nacelles) from international suppliers. With the components being dispatched from a holding area (assumed to be near one of the selected harbours) when required for installation on site. Establishing a large storage or holding area near the harbour will reduce/eliminate the need to construct a large storage area on site and hence the impact on the site, will be limited.
* Normal construction plant and equipment will either drive to site under their own power or be transported on low-beds. These are normally licensed vehicles do not need abnormal load permits. Many plant items will make a single trip to site and then be deployed in and around the site for the duration of the construction contract (minimum 12 months).
* These higher order roads are generally built with more generous road widths (sometimes with shoulders) and wider road reserves. The accommodation of abnormally long vehicles is likely to be easier with limited impact at intersections and temporary encroachment into corner properties.
* The extent of any road widening, intersection improvements associated with the transport routes has still to be determined but selecting the major roads will assist in limiting the associated impact.

Impact tables summarising the significance of transportation impacts (with and without mitigation)

Nature: Small Localised Improvements along the selected route between Cape Town and/or Saldanha Bay and the site Will most likely be road widening and corners at intersections, removal of traffic islands and replaced with road pavement structure, relocation of street furniture, installation of temporary support to culverts, bridges and canal crossings, vertical re-alignment of existing road to accommodate clearance of low-bed trailers and horizontal re-alignment of tight bends to accommodate 45 m blade trailers. Almost all of the works contemplated in this assessment will be within an existing road reserve with possible modifications to corner splays (fences) at intersections but generally the natural environment has already been impacted upon.		
	Without mitigation	**With mitigation**
Extent	Localised to the point where	N/A

	small scale modifications (1)	
Duration	Short- to medium-term (3)[29]	N/A
Magnitude	Minor (2)	N/A
Probability	Definite (5)	N/A
Significance	**Low (30)**	N/A
Status (positive or negative)	Negative on surfaced and gravel roads	
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » None		

Nature: Impacts on road surfaces

All the haul routes will be impacted upon by the abnormal wheel loads (specifically those with load limitations) and construction traffic. These vehicles will impart additional axle loading onto the existing road pavement structure. The structural capacity of the surfaced roads and un-surfaced gravel roads varies depending on the sub-soil conditions, sub-grade support material, and the thickness and quality of the materials making up the road pavement structure. The thickness of the existing road pavement layer(s), in-situ subgrade support and hence the structural strength of the road is unknown at this stage. The transportation of components and construction vehicles will have an impact on all roads along the proposed transport routes.

	Without mitigation	**With mitigation**
Extent	Regional (3)	N/A
Duration	Short-term (2-5 years) (2)	N/A
Magnitude	Minor (2)	N/A
Probability	Probable (5)	N/A
Significance	**Medium (35)**	N/A
Status (positive or negative)	Neutral[30]	Neutral
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impacts be mitigated?	N/A	
Mitigation: » It is recommended that Eskom obtain the current road inspection assessments from		

[29] Dependent on the modification under consideration

[30] There will be insignificant impact on roads that are designated abnormal load haul routes. There may be the need for minor modifications to intersections (very localised road widening, generally within the road reserve and accommodation of services, possibly supporting existing structures e.g. portal culverts, bridges, etc).

the Provincial Administration and confirm a "Status Quo" condition rating of the proclaimed main roads in and around the Koekenaap, Lutzville and Vredendal area that are going to be affected by the construction works.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 9

Eskom Holdings Limited is proposing to establish a commercial wind energy electricity generation facility on a site in the Western Cape Province. It is proposed for a cluster of up to **100 wind turbines** (typically described as a wind energy facility) to be constructed over an area of less than 20 km^2 in extent. An area of 37 km^2 in extent was identified for investigation, with an anticipated impact on an area of ~25 km^2. On review of the available layout of the facility, an effective area in the order of **16 km^2** could potentially be impacted upon.

The construction and commissioning of the facility is proposed to be implemented in **two phases**, with the first commissioned phase of the project planned to generate in the order of 100 MW (that is, approximately fifty 2 MW industry standard turbines). The second phase would comprise the remaining fifty turbines (the total facility not exceeding 100 turbines). The generating capacity of the facility will be dictated by the choice of turbine (a current industry standard of 2 MW turbines has been assumed at this time).

The three primary components of the project (i.e. areas of activity) include the following:

» A **Wind Energy Facility** including up to 100 wind turbine generator units, a substation, underground electrical cabling between turbines and the substation, internal access roads, and an office building and visitors centre at the facility entrance.
» Overhead **power lines** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» Upgrading activities to the existing Divisional Road 2225 (known as Skaapvlei road) to provide access to the site (i.e. act as a **haul road** during the construction phase) from the R363 main tarred road at Koekenaap.

