ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PROPOSED WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE ON SITE ON A SITE NORTH OF OYSTER BAY

EASTERN CAPE PROVINCE
(DEA Ref No: 12/12/20/1585)

FINAL FOR DEA REVIEW
November 2011

Prepared for:
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PROJECT DETAILS

DEAT Reference No.	:	12/12/20/1585
Title	:	Environmental Impact Assessment Process Final Environmental Impact Assessment Report: Proposed Wind Energy Facility and Associated Infrastructure on a site north of Oyster Bay, Eastern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Ravisha Ajodhapersadh & Jo-Anne Thomas
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Client	:	Renewable Energy Systems (RES) Southern Africa (Pty) Ltd
Report Status	:	Final Environmental Impact Assessment Report for DEA Review
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When used as a reference this report should be cited as: Savannah Environmental (2011) Final Environmental Impact Assessment Report: Proposed Wind Energy Facility and Associated Infrastructure on a site north of Oyster Bay, Eastern Cape Province, for RES SA (Pty) Ltd.

PURPOSE OF THE FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

RES Southern Africa (Pty) Ltd has undertaken an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of the proposed Wind Energy Facility on a site north of Oyster Bay, which is located in the Eastern Cape Province. RES Southern Africa (Pty) Ltd has appointed Savannah Environmental, as independent environmental consultants, to undertake the EIA. The EIA process was undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Final 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** describes the activities associated with the project (project scope).
» **Chapter 3** This chapter describes wind energy as a power option and provides insight to technologies for wind turbines
» **Chapter 4** outlines the regulatory and legal context of the EIA study
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken
» **Chapter 6** describes the existing biophysical and socio-economic environment
» **Chapter 7**describes the assessment of environmental impacts associated with the proposed wind energy facility
» **Chapter 8** presents the conclusions of the impact assessment as well as an impact statement
» **Chapter 9** contains a list references for the EIA report and specialist reports

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

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

PUBLIC REVIEW OF THE DRAFT EIA REPORT

The draft Environmental Impact Assessment Report was made available for review and comment by Interested and Affected Parties (I&APs) and stakeholders at the following public places in the project area from 14 September 2011 – 14 October 2011:

» Oyster Bay Library
» Humansdorp Public Library
» St Francis Bay Library

The report is also made available electronically on:
» www.res-sa.com (follow the link to Our Projects)
» www.savannahSA.com/projects

PUBLIC FEEDBACK MEETING

In order to facilitate comments on the draft EIA report and provide feedback on the findings of the EIA study undertaken, a public feedback meeting was held as follows:

Date: 20 September 2011
Time: 18:00 - 20:00
Venue: Oyster Bay Community Hall

PROJECT / EIA INFORMATION LIST – DEA & LEGAL REQUIREMENTS

According to the requirements of the DEA, sites, technical and environmental information on the proposed project are to be included in this EIA report or appended to these reports.

1. General Site

No.	Information	Provided / Reference
1.1	Descriptions of all affected farm portions	Refer to Chapter 1 of this report.
1.2	21 digit Surveyor General codes of all affected farm portions	Refer to Chapter 1 of this report.
1.3	Copies of deeds of all affected farm portions	Attached to Appendix Q
1.4	Photos of areas that give a visual perspective of all parts of the site	Refer to Chapter 6 of this report for photographs of the site and surrounds.
1.5	Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)	
1.6	Turbine design specifications including: * Nacelle height * Blade length * Turbine shaft dimensions * Foundation dimensions * Laydown area dimensions (construction period and thereafter) * Blade rotation direction * Generation capacity	Refer to Chapter 2
1.7	Generation capacity of the facility as a whole at delivery points	Up to 160 MW

2. Site maps and GIS information

No.	Information	Provided
2.1	All maps/information layers must also be provided in ESRI Shapefile format	Contained in the CD version of this report to DEA
2.2	All affected farm portions must be indicated	Refer to Figure 2.1 and 2.2 of this report – locality maps
2.3	The exact site of the application must be indicated (the areas that will be occupied by the application)	Refer to Figure 2.1 and 2.2 of this report – locality maps
2.4	A status quo map/layer must be provided that includes the following: Current use of the land on site including:	Refer to Appendix P for land-use map.
	2.4.1 Buildings and other structures	
	2.4.2 Agricultural fields	
	2.4.3 Grazing areas	
	2.4.4 Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support areas	See Figure 7.3
	2.4.5 Critically endangered and endangered vegetation areas that occur on the site	Potential habitat shown in Figure 7.3
	2.4.6 Bare areas which may be susceptible to soil erosion	n/a
	2.4.7 Cultural historical sites and elements	Unknown & non identified at this stage
	2.4.8 Rivers, streams and water courses	See Figure 4.23 & 4.24
	2.4.9 Ridgelines and 20m continuous contours with height references in the GIS database	See Figure 4.4
	2.4.10 Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs	***n/a***
	2.4.11 High potential agricultural areas as defined by the Department of Agriculture, Forestry & Fisheries	See Figure 6.8
	2.4.12 Buffer zones (also where it is dictated by elements outside the site): * 500m from any irrigated agricultural land * 1km from residential areas * Indicate isolated residential, tourism facilities on or within 1km of the site	* No infrastructure in located on any irrigated agricultural land * The site is 6 km north of Oyster Bay * See Figure 6.6.

	2.4.13 A slope analysis map / layer that include the following slope ranges: less than 8% slope between 8% and 12% slope between 12%and 14% slope steeper than 18 %slope	Refer to Appendix P for relief map.
	2.4.14 A map/layer that indicate locations of birds and' bats including roosting and foraging areas (specialist input required)	- Refer to Figure 6.24 for bird habitat - Bat location snot possible to map
2.5	A site development proposal map(s)/layer(s) that indicate:	Refer to Appendix P for A3 maps.
	2.5.1 Turbine positions	
	2.5.2 Foundation footprint	
	2.5.3 Permanent laydown area footprint	
	2.5.3 Construction period laydown footprint	
	2.5.4 Internal road indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible)	
	2.5.5 River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used	
	2.5.6 Substation (s) and/ transformer (s) sites including their entire footprint	
	2.5.7 Cable routes and trench dimensions (where they are not long internal roads)	
	2.5.8 Connection routes to the distribution / transmission network	
	2.5.9 Cut and fill areas along roads and at substation /transformer sites indicating the expected volume of each cut and fill	
	2.5.9 Borrow pits	
	2.5.10 Spoil heaps (temporary for topsoil & subsoil and permanently for excess material)	
	2.5.11 Buildings including accomodation	

3. Regional map and GIS information

No.	Information	Provided
3.1	All maps/information layers must also be provided in ESRI Shapefile format	Maps contained in the CD version of this report to DEA
3.2	The map/layer must cover an area of 20km around the site	Refer to Appendix P for A3 maps.
3.3	Indicate the following: * roads including their types (tarred or gravel) and category (national, provincial, local or private) * Railway lines and stations * Industrial areas * Harbours and airports * Electricity transmission and distribution lines and substations * Pipelines * Water sources to be utilizes during the construction and operational phases * Critical Biodiversity Areas and Ecological Support Areas * Critically Endangered and Endangered vegetation areas * Agricultural fields * Irrigated areas * An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams	**Refer to Appendix P – Project maps**

4. Content of EIA Report in terms of NEMA EIA Regulations

NEMA REGULATION 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS SCOPING REPORT
(a) details of— (i) the EAP who prepared the report; and (ii) the expertise of the EAP to carry out an environmental impact assessment;	Section 1.4
(b) a detailed description of the proposed activity	Chapter 2 and Chapter 3
(c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is— (i) a linear activity, a description of the route of the activity; or (ii) an ocean-based activity, the coordinates where the activity is to be undertaken	Section 1.1
(d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	Chapter 6
(e) details of the public participation process conducted in terms of subregulation (1), including— (i) steps undertaken in accordance with the plan of study; (ii) a list of persons, organisations and organs of state that were registered as interested and affected parties; (iii) a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and (iv) copies of any representations and comments received from registered interested and affected parties	Section 5.3.2 and Section 5.3.7
(f) a description of the need and desirability of the proposed activity;	Chapter 3
(g) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 2.4
(h) an indication of the methodology used in determining the significance of potential environmental impacts	Chapter 5

NEMA REGULATION 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS SCOPING REPORT
(i) a description and comparative assessment of all alternatives identified during the environmental impact assessment process	Chapter 7 and Section 8.3
(j) a summary of the findings and recommendations of any specialist report or report on a specialised process	Section 8.2
(k) a summary of the issues raised by interested and affected parties, the date of receipt of and the response of the EAP to those issues	See Appendix E, to be updated for Final EIA report to DEA
(i) a description of the need and desirability of the proposed activity	Chapter 3
(j) a description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity	Section 2.4
(k) a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures	Chapter 7
(l) an assessment of each identified potentially significant impact, including— (i) cumulative impacts; (ii) the nature of the impact; (iii) the extent and duration of the impact; (iv) the probability of the impact occurring; (v) the degree to which the impact can be reversed; (vi) the degree to which the impact may cause irreplaceable loss of resources; and (vii) the degree to which the impact can be mitigated	Chapter 7 and Section 7.9
(m) a description of any assumptions, uncertainties and gaps in knowledge	Section 5.3.6
(n) a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 8.5
(o) an environmental impact statement which contains— (i) a summary of the key findings of the environmental impact assessment; and (ii) a comparative assessment of the positive and	Section 8.4

NEMA REGULATION 543, SECTION 31 REQUIREMENTS FOR THE CONTENT OF ENVIRONMENTAL IMPACT ASSESSMENT REPORTS	CROSS REFERENCE IN THIS SCOPING REPORT
negative implications of the proposed activity and identified alternatives;	
(p) a draft environmental management programme containing the aspects contemplated in regulation 33	Appendix O
(q) copies of any specialist reports and reports on specialised processes complying with regulation 32	Appendix F - N
(r). any specific information that may be required by the competent authority.	See Page iii - ix

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Renewable Energy Systems (RES) Southern Africa (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located north approximately 6 km north of Oyster Bay in the Eastern Cape Province. The proposed development site is located within the Kouga Local Municipality.

The primary components of the project (i.e. areas of activity) include the following:

» A **wind energy facility** including wind turbine generator units as indicated in the **revised layout – Figure 8.2) which is nominated as the preferred option for implementation**. The facility would be operated as a single facility with each turbine being between 1,8MW and 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades between 45 to 55m long attached to the hub.
» Possibly small transformer outside each turbine tower, depending on the type of turbine deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
» Crane hard standings (approximately 60x 40m depending on turbine choice, crane choice and geotechnical considerations).
» Cabling between the components, laid approximately 1 m underground where feasible. In as far as possible, cabling will follow the internal access roads.
» Internal roads (approximately 5-6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» An on-site substation to facilitate the connection between the facility and the grid. Two options are being considered, namely:
  * Option 1: the B04 and
  * Option 2: KromRivier Intake/Switching Substation

  This proposed substation will have a high-voltage (HV) yard footprint of approximately 120m x 120m.
» A new 132kV overhead power line to connect to Eskom's existing Melkhout (132kV) substation which is approximately 20km from the site. Three corridor options are under consideration for this power line
» **Operations and service building area** for control, maintenance and storage

(approximately 20 x 40m depending on turbine choice).

RES 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 Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA 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. The EIA Phase addressed those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. This final EIA Report has incorporated all issues and responses raised during the public review of the draft EIA Report prior to submission to the National Department of Environmental Affairs (DEA).

The EIA Phase aimed to achieve the following:

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

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

The 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
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the substations and overhead power lines
» Impacts on the social environment.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.
» Based on the findings of the Social Impact Assessment, none of the landowners who stand to be directly affected by the proposed wind energy facility are opposed to the development, as they will benefit from the leasing of the land by RES SA. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures and recommendations listed in the report to address the potential negative impacts during the construction phase, specifically the presence of construction workers, should also be implemented.
» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. This is demonstrated through the development of the revised layout, as discussed in Section 8.6. 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 following conditions would be required to be included within an authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.

» The draft Environmental Management Plan (EMP) as contained within Appendix O 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.

» RES to continue with the long-term bird monitoring programme already commenced with in order to understand the nature of impacts on avifauna due to wind energy facilities on the site and in South Africa. Pre-construction bird monitoring should continue for a 12-month period as planned, to establish an adequate baseline for comparative purposes. Pre-construction and post-construction monitoring is implemented any accepted or endorsed bird monitoring guidelines or standard.

» The power line should be marked with Double Loop Bird Flight Diverters on the earth wire of the line, 5m apart, and alternating black and white to mitigate against impacts on birds.

» Quarterly noise monitoring should be conducted an acoustic consultant for the first year of operation. This monitoring is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured at a 10 meter height. These samples should be collected when the Wind Turbines are operational. Quarterly monitoring is recommended at NSD32 and one in the vicinity of NSD31 for the first year, as well as any other NSDs that have complained to the developer regarding noise originating from the facility.

» Should the layout (or type of wind turbines used) change significantly during the final design, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.

» The final location of the wind turbines and associated infrastructure within identified sensitive areas (if any) must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMP to be compiled for the project.

» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.

» Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
» An on-going monitoring programme should be established to detect and quantify any alien species. During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
» A comprehensive storm water management plan should be compiled for the substation footprints prior to construction.
» Applications for all other relevant and required permits if required to be obtained by RES SA must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any riparian vegetation or wetlands.

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APPENDIX LIST

ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DEA	National Department of Environmental Affairs
DEDEA	Eastern Cape Department of Economic Development and Environmental Affairs
DMR	Department of Mineral Resources
DOT	Department of Transport
DWA	Department of Water Affairs
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
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
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework
SIA	Social Impact Assessment
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 activities 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).

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.

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

Renewable Energy Systems (RES) Southern Africa (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure (referred to as the **Oyster Bay Wind Energy Facility**) on a site located north of Oyster Bay in the Eastern Cape Province. Based on pre-feasibility analysis and site identification processes undertaken by RES, a favourable area has been identified for consideration and evaluation as per the requirements of an Environmental Impact Assessment (EIA).

The nature and extent of this facility, as well as potential environmental impacts associated with the construction and operation of a facility of this nature are assessed in this Draft Environmental Impact Assessment (EIA) Report. This EIA Report consists of the following sections:

» **Chapter 1** provides background to the proposed Wind Energy Facility project and the environmental impact assessment
» **Chapter 2** describes the activities associated with the project (project scope).
» **Chapter 3** This chapter describes wind energy as a power option and provides insight to technologies for wind turbines
» **Chapter 4** outlines the regulatory and legal context of the EIA study
» **Chapter 5** outlines the process which was followed during the EIA Phase of the project, including the consultation program that was undertaken
» **Chapter 6** describes the existing biophysical and socio-economic environment
» **Chapter 7**describes the assessment of environmental impacts associated with the proposed wind energy facility
» **Chapter 8** presents the conclusions of the impact assessment as well as an impact statement
» **Chapter 9** contains a list references for the EIA report and specialist reports

1.1. Project Overview

RES Southern Africa is a renewable energy project developer based in Cape Town. It is part of the RES Group, one of the world's leading renewable energy developers working across the globe to develop, construct and operate projects that contribute to the goal of a sustainable future. RES has been involved in the development, construction and operation of wind energy facilities for over 25 years and completed their first wind farm in 1992. RES has since constructed several thousand megawatts of wind energy capacity around the world.

In response to the need for renewable energy as part of the power generation mix identified by the South African government, RES Southern Africa is proposing the establishment of a commercial wind energy facility approximately 6 km north of Oyster Bay in the Eastern Cape Province. In terms of its specific location, the wind energy facility is proposed on the following farm portions (refer to Figure 1.1):

» Portion 3 of Farm Klein Rivier 713
» Portion 1, 2 , 3, 4 and the Remainder of Farm Rebok Rant 715
» Portion 1 and 3 of Farm Ou Werf 738
» Portion 5 of Farm Klippedrift 732
» Portion 10 and Portion 12 of Farm Kruis Fontein 681.

This proposed site is approximately 23km^2 in extent. Approximately 90% of the area under consideration for development will not be disturbed during the construction and operation of this project. The facility is proposed to have an energy producing capacity of up to 160 MW. Depending on the turbine type selected as preferred for the site, the facility could comprise up to 50 turbines of size 3MW each or up to 80 turbines of size 1.8MW each. The total permanent infrastructure associated with the facility would include:

» **Wind turbines** (between 80m – 120m hub height) and **concrete foundations** to support them.
» Possibly **small transformer** outside each turbine tower, depending on what make and model of turbine which is deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
» **Crane hard standings**.
» **Cabling** between the turbines, to be laid underground where practical.
» **Internal access roads** to each turbine.
» **Workshop area** for control, maintenance and storage.
» Temporary and permanent **wind monitoring masts** for calibration and site monitoring.
» Small **mast for telecommunications**
» An on-site **substation** to facilitate the connection between the wind energy facility and the grid.
» New overhead 132kV **power line** to connect to Eskom's existing Melkhout (132/66kV) substation, which is located approximately 20km north of the site