Through a regional assessment site identification and selection process, Eskom were guided to site/locate their proposed wind energy facility within an area/zone of preference in terms of environmental and planning criteria, and delineated boundaries for a larger site with the best potential from a wind resource perspective coupled with the consideration of the results from the environmental and planning criteria.

An area ~37 km^2 in extent falling within the Matzikama Local Municipality and the WCMA01 on the West Coast was identified by Eskom as being potentially suitable for wind energy development. This area comprises the following farms:

» Portion 5 of the farm Gravewaterkop 158 (known as Skaapvlei)
» A portion of Portion 620 of the farm Olifants River Settlement (known as Skilpadvlei)
» A portion of Portion 617 of the farm Olifants River Settlement (known as Nooitgedag)

The environmental impact assessment (EIA) for the proposed Wind Energy Facility has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

The EIA Phase aimed to achieve the following:

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

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

9.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices G - Q provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the EIA process by providing a holistic evaluation of the most important environmental impacts identified through the process. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental consultants during the course of the EIA and presents an informed opinion of the proposed project.

The most significant environmental impacts associated with the proposed project, as identified through the EIA, include:

» Visual impacts on the natural scenic resources of the region imposed by the components of the facility.
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the overhead power line between Juno Substation and the Wind Energy Facility substation.
» Impacts associated with the transportation of components to the site during the construction phase.
» Impacts on the social environment.

9.1.1. Visual Impacts associated with the Wind Energy Facility and associated Infrastructure

The most significant impact associated with the proposed wind energy facility and associated infrastructure is the visual impact on the natural scenic resources of this region imposed by the components of the facility. Potentially uninterrupted exposure of the facility is largely contained within the 25 km buffer zone of the site. The majority of potentially uninterrupted exposure occurs within the 0 – 10 km zone.

Visibility beyond the 25 km mark becomes scattered and broken and ultimately negligible as it nears the 50 km buffer distance. From such a distance, visibility, even on a perfectly clear day, could theoretically be possible although highly unlikely to constitute a negative visual impact. In practical terms, this rationale implies that although the facility may potentially be visible (due to the flat terrain and the low visual absorption capacity of the natural vegetation) from sections of the N7 national road (50 km away), it would be difficult to distinguish the facility within the larger landscape.

The natural and relatively unspoiled wide-open views surrounding the wind energy facility and power line corridor will be transformed for the entire operational lifespan (approximately 30 years) of the facility. The primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape. The functional design of the structures and the dimensions of the facility cannot be changed in order to reduce visual impacts. Alternative colour schemes (i.e. painting the turbines sky-blue, grey or darker shades of white) are not permissible as the CAA's Marking of Obstacles expressly states, "*Wind turbines shall be painted bright white to provide the maximum daytime conspicuousness*". Failure to adhere to the prescribed colour specifications will result in the fitting of supplementary daytime lighting to the wind turbines, once again aggravating the visual impact. The potential for mitigation is therefore low or non-existent.

The mitigation of secondary visual impacts, such as security and functional lighting, construction activities, etc. may be possible and should be implemented and maintained on an on-going basis.

9.1.2. Local Site-specific Impacts

A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 37 km^2 was originally considered for the facility, with the anticipation that an area of ~25 km^2 would be required for the placement of the required infrastructure within this broader site. From the results of the facility layout determination exercise, it is now apparent that the effective area required to accommodate the infrastructure is in fact approximately 15.6 km^2 in extent (this amounts to approximately 42% of the total 37 km^2 site earmarked for development). The bulk of this effective area required for the facility footprint would not suffer any level of disturbance as a result of the required activities on site.

Permanently affected areas comprise 100 turbine footprints (100 foundation areas of 15 m x 15 m in extent), access roads (6 m in width), a substation footprint (80 m x 80 m in extent) and a visitor's centre (~1 000 m^2 under roof and parking). The area of permanent disturbance is as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
100 turbine footprints (each 15 m x 15 m)	40 000
Permanent access roads (excluding Skaapvlei road which is an existing permanent feature bisecting the site) and power line footprints (parallel to permanent access road)	210 000
Substation footprint (80 m x 80 m)	6 400
Visitors centre building and parking areas	1 000
TOTAL	**257 400** (of a total area of 37 001 985) = 0.7% of site

Temporarily affected areas comprise laydown areas for turbines (each laydown area with a footprint of 40 m x 40 m) as well as a track of an additional 8 m in width for the crawler crane to move across the site (i.e. an additional 8 m width to the permanent road of 6 m in width). The 33 kV cabling to connect the turbines to the substation is to make use of the disturbed area travelled over by the crane. An approximately 1 m wide trench would be excavated, the cabling laid and the area rehabilitated. The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
100 turbine laydown areas	160 000
Temporary crane travel (8m) track adjacent to permanent access road PLUS trench for 33 kV cabling	280 000
TOTAL	**440 000** (of a total area of 37 001 985) = 1,2% of site

Therefore, a total area of 697 400 m^2 (i.e. almost 70 ha) can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to **less than 2%** of the total 3 700 ha area which will form part of the total wind energy facility site.