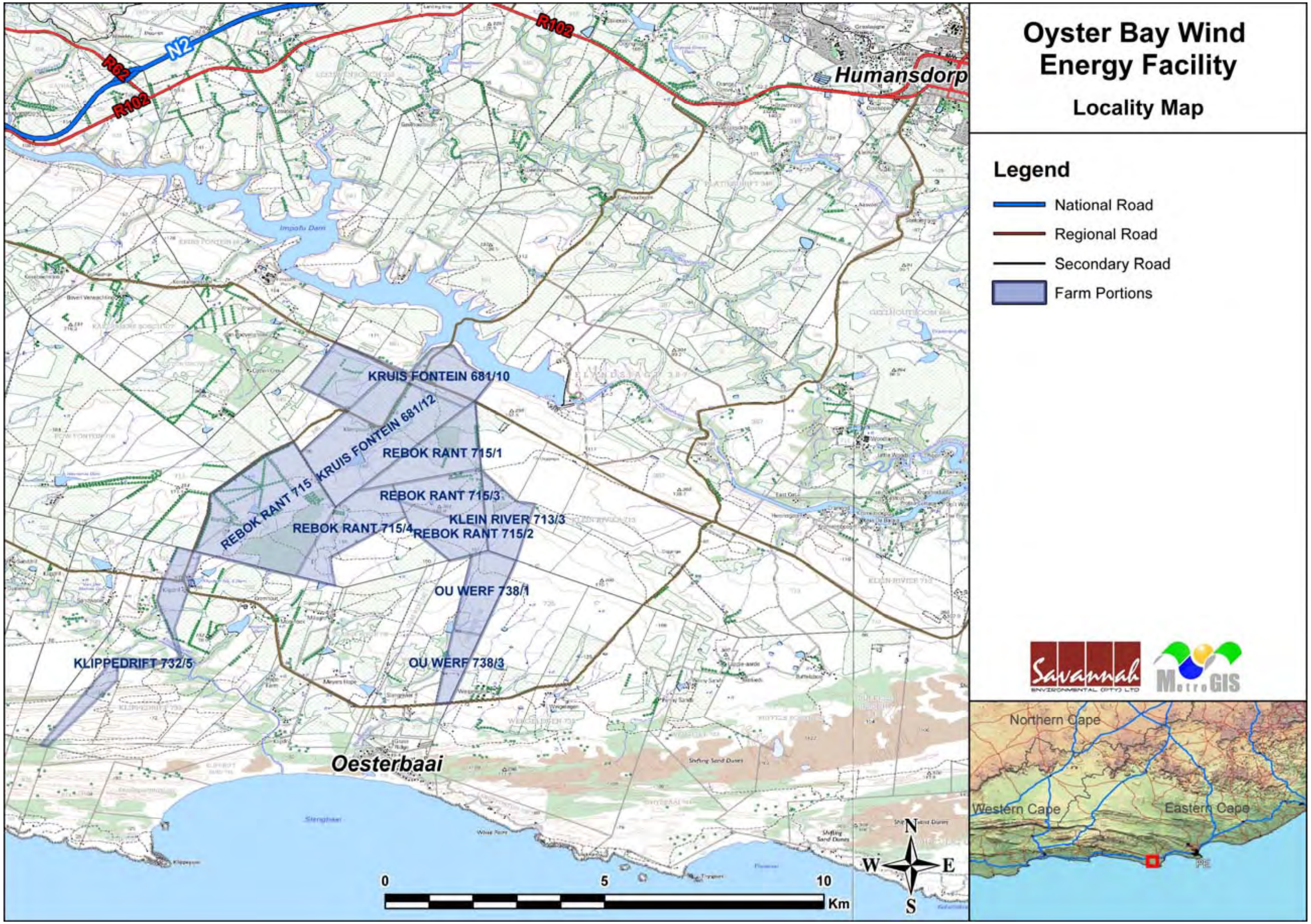

Figure 1.1: Locality map indicating the proposed development site

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**. **Local level environmental and planning issues** are being considered within **site-specific studies** and assessments through the EIA process in order to delineate areas of sensitivity within the broader site and ultimately inform the placement of the wind turbines and associated infrastructure on a site.

As the performance of the turbines is affected by disturbances to the wind resource, turbines must be appropriately spaced within the facility to minimise the potential for reduced turbine efficiency. A preliminary design for the wind turbines is considered within this EIA report. The exact positioning or detailed layout of the components of this proposed wind energy facility will be developed by taking cognisance of environmental sensitivities and mitigation measures identified through the EIA process. A final layout of the turbines within the facility would be prepared prior to construction.

The scope of the proposed Wind Energy Facility, including details of all elements of the project (for the construction, operation and decommissioning phases) is discussed in more detail in Chapter 2.

1.2. Requirement for an Environmental Impact Assessment Process

The proposed 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 (DEA) is the competent authority for this project. An application for authorisation has been accepted by the DEA (under Application Reference number **12/12/20/1585**). Through the decision-making process, the DEA will be supported by the Eastern Cape Department of Economic Development and Environmental Affairs (Eastern Cape DED&EA).

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. RES has 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[1], 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):

Number and date of the relevant notice	Activity No (s) (in terms of the relevant notice):	Description of listed activity from Regulations	Relevance of Regulation to Project
Government Notice R387 (21 April 2006)	1(a)(i)	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	Construction of a wind energy facility with a generating capacity of up to 160 MW.
Government Notice R387	1(l)	The construction of facilities or infrastructure, including	The construction of a power line with a capacity of

[1] Note that this EIA is being conducted in accordance EIA Regulations that were current at the time of submitting the Application for Authorisation (i.e. the EIA Regulations of April 2006). No additional listed activities in terms of the EIA Regulations promulgated in August 2010 are triggered by the proposed wind energy facility development. Therefore, no additional activities are required to be considered within this application.

Number and date of the relevant notice	Activity No (s) (in terms of the relevant notice):	Description of listed activity from Regulations	Relevance of Regulation to Project
(21 April 2006)		associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kV or more	132kV
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.	The construction of a wind energy facility and associated infrastructure in an area covering approximately 2300 Ha
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 National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004).	Removal of indigenous vegetation in an area in excess of 3 ha.
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 15m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles	Construction of telecommunication and wind monitoring masts
Government Notice R386	16(a)	The transformation of undeveloped, vacant or	The transformation of vacant land in excess of

Number and date of the relevant notice	Activity No (s) (in terms of the relevant notice):	Description of listed activity from Regulations	Relevance of Regulation to Project
(21 April 2006)		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.	1 ha to a wind energy facility.
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 30m long.	Access roads to each turbine will be required of up to 6m wide.
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 $30m^3$ but less than 1 $000m^3$ at any one location or site.	Storage of dangerous goods in containers
Government Notice R386 (21 April 2006)	13	The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.	Abstraction of ground water may be required for concrete batching.

1.3. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process refers to the process of identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project in order to identify and describe potential environmental impacts. The Scoping Phase included input from the project proponent, specialists with experience in the study area as well as in EIAs for similar projects, as well as a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

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

The release of the draft EIA Report provides stakeholders with an opportunity to verify the issues they have raised through the EIA process have been captured and adequately considered. This final EIA Report incorporates all issues and responses raised during the public review of the draft EIA Report prior to submission to DEA.

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

Savannah Environmental was contracted by RES Southern Africa as the independent environmental consultant to undertake both Scoping and EIA processes for the proposed project. Neither Savannah Environmental nor any its specialist sub-consultants on this project are subsidiaries of or are affiliated to RES Southern Africa. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing holistic environmental management services, including environmental impact assessments and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools. Savannah Environmental benefits from the pooled resources, diverse skills and experience in the environmental field held by its team.

The Savannah Environmental team have considerable experience in environmental impact assessments and environmental management, and have been actively involved in undertaking environmental studies, for a wide variety of projects throughout South Africa, including those associated with electricity generation.

The EAPs from Savannah Environmental who are responsible for this project are:

» Jo-Anne Thomas - a registered Professional Natural Scientist and holds a Master of Science degree. She has 13 year's experience consulting in the environmental field with a. Her key focus is on strategic environmental assessment and advice; management and co-ordination of environmental projects, which includes integration of environmental studies and environmental processes into larger engineering-based projects and ensuring compliance to legislation and guidelines; compliance reporting; the identification of environmental management solutions and mitigation/risk minimising measures; and strategy and guideline development. She is currently responsible for the project management of EIAs for several renewable energy projects across the country.
» Ravisha Ajodhapersadh – the principle author of this report, holds an Honours Bachelor of Science degree in Environmental Management and has more than 4 years' experience in environmental management. She is currently the responsible EAP for several renewable energy projects, other EIAs and environmental auditing across the country.

In order to adequately identify and assess potential environmental impacts associated with the proposed project, Savannah Environmental has appointed the following specialist sub-consultants to conduct specialist impact assessments:

» Ecology – David Hoare Consulting cc
» Geology – Outeniqua Geotechnical Services
» Agricultural potential & soils – TerraSoil Science
» Heritage Resources – Albany Museum
» Palaeontology - John Almond
» Noise – MENCO (M2 Environmental Connections cc)
» Visual – MetroGIS (Pty) Ltd
» Social – Tony Barbour
» Avifauna study – Chris van Rooyen
» Public Consultation – Sustainable Futures ZA

Refer to **Appendix A** for the curricula vitae for Savannah Environmental and the specialist sub-consultants team.

OVERVIEW OF THE PROPOSED PROJECT CHAPTER 2

Renewable Energy Systems (RES) Southern Africa (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located north approximately 6 km north of Oyster Bay in the Eastern Cape Province. The proposed development site is located within the Kouga Local Municipality.

This chapter provides details regarding the scope of the proposed wind energy facility, including all required elements of the project and necessary steps for the project to proceed. The scope of the project includes construction, operation and decommissioning activities. This chapter also explores wind energy as a power generation technology, as well as the alternative options pertaining to the proposed wind energy facility development, including the 'do nothing' option.