From the specialist investigations undertaken for the proposed wind energy facility development site, no absolute environmental 'no go' areas were identified. Nor were areas of regionally high or very high sensitivity identified.

The only area which can be considered as a 'no go' area for the construction of infrastructure (including turbines) is the portion of the site within the 95 m building restriction to the DR2225 (Skaapvlei road). In the case of a divisional road, any structure built should be 95 m away from the centre of the road. This could potentially affect **turbine positions 53 and 82**, as well the internal access road. Construction of infrastructure in this restricted zone would not be acceptable in terms of the Road Access Guideline. The opportunity for relocating these turbines within the disturbance corridor would be required to be investigated.

From an environmental perspective, potentially sensitive areas including the a) Short Strandveld and Namaqualand Sand Fynbos vegetation types, b) archaeological sites (with an approximate 30 m buffer for each site) as well as c) possible pans (with an approximate 50 m buffer) have been highlighted as being potentially affected by the facility. These areas are illustrated in Figure 9.1.

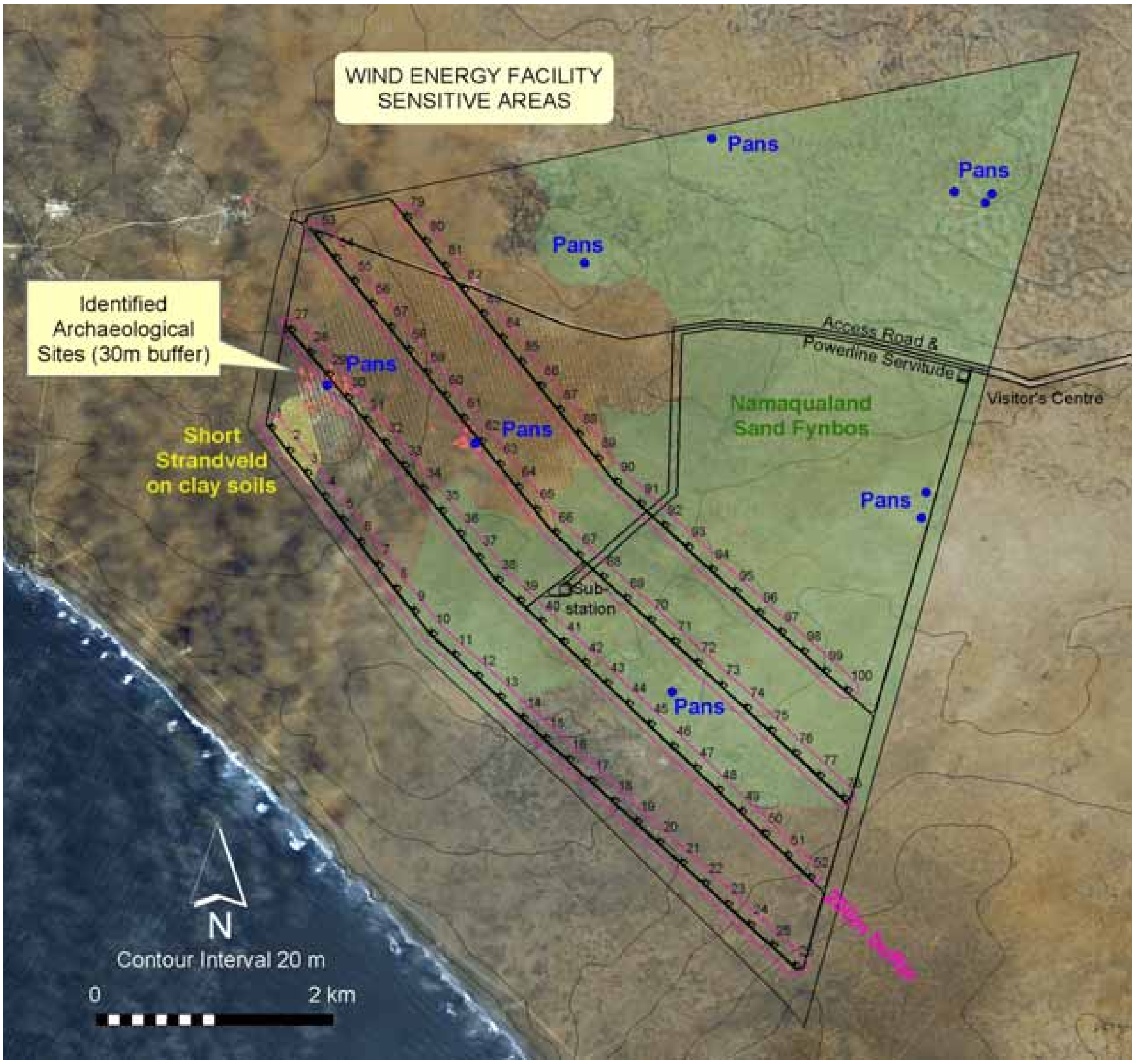

Figure 9.1: Identified potentially sensitive areas in relation to the Wind Energy Facility layout