2.1. Description of the Proposed Wind Energy Facility

The wind energy facility was proposed to accommodate up to **80 wind turbines** but has now been reduced to **62 wind turbines** after feedback from the EIA specialist studies, appropriately spaced to make use of the wind resource on the site. The facility is proposed to have a generating capacity of up to 160 MW, depending on the final turbine selected for implementation. The facility would be operated as a single facility with each turbine being between 1,8MW and 3MW in capacity. Associated infrastructure proposed includes:

» Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades between 45 to 55m long attached to the hub.
» Possibly small transformer outside each turbine tower, depending on the type of turbine deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
» Crane hardstandings (approximately 60x 40m depending on turbine choice, crane choice and geotechnical considerations).
» Cabling between the components, laid approximately 1 m underground where feasible. In as far as possible, cabling will follow the internal access roads.
» Internal roads (approximately 5-6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» An on-site substation to facilitate the connection between the facility and the grid. Two options are being considered, namely:

- o Option 1: the B04 and
- o Option 2: KromRivier Intake/Switching Substation

This proposed substation will have a high-voltage (HV) yard footprint of approximately 120m x 120m.

» A new 132kV overhead power line to connect to Eskom's existing Melkhout (132kV) substation which is approximately 20km from the site. Three corridor options are under consideration for this power line

» **Workshop area** for control, maintenance and storage (approximately 20 x 40m depending on turbine choice).

A broader study area of ~23 km^2 in extent is being investigated within this EIA process within which the proposed wind energy facility is to be established. This area comprises the following farm portions:

» Portion 3 of Farm Klein Rivier 713
» Portion 1, 2 , 3, 4 and the Remainder of Farm Rebok Rant 715
» Portion 1 and 3 of Farm Ou Werf 738
» Portion 5 of Farm Klippedrift 732
» Portion 10 and Portion 12 of Farm Kruis Fontein 681.

2.2. The Purpose of the Proposed Project

Internationally there is increasing pressure on countries to increase their share of renewable energy generation due to concerns such as climate change and the on-going exploitation of resources. Grid connected renewable energy is currently the fastest growing sector in the global energy market. Installed global wind capacity was in the order of just more than 193GW by the end of 2010 (http://www.wwindea.org/home/images/stories/pdfs/main.swf). Targets for the promotion of renewable energy now exist in more than 58 countries, of which 13 are developing countries. As stated in the most recently available State of Environment Report of 2006 (Department of Environmental Affairs - http://soer.deat.gov.za/themes.aspx?m=406#) on Renewable Energy, South Africa has the following renewable generation capacity in Megawatts of electrical power (MWe):

» ~415 MWe from Biomass (this can be broken down as ~245 MWe from sugar refineries and ~170 MWe from pulp mills);
» 8MWe from Wind;
» Over 8MWe from Solar,
» 4,2MW biogas (PetroSA), and
» 661 MWe from Hydroelectricity.

In order to meet the long-term goal of a sustainable renewable energy industry, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation capacity being derived from renewable energy forms by 2030. This is, however, dependent on the assumed learning rates and associated cost reductions for renewable options.

The purpose of the proposed Oyster Bay wind energy facility is to add new capacity for generation of renewable energy to the national electricity supply, thereby aiding in achieving the government's goal as targeted within the IRP.

At a local level, the proposed project is in line with the Local Municipality goals for economic growth and development within the region as a result of the significant investment RES will make in the area, as well as through the possible employment and business opportunities for local communities. In addition, the project will generate an income through the sale of the electricity produced, which can supplement the income of the farms on which it is proposed to be located, and can be used to fund local community development projects.

It is considered therefore viable that long-term benefits for the community and/or society in general can be realised should the site identified by RES SA prove to be acceptable from a technical and environmental perspective for the potential establishment of a wind energy facility. In the event of a development such as the Wind Energy Facility north of Oyster Bay being developed, it will contribute to and strengthen the existing electricity grid for the region. In addition, the implementation of the proposed project will aid in achieving the goal of a 30% share of all new power generation being derived from independent power producers (IPPs), as targeted by the Department of Energy (DoE).

At national, regional and local levels, investment in renewable energy initiatives, such as the proposed wind energy facility, is supported. As South Africa is a signatory to the Kyoto Protocol, it is important that positive policy is enacted at the national level to encourage renewable energy development

2.3. Site Selection and Pre-Feasibility Analysis.

RES examined a shortlist of sites created from assessing the broader areas of the Northern, Western and Eastern Cape provinces. The shortlist was created by a high level review of predicted wind climate, proximity to grid, land availability, and minimum environmental, technical and engineering constraints.

With the experience of over 25 years of wind energy development, RES have fine-tuned their site assessment process and have created in-house specialised modelling techniques. RES applied this process to the shortlist and through comparison, selected the most favourable and feasible sites.

Therefore the site north of Oyster Bay was selected by RES for the development of a wind energy facility based on expert analysis of its predicted wind climate (high wind speeds), proximity in relation to the existing electricity grid, land availability, and minimum environmental, technical constraints from a construction and technical point of view.

From available data, RES SA considers the site to be feasible from a technical perspective for a wind energy facility development. On-site wind monitoring is currently underway from an 80 m wind monitoring masts in order to confirm the wind resource on site and inform the turbine selection process and final facility layout.

2.4. Project Alternatives

In accordance with the requirements of the EIA Regulations, project alternatives have been considered within the EIA process. These are detailed below.

2.4.1. Site Alternatives

No feasible site alternatives within this area of South Africa have been identified by RES, as the wind resource is a key factor for the siting of a wind project. One of the main constraining factors to considering alternatives is land availability.

2.4.2. Technology Alternatives

Following significant consideration of technology alternatives based on site characteristics it was determined by the developer that the site would only be suitable for a wind energy facility. This is largely due to the local topography which is unsuitable for the construction of a solar energy facility, but also due to the fact that the wind resource is considered more feasible to exploit compared to the solar resource in this area.

RES will be considering various wind turbine types in order to maximise the capacity of the site and the efficiency of the proposed facility. This selection will be based on the results of the on-site wind monitoring as well as on local on-site conditions. The turbines being considered for use at this wind energy facility will be between 1.8 MW and 3 MW in capacity. The turbines will have a hub height of between 80m – 120m, and a rotor diameter of between 80 – 112m (i.e. each blade up to a maximum 55 m in length). The technology provider has not yet been confirmed and will be decided after further wind analysis and a competitive tender process. Note that RES intend installing the same make and model (and size) of turbine across the whole site.

2.4.3. Layout Design Alternatives

Layout design alternatives include the consideration of alternative turbine positions within the broader 23km^2 area under investigation. Specialist software is available to assist developers in selecting the optimum position for each turbine. The overall aim of this process is to maximise electricity production through exposure to the wind resource, while minimising infrastructure, operation and maintenance costs, and social and environmental impacts. Preliminary turbine micro-siting information was provided by RES on the basis of preliminary on-site wind data and environmental sensitivities identified in the scoping study (refer to **Figure 2.1**).

In addition, alternative entrance options to the site, feasible sites for the on-site substation and access road alignments were provided to inform the specialist impact assessments. This layout was assessed by the specialists within this EIA report to determine the impacts such a facility would have on the environment. On the basis of the findings of the specialist studies, RES has revisited this preliminary layout and have provided a revised layout in order to minimise environmental impacts (refer to **Figure 2.2**). This alternative layout is comparatively assessed within this EIA report and a preferred alternative recommended.