The extent of the Namaqualand Sand Fynbos (Fynbos biome) vegetation type is illustrated in Figure 9.1 above. This vegetation type is listed as Least Threatened in the NSBA, with 98% remaining, and a conservation target of 29% (1% currently conserved). As at least one Red Data Book listed species was found in significant numbers in this area during the field survey, and as the habitat is regarded as more sensitive than the Dune Strandveld area from an erosion and regional botanical point of view, it is highlighted as an area of potential sensitivity for which due care is required. Therefore it has been highlighted on Figure 9.1 above, but is not considered a 'no-go' area. It is recommended that a Search and Rescue exercise should locate any Red Data Book listed species plants before development and remove them to secure areas.

The areas illustrated on Figure 9.1 above which should be avoided (where possible) or alternatively subject to intensive ground-truthing prior to construction works beginning are clustered to the western corner of the site. These areas include:

1. The high local sensitivity area (clay hill) in terms of vegetation at the western corner of the site. This area supports an unusual mix of species on heavier clay soils, including at least one Red Data Book listed species (*Leucoptera nodosa*).
2. Two small wetlands which may be located within 50 m of a turbine and/or internal access road.
3. A concentration of small shell middens recorded at each of two dried springs that were once waterholes with potable water. The value of the waterhole-related sites is that they represent two complete systems of occupation which are of scientific value in terms of their potential to provide information about the cultural affinities of the people who lived there, and the time depth of their occupancy of the area.

A zoomed-in image of the western portion of the site is provided in Figure 9.2 to illustrate the local/site specific areas of sensitivity in more detail.