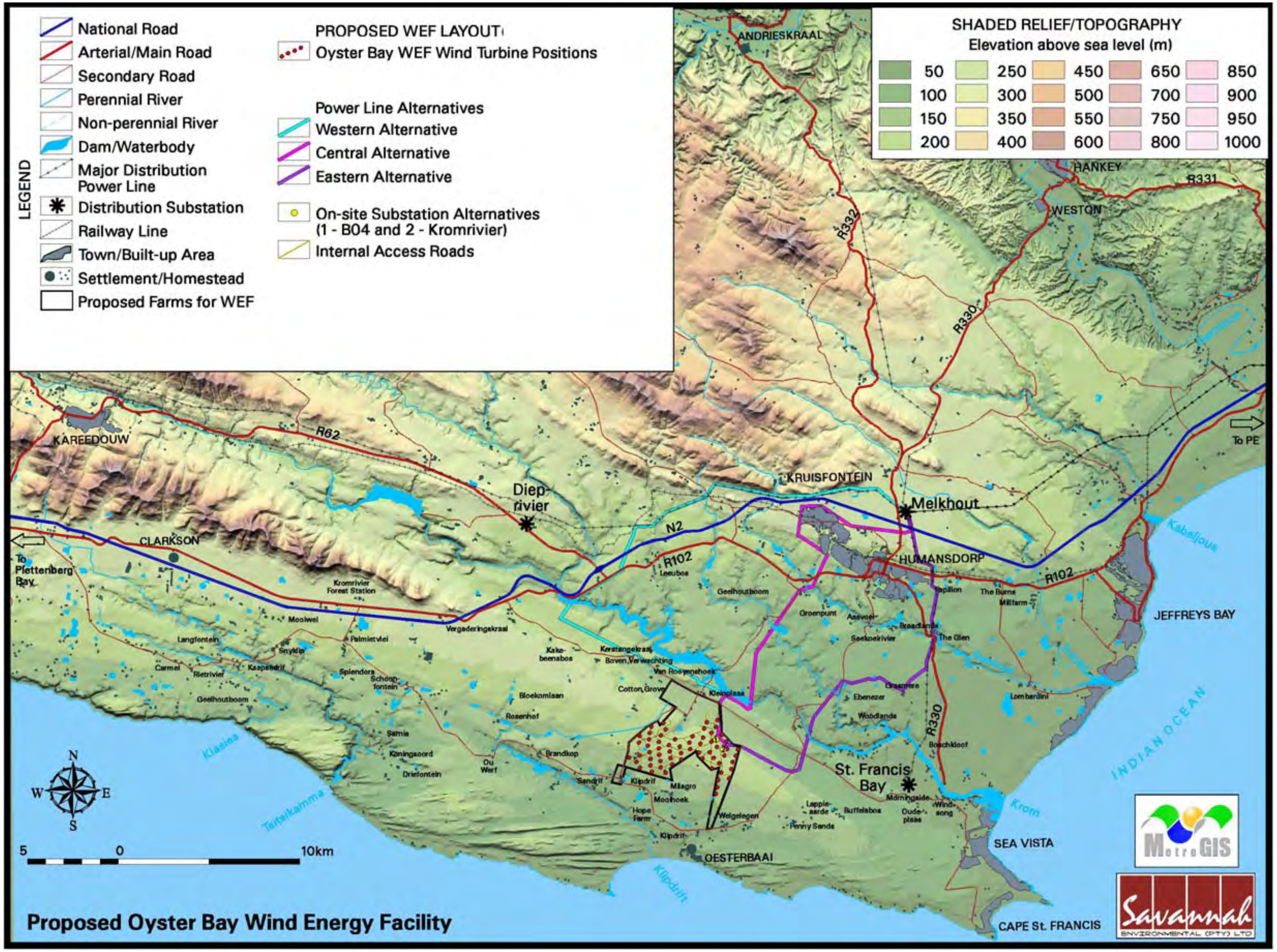

Figure 2.1: Preliminary layout of the wind energy facility, showing location of wind turbines, alternative power line corridors and substation locations

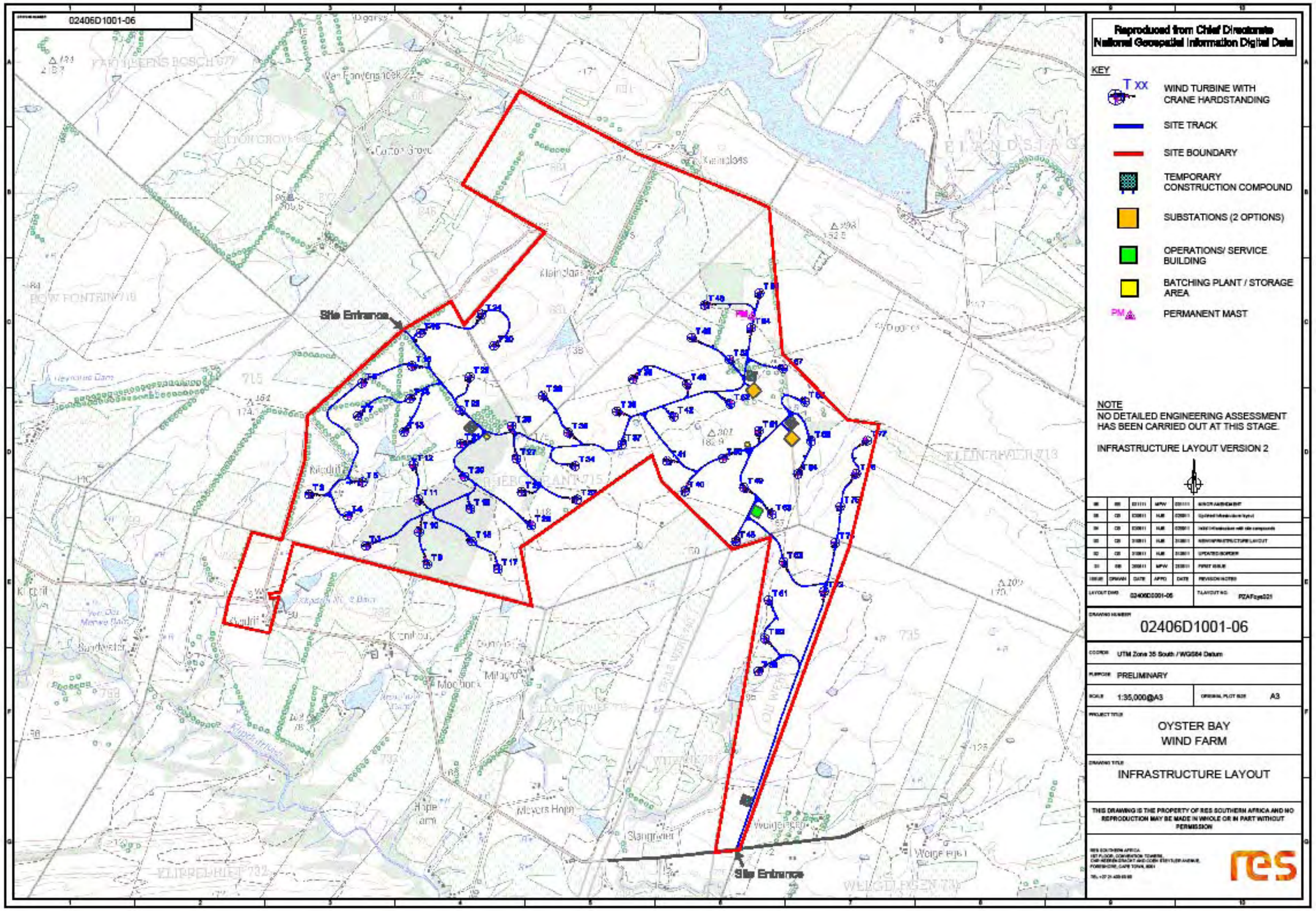

Figure 2.2: Revised layout of the wind energy facility (62 wind turbines)

2.4.4. Alternative Power line Corridors

Planning and design for the transmission of the power generated at the wind energy facility is being undertaken by RES in consultation with Eskom. The point of connection has been informed through understanding the local power requirements and the stability of the local electricity network, and will depend on the final grid connection agreement with Eskom[2]. A 132kV overhead power line will connect the on-site substation within the wind energy facility to the electricity distribution network/grid via Eskom's existing Melkhout Substation, which is located approximately 20km to the north east of the site. Alternative routes/corridors for the 132 kV power line have been proposed by RES, and have been comparatively assessed in this EIA report. These power line corridors are also shown in **Figure 2.1**. The three corridor options are under consideration for this power line includes:

- The **Western Corridor** option is approximately 38km in length. The route heads north along the eastern boundary of the site, crosses the ridge and turns north-west just before the Mpofu Dam. It follows the boundary of the water purification plant and aligns itself with the existing 22kV power line running north westward. It continues along the 22kV power line and crosses the upper reaches of the Mpofu Dam. The corridor then follows the R102 for approximately 2.8km turning north over the R102 and heads north-easterly to cross the N2. The corridor continues in a north easterly direction until it reaches the 66kV power line feeding into the Melkhout Substation. It then follows this 66kV power line alignment to the Melkhout Substation.
- The **Central Corridor** is approximately 26km in length. The route heads north along the Eastern boundary of the wind farm, crosses the ridge and turns south east just before the Mpofu Dam. It then heads towards the dam wall where it aligns itself with the proposed Eskom A-route from Thuyspunt to Melkhout Substation.
- The **Eastern Corridor** option is approximately 25km in length. The route heads south east, exiting the farm boundary until it reaches the proposed Eskom B-route from Thuyspunt to Melkhout Substation. It follows the Eskom route option north for approximately 5.5km then turns east towards the R330. At the R330 the line turns north and aligns itself with the existing 66kV power line. It follows this alignment to the Melkhout Substation.

[2] The government are currently in the process of establishing a Single buyers Office for IPP generated power. Once this entity is operational, they would become responsible for the issuing of Power Purchase Agreements and the purchase of the power from facilities such as that proposed.

2.4.5 Alternative locations of on-site substation

Two options are being considered for the on-site substation to facilitate the connection between the facility and the grid, namely:

» Option 1: the B04 and
» Option 2: KromRivier Intake/Switching Substation.

These substation locations are also shown in **Figure 2.1.**

2.4.6 Alternative Entrances to Wind Energy Facility Site

The wind energy facility site will be accessed via existing tar and gravel roads within the study area. Two alternative entrances to the site are proposed as follows (refer to **Figure 2.3**):

- An entrance to the south of the site along the R330 (tarred), via Humansdorp and St Francis Bay, a distance of approximately 33 km from the N2 (purple line on Figure 2.3).
- An entrance on the north-western side of the site along the R102 and then south east along the DR01765, a distance of approximately 23 km from the N2 (yellow line on **Figure 2.3**).