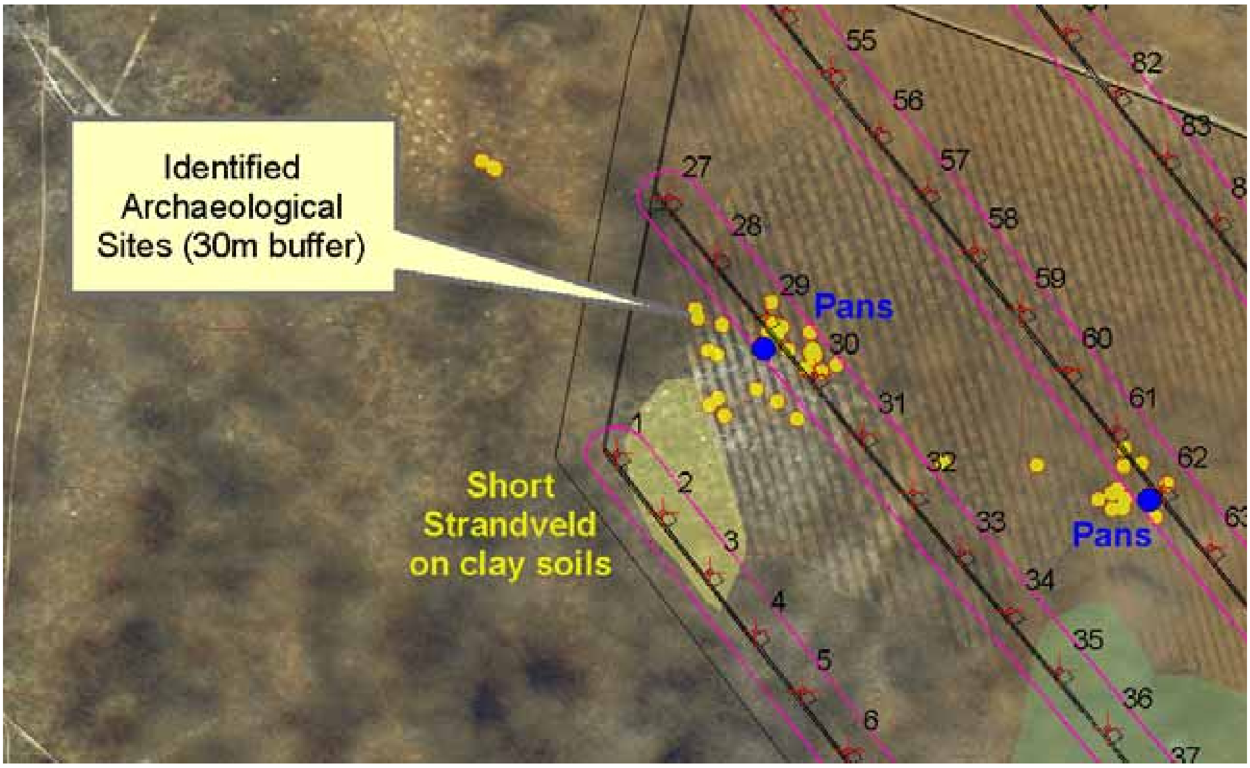

Figure 9.2: Identified potentially sensitive areas in relation to the Wind Energy Facility layout (200m 'impact corridor' illustrated in pink, turbine positions illustrated as a red X, laydown areas illustrated as a square adjacent to the X, and access roads as a solid line)

In order to minimise potential impacts during construction on these three potentially sensitive areas within the site, the following recommendations have been made:

1. The extent of the high local sensitivity area (clay hill) at the western corner of the site should be accurately defined through further field survey/ground-truthing. This will determine a) if the area can be effectively avoided through micro-siting relocation of the first three turbine positions (**turbine numbers 1-3**) and associated infrastructure within the impact corridor; b) the need for a suitably qualified botanist to position the turbines and infrastructure in this area with the least impact possible, and to plan a Search and Rescue program for any plants of concern that can be translocated; or c) if the turbine positions require total re-positioning within the turbine field/site to avoid the area completely (best practice requires avoidance of impacts). Although the placement of turbines and infrastructure in this area cannot be viewed as a fatal flaw, it is supported (from a botanical perspective) that the impact be avoided or minimised to an acceptable level.
2. In order to ensure adequate buffer areas (minimum of 50 m) around the wetlands/pans on the site, **turbine number 62** and associated access road (Row C) and the **access road within Row B** of turbines should be shifted at least 20 m and 10 m respectively within the impact corridor.
3. In order to minimise impacts on historical and archaeological heritage, a) a program of archaeological sampling of Late Stone Age archaeological sites of the two clusters of sites, and b) where possible, micro adjustment of turbine and road positions (**turbine numbers 29 and 30 in Row B; and turbine numbers 61 and 62 in Row C**) should be implemented. All sampling should be undertaken ahead of construction work at the affected sites. Eskom will need to apply for sampling permits from Heritage Western Cape. The permit application will need to be accompanied by detailed specifications of which sites are to be sampled, how large the samples will be, and how and where the sampled material will be stored (the NHRA requires indefinite institutional storage of all archaeological remains). The turn-around period for the issuing of permits is generally about 5 weeks and permits are usually valid for a period of a year but can be extended for a further 2 years if required. Once the archaeological sampling is completed, a permit for destruction of any remaining archaeological material on any of the development sites must be obtained from Heritage Western Cape.

Ideally, unvegetated and poorly vegetated aeolian dunes and sediments, which represent a higher erosion risk should be avoided for the siting of infrastructure, particularly the access road. In particular, the crests of dunes, which represent the most sensitive component of the landscape, should be avoided wherever possible.

In order to minimise direct impacts on the ecology of the site, infrastructure such as the substation and laydown areas should ideally be placed within the previously cultivated/disturbed area, where possible. The substation has been located in a central position between Rows B and C in order to facilitate the reduction in the length of the longest 33 kV cable between the turbines and substation. This site does not fall within this previously disturbed area. In consideration of the repositioning of this substation to this disturbed area to minimise ecological impacts, increased negative impacts to the social environment, including visual and lighting impacts on users of Skaapvlei road and on the residences at Skaapvlei, would be realised. Therefore, on balance of the technical, ecological and social considerations, the central location of the substation is considered acceptable.

However, in order to limit site-specific impacts on vegetation during the construction phase, it is recommended that a survey of all permanent, hard surface development footprints (i.e. all buildings, new roads, and turbine positions) be undertaken by suitably qualified botanist prior to the commencement of construction in order to identify and rescue any translocatable, selected succulents, shrubs and bulbs. All rescued plant species should be bagged (and cuttings taken where appropriate) and kept in an on-site nursery (if water can be provided; otherwise off-site) and should be returned to site once all construction is completed and rehabilitation of disturbed areas is required.

During operation of the facility, the threat of collision of avifauna with the turbine blades is the most concerning issue. However, the real extent of this threat is not currently well understood within the South African context. Unlike more problematic wind energy facilities identified in other parts of the world, the proposed wind energy facility is not positioned overly close to any known avian fly-ways, and does not otherwise impose on a particularly bird-rich environment, so it is **unlikely** to result in significant numbers of avian casualties through collision with the turbine blades, or cause undue loss of habitat or disturbance to any locally, regionally or nationally important bird populations. However, it is *essential* that the bird interactions which do take place with the establishment of the facility are fully documented, and that every opportunity to learn about birds and their interactions with wind energy facilities in the South African environment is fully exploited. To this end, the initiation of a comprehensive pre-and-post commissioning monitoring programme, and a longer-term scheme for surveying bird movements in relation to the wind energy facility and fully documenting all collision casualties, is considered critical. Such a monitoring programme will also inform and refine any post-construction mitigation of impacts which might ultimately be required.