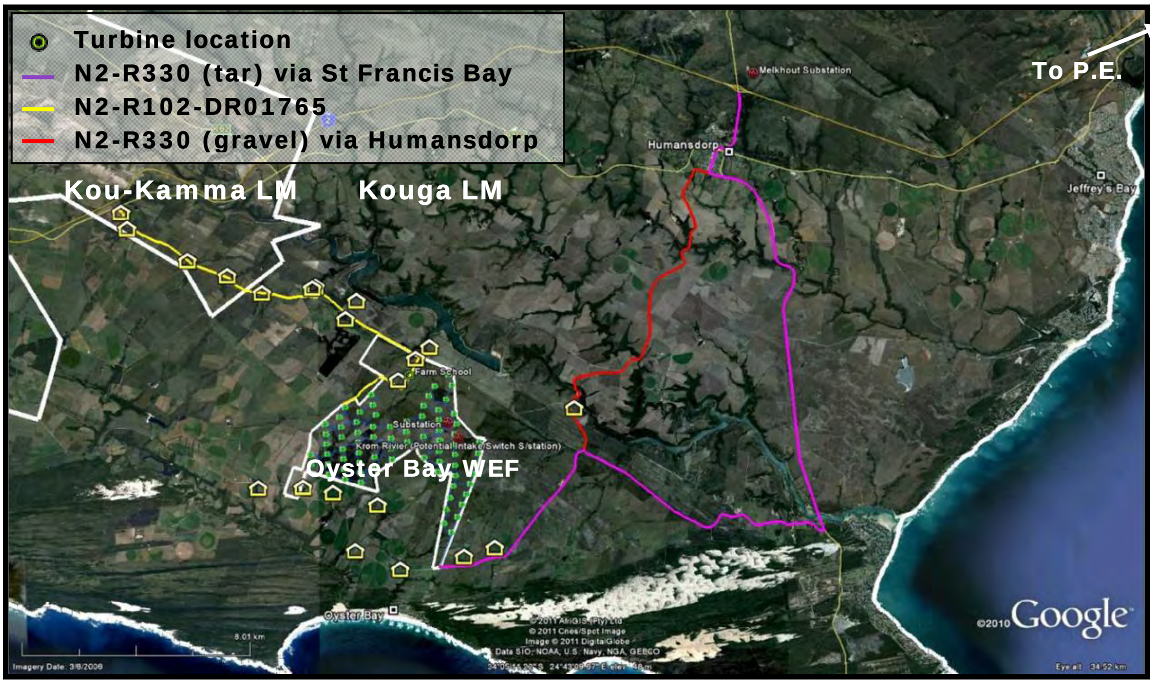

Figure 2.3: Access road from the N2 via the R330 and the R102

2.5 The 'do-nothing' Alternative

The 'do-nothing' alternative is the option of not constructing the Wind Energy Facility on the proposed site north of Oyster Bay. This alternative would result in no environmental impacts on the site or surrounding area. Should the wind project not be developed on the land, the land will continue to be used for grazing of cattle and / sheep/ dairy farming, a consumptive land-use.

The electricity demand in South Africa is placing increasing pressure on the country's existing power generation capacity. The need for the project is real. The demand for electricity in the country as a whole is expected to continue to increase. There is therefore a need for additional electricity generation options to be developed throughout the country. The decision to expand South Africa's electricity generation capacity, and the mix of generation technologies is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Energy (DoE), the National Energy Regulator of South Africa (NERSA) and Eskom Holdings Limited (as the primary electricity supplier in South Africa).

The 'do nothing' alternative will not assist the South African government in reaching their set targets for renewable energy. In addition, the following positive impacts from this specific project will not be realised:

» Job creation from the construction and operational phases
» Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
» Utilisation of clean, renewable energy in an area where it is optimally available.

Due to the lost opportunity, this is, therefore, not a preferred alternative.

WIND ENERGY AS A POWER GENERATION TECHNOLOGY CHAPTER 3

This chapter provides an overview of wind energy as a power generation technology, as well as details regarding construction, operation and decommissioning activities associated with the proposed wind energy facility.

3.1. Wind Energy as a Power Generation Technology

Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines. The use of wind for electricity generation is a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its lifecycle. Wind power consumes no fuel for continuing operation, and has no emissions directly related to electricity production.

Wind energy is one of the fastest growing electricity generating technologies and features in many energy plans worldwide. Operation does not produce carbon dioxide, sulphur dioxide, mercury, particulates, or any other type of air pollution, as do fossil fuel power sources.

Environmental pollution and the emission of CO_2 from the combustion of fossil fuels constitute a threat to the environment. The use of fossil fuels is reportedly responsible for ~70% of greenhouse gas emissions worldwide. The climate change challenge needs to include a shift in the way that energy is generated and consumed. Worldwide, many solutions for reducing emissions are being developed to reduce emissions. However, it is important to acknowledge that the more cost effective solution for increasing energy supply in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy is considered a ‘clean source of energy’ with the potential to contribute greatly to a more ecologically, socially and economically sustainable future. The challenge now is ensuring wind energy projects are able to meet all economic, social and environmental sustainability criteria.

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 energy facility (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 as it influences the turbulence over the site, and therefore the potential energy output. However, wind turbines can extract energy from any wind direction as the nacelle automatically turns to face the blades into the predominant wind direction at any point in time.

South Africa in general can be considered as having a moderate wind resource as compared to Northern Europe (Scandinavia), Great Britain and Ireland, New Zealand and Tasmania. 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).

The wind speed measurements taken at a particular site are affected by the local topography (extending to a few tens of kilometres from the mast) or surface roughness. This is why local on-site monitored wind speed data is so important for detailed wind energy facility design. 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.

A wind resource measurement and analysis programme is planned to provide measured data and a prediction of the facility’s expected energy production over its lifetime. The design (and micro-siting) of a wind energy facility is sensitive to the predominant wind directions and wind speeds 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.

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. Once a viable footprint for the establishment of the wind energy facility has been determined (through the consideration of both technical and environmental criteria), the micro-siting of the turbines on the site will be determined using industry standard software systems, which will automatically consider the spacing requirements.

3.2. How do wind turbines function

Wind turbines, like windmills, are mounted on a tower to capture the most energy. The kinetic energy of wind is used to turn a wind turbine to generate electricity. The wind is less turbulent and generally faster with an increase in height above the ground and the turbines can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Usually, two or three blades are mounted on a shaft to form a **rotor**. Generally a wind turbine consists of **three rotor blades** and a **nacelle** mounted at the top 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.

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 will have a hub height of between 80 m and 120 m, and a rotor diameter of up to 112 m (i.e. each blade up to maximum 55 m in length). These turbines would have a generating capacity of between 1.8 MW and 3 MW (in optimal wind conditions). Wind turbines can start generating at wind speed 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).

The capacity of the wind energy facility will depend on the wind turbine chosen by RES SA (turbine capacity and model that will be deemed most suitable for the site). Turbines of between 1.8 MW and 3 MW in capacity are being considered for the site. Initially, up to a maximum of 80 turbines were estimated for the site north of Oyster Bay however this has been revised down to 62 turbines following the results of the EIA specialist studies.

Other infrastructure associated with the facility includes internal service roads, an access road, power line and a substation (placed within the facility). The construction phase of the wind energy facility is dependent on the number of turbines erected and is estimated at one week per turbine, or in total approximately 24 months (including all infrastructure). The lifespan of the facility is approximated at 20 to 25 years.

3.2.1. Main Components of a Wind Turbine

The turbine consists of the following major components:

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

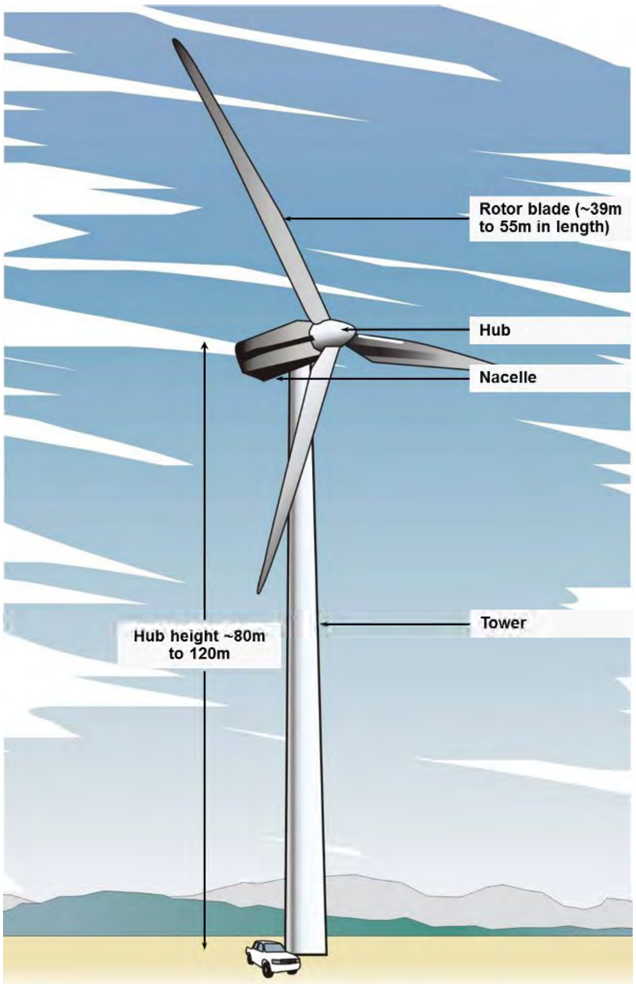

Figure 3.1: Illustration of the main components of a wind turbine

The Rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor comprises of three rotor blades (the approximate rotor diameter is in the range of 90m – 112m, and the length of blade is between 45m – 55m long). The rotor blades use the latest advances in aeronautical engineering materials science to maximise efficiency. The greater the number of turns of the rotor the more electricity is produced. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate about 15 to 28 revolutions per minute (rpm). The speed of rotation of the blades is controlled by turning the blades to face into the wind ('yaw control'), and changing 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.