9.1.3. Impacts Associated with the Power Line between Juno Substation and the Wind Energy Facility Substation

A double circuit 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal), a distance of approximately 40 km. Alternative routes/corridors for the 132 kV power line have been identified and assessed in the EIA phase (refer to Figure 9.3). The power line servitude options are proposed to follow other existing linear infrastructure (including roads and or other power lines) as closely as possible to consolidate linear infrastructure in the area, and to minimise the need for additional points of access.

From the results of the specialist investigations, Alternative 1 is nominated as the preferred power line alternative by the majority of specialist findings. Alternative 1a is also considered to be acceptable, with Alternative 2 being the least preferred.

One area of botanical sensitivity north of Koekenaap has been identified to be traversed by Alternative 1. This area comprises significant patches of Very High sensitivity vegetation, mostly in the form of Knersvlakte Quartz Vygieveld. With the implementation of Alternative 1, an impact of very high significance on vegetation is anticipated in this area due to long-term to permanent loss of vegetation and habitat in quartz patches in this area. A power line through these highly sensitive quartz patches would cause significant and permanent damage in the form of plant loss due to crushing, and permanent habitat alteration. The fine covering of quartz pebbles is key to the habitat, and any heavy machinery severely disturbs this layer, effectively rendering the habitats unsuitable for these specialised plants for many decades after disturbance. Given that the quartz patches are fairly small and localised on a landscape scale, it is not considered acceptable to have infrastructure routed through them when they are relatively easy to avoid (and activities that may negatively impact on the habitat/ecological functioning of habitats that may contain a unique signature of species e.g. quartz patches are also not supported by CapeNature). The significance of this impact is not off-set by the fact that an existing disturbance occurs in the form of the existing power line. New impacts would develop with the introduction of new power line infrastructure.

Therefore, in order to avoid the only Very High impact associated with the construction of the Juno-Wind Farm power line, it is proposed that **Alternative 1 with sub-alternative 1a** is nominated as the preferred alternative. This alternative still meets the acceptance level for all identified environmental impacts, and will ensure that impacts are minimised to an acceptable level which can be managed through the implementation of an Environmental Management Plan (EMP).

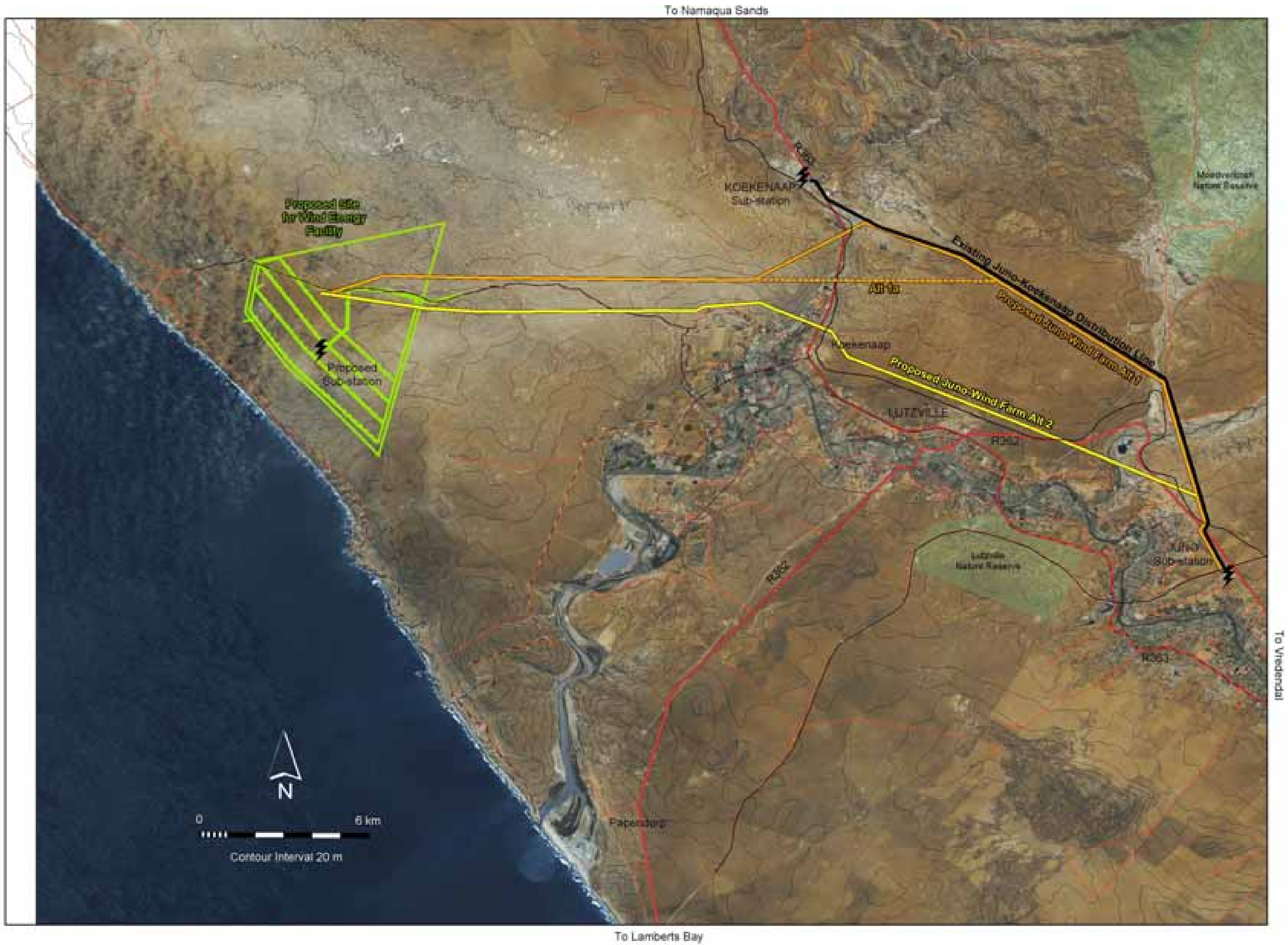

Figure 9.3: Alternative power line corridors 1 (and 1a) and 2 identified for consideration in the EIA process

9.1.4. Impacts Associated with the Transportation of Components to the Site during the Construction Phase

Potential impacts associated with transportation and access relate to works within the site boundary (i.e. the wind energy facility and ancillary infrastructure) and works external works outside the site boundary (i.e. road reconstruction/rehabilitation (e.g. Skaapvlei Road), widening intersections, protection/accommodation of existing Eskom, Telkom and other municipal services, protection of existing road related structures etc.).

During construction, the access and internal service roads must be upgraded/constructed to support 15 ton axle loads to support the abnormal loads delivering the nacelles, crawler crane and other components. Options to obtain suitable spoil material from sources such as the adjacent diamond mining concession area or from commercial sources (and transported to the site by trucks) are required to be investigated, and current indications are that the borrowed material from commercial sources will be sufficient. It is assumed existing commercial quarries have already been authorised and that material is available in the area. Should an appropriate source of material (or borrow pit) be required for borrow material, this would be required to be located and a mining permit obtained through the Department of Minerals and Energy (DME).

The crawler crane required for the erection of the wind turbines has a tracked width of 11 m when assembled. Within the wind energy facility development area, the crane lay down area, the operating platform and the service road area should be carefully planned and overlapped as much as practically possible in order to limit impacts on the surrounding area.

The additional construction traffic to the site has the potential to lead to premature failure of access roads, both surfaced and gravel, between the source and the site. The gravel roads may need regular grading to smooth out the surface, but may need to be re-gravelled after completion of the project to restore it to its former condition. A maintenance strategy for the project construction phase will need to be submitted to the satisfaction of the Provincial Governments, District Roads Engineer (DRE) for Skaapvlei road (DR2225). The formalisation of the main local access to an asphalt surface could be considered, provided the existing pavement structure is adequate. This will require further investigation by Eskom from both a technical and economic perspective, and will require a detailed pavement design. In addition, in order to mitigate the impact of turning construction traffic and other vehicles using the R363, it is recommended that the intersection (and possibly the first 800 m portion of the Skaapvlei Road (DR2225)) be reconstructed to a bituminous surfaced road. This would also assist in minimising the noise impact on the residents of the agricultural smallholdings adjacent to the Skaapvlei road who are situated close to the road.

Permits will be required to be obtained by Eskom for transporting all components to site. These permits are at the discretion of the Permit Issuing Authorities. The issue of these permits is a major consideration before addressing the physical capability of the transport companies to deliver these components.