The rotation of the rotor blades produces a characteristic 'swishing' sound as a blade passes 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 nacelle

The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction (as shown in Figure 3.2).

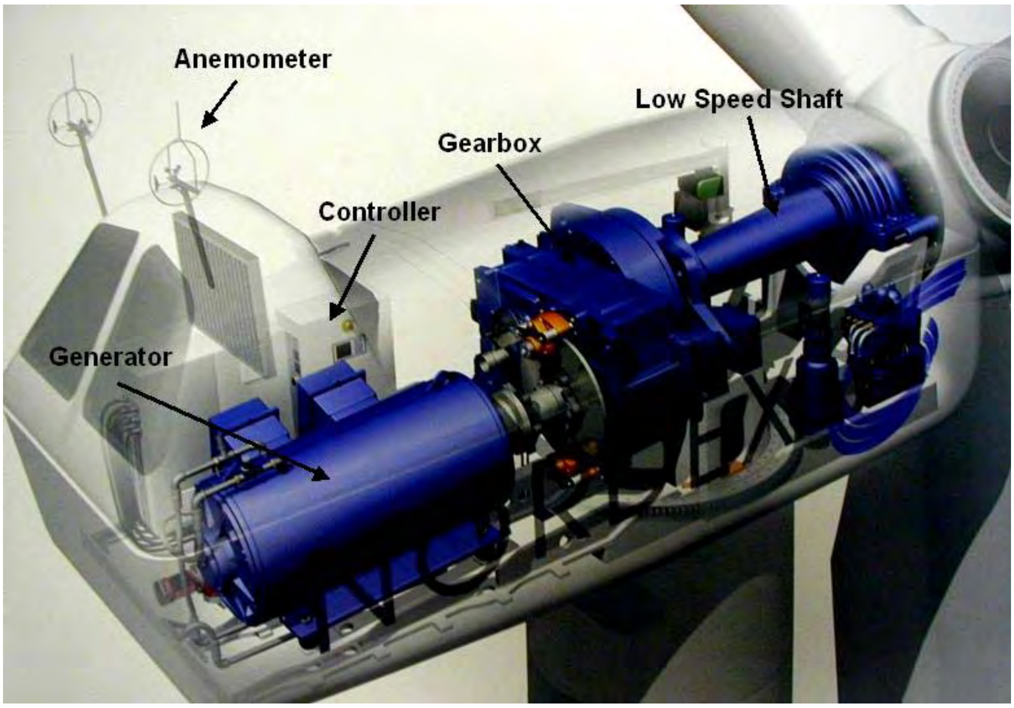

Figure 3.2: Detailed structure of a nacelle of a horizontal axis turbine

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 partly dependent on the length of the wind turbine's blades because more energy is captured by longer blades.

The tower

The tower is a hollow structure allowing access to the nacelle (between 80m and 120m in height). The height of the tower is a key factor in determining the amount of electricity a turbine can generate. Small transformers may occur outside each turbine tower, depending on what make and model of turbine is deemed most suitable for the site. Such a transformer would have its own foundation and housing around it. Alternatively, the transformer could be housed within the tower. The transformers convert the electricity to the correct voltage for transmission into the grid.

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

3.2.2. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a wind energy facility 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.

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. If the blades extracted 100% of the wind’s energy, a wind turbine would not work because the air, having given up all its energy, would entirely stop. So, if a blade were 100% efficient then it would extract 59% of the energy as this is the maximum (due to Betz law). In practice, the collection efficiency of a rotor is not 100%. A more typical efficiency is 35% to 45%. A complete wind energy system incurs losses through friction etc. and modern systems end up converting between 20-25% of the energy in the air into electricity which equates to 34-42% of the maximum (due to Betz Law).

However, because the energy in the air is free, describing how efficiently the energy is converted is only useful for system improvement and monitoring purposes. A more useful measurement is the Capacity Factor which is also represented as a percentage. The Capacity Factor % is calculated from the actual MWh output of electricity from the entire wind farm over 1 year divided by the nameplate maximum theoretical output for the same period. It therefore also takes wind resource, wind variability and system availability (downtime, maintenance and breakdowns) into account. RES Southern Africa projects have initial predictions for Capacity Factors of between 35-40%. This figure will be predicted more accurately when more on-site wind data has been recorded.

Wind turbines can be used as stand-alone applications, or they can be connected to a utility power grid. For utility-scale sources of wind energy, a large number of wind turbines are usually built close together to form a **wind energy facility.**

3.3. Project Construction Phase

The construction phase of the wind energy facility is dependent on the number of turbines to be erected, but can be estimated at 24 months. It is expected that the project will create approximately 200 temporary employment opportunities s over this period.

No on-site labour camps are envisaged. Construction workers will be accommodated in the nearby towns such as Oyster Bay and Humansdorp and transported to and from site on a daily basis. Overnight on-site worker presence would normally be limited to security staff.

Construction is envisaged to begin in 2013, provided that the project is approved by DEA, accepted by the DoE into the Independent Power Producer Procurement Programme, a generating license is issued by NERSA, and a Power Purchase Agreement secured with Eskom. In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The construction process is discussed in more detail below.

3.3.1. Conduct Surveys

Prior to initiating construction, a number of surveys will be required including, but not limited to, geotechnical survey, site survey and confirmation of the turbine micro-siting footprint, survey of substation site/s and survey of power line servitude to determine tower locations and all other associated infrastructure.

3.3.2. Establishment of Access Roads to the Site

The N2 (Port Elizabeth-Plettenberg Bay), the R102 (Port Elizabeth-Plettenberg Bay) to the north of the proposed site and the R330 (Humansdorp-St. Francis Bay) to the east of the proposed site are the main access points of entry to the site. Within the site itself, access will be required between the turbines for construction purposes (and later limited access for maintenance). Permanent internal roads require a minimum width of 5 m, although these may be up to 13m in width in places during the construction phase.

Special haul roads may need to be constructed to and within the site to accommodate abnormally loaded vehicle access and circulation. The internal service road alignment will be informed by the final micro-siting/positioning of the wind turbines. 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.

3.3.3. Undertake Site Preparation

Site preparation activities will include clearance of vegetation at the footprint of each turbine, establishment of laydown areas (refer to Section 3.3.4 below), the establishment of internal access roads and excavations for foundations. These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site. Figure 3.3 illustrates these areas.

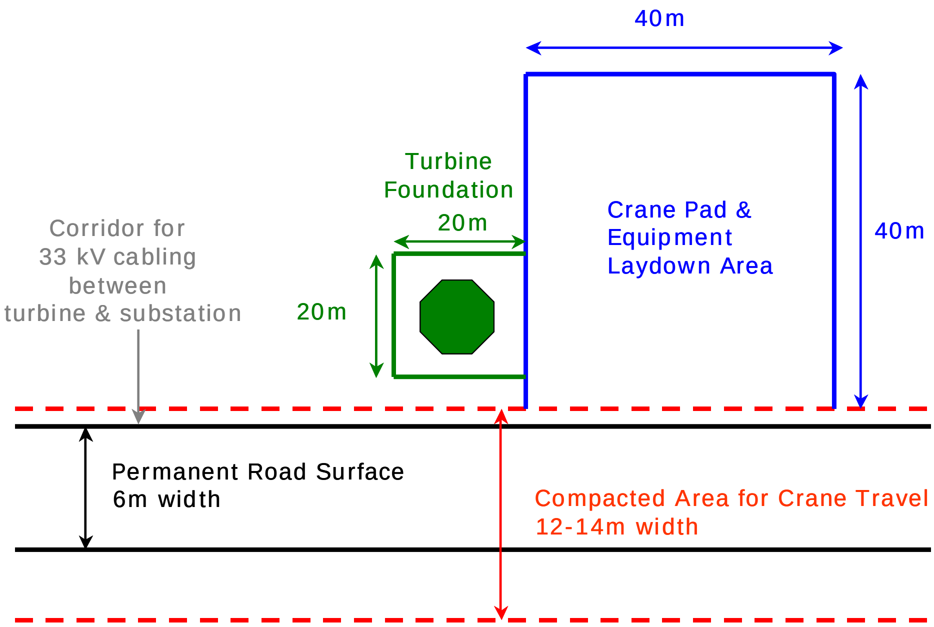

Figure 3.3: Diagrammatic representation of the proposed layout of the components

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).

3.3.4. Establishment of Laydown Areas on Site

Laydown areas will need to be established at each turbine position for the storage of wind turbine components. The laydown area will need to accommodate the cranes required in tower/turbine assembly. Laydown and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.

A large laydown area will be required at each position where the main lifting crane may be required to be erection and/or disassembled. Each turbine needs a flat and hardened lay-down area of 60 m x 40 m, needed during the construction process. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the lifting crane from all sides.

3.3.5. Establish Concrete Batching Plant/s

Approximately 300-500 cubic metres of concrete volume is required for one wind turbine foundation, depending on turbine type and ground conditions. Therefore concrete is one of the main raw materials required for the wind turbine. RES plan to develop a concrete batching plant on-site during construction. Concrete batching plants are where sand, gravel, cement and water are mixed into concrete which will be poured into the foundation of the wind turbine.