9.1.5. Impacts on the Social Environment

The land surrounding the proposed facility is primarily undeveloped farmland that is very sparsely populated. The closest farm homesteads or residences to the proposed wind energy facility site are at Skaapvlei, Skilpadvlei and Nooitgedag. The distances between the proposed wind energy facility site and these residences are:

» Skaapvlei situated approximately 690 m west of the nearest turbine
» Nooitgedag situated approximately 2 816 m south east of the nearest turbine
» Skilpadvlei situated approximately 5 135 m east of the nearest turbine

Impacts on the social environment are expected during both the construction phase and the operational phase of the wind energy facility. Impacts are expected at both a local and regional scale. Impacts on the social environment as a result of the construction of the wind energy facility can be mitigated to impacts of low significance or can be enhanced to be of positive significance to the region.

On-site construction noise would not impact on any noise-sensitive land other than in the vicinity of Skaapvlei. No construction camp will be established on the site, and construction workers will be housed in neighbouring formal towns. Construction activities on the site will be restricted to day-light hours, and the construction phase is anticipated to extend for a minimum 24-month period.

Impacts on current and future agricultural activities are of potential concern. It is Eskom's intention to purchase the three properties which comprise the 37 km^2 area. The end use of the property will be primarily for electricity generation (the property would be re-zoned to industrial in order to accommodate the facility). The option of granting grazing rights to the affected farmers would be required to be considered by Eskom. However, given the long regeneration periods for disturbances to the natural vegetation it will take time for the areas disturbed by the construction activities to recover. This, combined with the low stock carrying capacity in the area (approximately 1 SSU/10 ha), will impact on the economic viability of the affected farms. It is recommended that an opinion from an agricultural-economist specialist be sought once the final footprint for the proposed wind energy facility is available in order to understand the impact on each of the affected farm owners, and to inform the negotiation process undertaken by Eskom with the affected landowners.

Impacts during the operation phase relate mainly to the visual impact imposed by the facility on the local environment (refer to Section 9.1.1 above). There will be no impact of outdoor noise emanating from the wind turbines during the operational phase at the nearest noise sensitive area (i.e. Skaapvlei) and at all other noise sensitive land. Low-frequency noise emanating from the turbines might have a low negative impact of low significance within dwellings at Skaapvlei.

The proposed wind energy facility could become a tourist attraction for the area, with benefits to the local tourism industry. The inclusion of a Renewable Energy Interpretation Centre (including weather-proof information boards) at the visitors centre is recommended. Such a facility could play a positive role in highlighting Eskom's leadership role and forward thinking in the area of renewable energy generation, while at the same time providing a much-needed major tourist attraction to the benefit of the area.

9.2. Overall Conclusion (Impact Statement)

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and exploitation of resources. The South African Government has set a 10-year cumulative target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This amounts to ~4% (1667 MW) of the total estimated electricity demand (41 539 MW) by 2013.

In responding to the growing electricity demand within South Africa, as well as the country's targets for renewable energy, Eskom has a drive to establish renewable forms of energy generation capacity and contribute to the targets published in the Renewable Energy White Paper. Through research, the viability of a wind energy facility has been established, and Eskom propose that a facility comprising up 100 wind energy turbines can be established on the identified site on the West Coast.

The positive implications of establishing a wind energy facility on the demarcated site within the Western Cape include:

» The project would assist Eskom or the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good wind energy resources at the site north of the Olifants River would be realised.

» The National electricity grid would benefit from the additional generated power (Eskom propose that up to at least 200 MW can be realised from the proposed facility on the West Coast (based on turbine technology choice).

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that there are **no environmental fatal flaws** that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. With reference to the information available at this planning approval stage in the project cycle, the **confidence** in the environmental assessment undertaken is regarded as **acceptable**.

The proposed power line alternatives are all considered to be acceptable from an environmental perspective, with **Alternative 1 with sub-alternative 1a** being considered as the preferred alternative and more appropriate for development in order to minimise impacts of unacceptably high significance on a botanically sensitive habitat.

9.3. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility, the findings of the EIA, and the understanding of the low significance level of potential environmental impacts, it is the opinion of the EIA project team that the environmental impacts associated with the application for the proposed wind energy facility and associated infrastructure can be mitigated to an acceptable level. The visual impact associated with the facility is the primary impact which cannot be significantly mitigated.

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

» As far as possible, wind turbines and associated laydown areas and access roads which could potentially impact on sensitive areas should be shifted within the impact corridor in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» Power line Alternative 1 with sub-alternative 1a must be adopted in order to minimise impacts of unacceptably high significance on vegetation.
» The extent of upgrading of the Skaapvlei road (DR2225) be determined to ensure a durable haul route for the duration of the construction phase, and

for the road to remain in a similar (or better) condition upon completion of the construction phase.

» All mitigation measures detailed within this report and the specialist report contained within Appendices G to Q must be implemented.
» The Environmental Management Plan (EMP) as contained within Appendix S of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project. It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.
» Applications for all other relevant and required permits required to be obtained by Eskom be submitted. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to archaeological sites, disturbance of protected vegetation, and disturbance to any wetlands.

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