3.3.6. Construct Foundation

Concrete foundations will be constructed at each turbine location (as shown in Figures 3.5 – 3.8[3]). Turbine foundations will be up to 25m in diameter (octagonal shape), with the majority of this area being buried. The final re-instated foundation is the plinth with a diameter of up to 6.5m, onto which the turbine tower bolts on to. Foundation holes will be mechanically excavated to a depth of approximately 5m, depending on the underlying geotechnical conditions on site. The reinforced concrete foundation will be poured and support a mounting ring. The foundation will then be left up to a week to cure.

Figure 3.5: Construction of turbine foundation

[3] All photographs courtesy of RES. Photographs copyright of RES.

Figure 3.6: Construction of turbine foundation

Figure 3.7: Construction of turbine foundation

3.3.7. Transport of Components and Equipment to Site

The wind turbine, including the tower, will be brought on site by the turbine supplier in sections on flatbed trucks, as shown in Figure 3.8 (Photograph courtesy of RES. Photograph copyright of RES). Turbine units which must be transported to site consist of: the tower (in segments), nacelle, and three rotor blades.

Figure 3.8: Typical abnormal load for transportation of wind turbine components in segments

Approximately 470 - 500 abnormal load trips will be associated with the transport of turbine components onto site (i.e. 8-10 x trips per turbine depending on the type of turbine) over the entire construction period. These will include abnormally long loads associated with 40-55 m rigid turbine blades, as well as abnormally heavy loads associated with the 80-100 ton nacelles.

The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989)[4] by virtue of the dimensional limitations (abnormal length of the blades) and load limitations (i.e. the nacelle). In addition, components of various specialised construction and lifting equipment are required on site to erect the wind turbines and need to be transported to site. In addition to the specialised lifting equipment/cranes, 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, cement trucks, etc.).

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

The components required for the establishment of the substations (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 load during the construction phase (length/ height) may require alterations to the existing road infrastructure (e.g. widening on corners), accommodation of street furniture (e.g. street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (i.e. bridges, culverts, portal culverts, retaining walls etc.) as a result of abnormal loading.

The equipment will be transported to the site using appropriate National and Provincial roads, and the dedicated access/haul road to the site itself.

3.3.8. Erect Turbine

A large lifting crane will be brought on site. It will lift the tower sections into place (See Figure 3.9 and 3.10[5]).

Figure 3.9: Lifting of rotor blades during erection of turbine

[5] All photographs courtesy of RES. Photographs copyright of RES.

Figure 3.10: Lifting of rotor blades during erection of turbine

The nacelle, which contains the gearbox, generator and yawing mechanism, will then be 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. It will then be lifted 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 put it in place. It will take approximately 2 days to erect a single 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 lifting cranes may be required to move between the turbine sites. Crawler cranes are not necessarily required. 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 13 m in width to move on.

3.3.9. Construct Substations

One substation will be constructed within the site footprint. The turbines will be connected to the substation via underground cabling. The final position of the substation will be informed by the final micro-siting/positioning of the wind turbines. The layout of the turbines will determine the optimum position for the construction of a substation. The internal substation will be constructed with a high-voltage (HV) yard footprint of up to 120m x 120m.

The construction of the substations would require a survey of the site; site clearing and levelling and construction of access road/s to the substation sites (where required); construction of substation terrace and foundations; assembly, erection and installation of equipment (including transformers); connection of conductors to equipment; and rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Figure 3.11: Example of a typical 132kV substation

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.

3.3.10. Connection of Wind Turbines to the Substation

Each wind turbine will be connected to an optimally positioned substation on site 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. The underground cables will be planned to follow the internal access roads, as far as possible.

3.3.11. Establishment of Ancillary Infrastructure

A workshop as well as a contractor's equipment camp may also be required to be constructed. The establishment of these facilities/buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A laydown area for building materials and equipment associated with these buildings will also be required. An operations and maintenance facility, including a storage building (40 m x 20 m), security office and a car park area is proposed.

3.3.12. Connect Substation to Power Grid

The on-site 132 kV substation will connect to a 132kV power line (refer to Figure 3.12) that will in turn connect into the Eskom grid via the existing Melkhout substation (shown in Figure3.13). The authorised route for the power line will be assessed, surveyed and pegged prior to construction.

Figure 3.12: Example of the proposed 132 kV monopole power line tower type

Figure 3.13: Melkhout substation

3.3.13. Undertake Site Rehabilitation

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.

3.4. Project Operation Phase

Depending on various factors, power generation is envisaged to begin in 2014-15. Based on information provided by the proponent, the proposed WEF will employ approximately 45 full time and approximately 70 temporary employees over the 20-25 year operational phase of the project. It is anticipated that there will be full time security, maintenance and control room staff required on site.

Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, inclement weather conditions, maintenance activities or curtailment or constraining by Eskom. The wind turbine will be subject to periodic maintenance and inspection. Periodic oil changes will be required. Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.

3.5. Project Decommissioning Phase

The turbine infrastructure which will be utilised for the proposed Wind energy facility is expected to have a lifespan of approximately 20 - 25 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. 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.

3.5.1. Site Preparation

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

3.5.2. Disassemble and Remove Turbines

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.

Any decommissioning activities will be required to comply with the legislation relevant at the time.

REGULATORY AND LEGAL CONTEXT CHAPTER 4

4.1 Policy and Planning Context for Wind Energy Facility Development in South Africa

The need to expand electricity generation capacity in South Africa is based on **national policy** and informed by on-going strategic planning undertaken by the Department of Energy (DoE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as wind energy facilities is illustrated in Figure 4.1. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the proposed wind energy facility development.

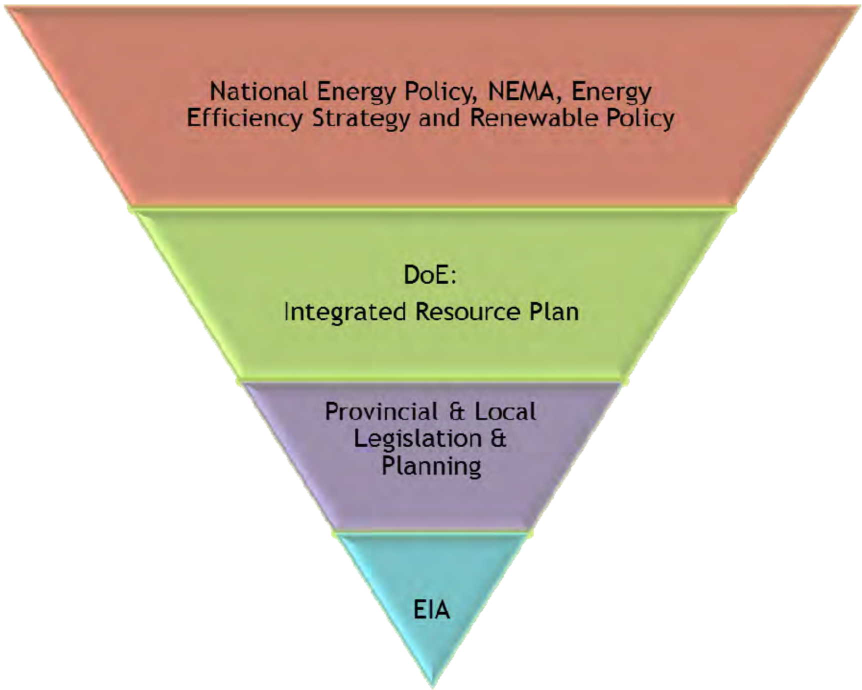

Figure 4.1: Hierarchy of electricity policy and planning documents

4.1.1 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 the then Department of Minerals and Energy (DME) in 1998. This White Paper identifies key objectives for energy supply within South Africa, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversity.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the White Paper on Energy Policy for South Africa. In this regard the document notes that government policy is based on an understanding that renewable energy sources have significant medium- and long-term commercial potential and can increasingly contribute towards a long-term sustainable energy future in South Africa. The support for renewable energy policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and ***wind*** and that renewable applications are in fact the least cost energy service in many cases; more so when social and environmental costs are taken into account.

4.1.2 Renewable Energy Policy in South Africa, 1998

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. 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. Government policy on renewable energy is therefore concerned with meeting economic, technical and other 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).

The White Paper on Renewable Energy states "*It is imperative for South Africa to supplement its existing energy supply with renewable energies to combat Global Climate Change which is having profound impacts on our planet. Wind energy is a clean, renewable resource and should be developed in South Africa on the basis of national policy as well as provincial and regional guidelines*."

4.1.3 Final Integrated Resource Plan, 2010 - 2030

The Energy Act of 2008 obligates the Minister of Energy to develop and publish an integrated resource plan for energy. Therefore, the Department of Energy (DoE), together with the National Energy Regulator of South Africa (NERSA) has compiled the Integrated Resource Plan (IRP) for the period 2010 to 2030. The objective of the IRP is to develop a sustainable electricity investment strategy for generation capacity and transmission infrastructure for South Africa over the next twenty years. The IRP is intended to:

» Improve the long term reliability of electricity supply through meeting adequacy criteria over and above keeping pace with economic growth and development;
» Ascertain South Africa's capacity investment needs for the medium term business planning environment;
» Consider environmental and other externality impacts and the effect of renewable energy technologies;
» Provide the framework for Ministerial determination of new generation capacity (inclusive of the required feasibility studies)

The objective of the IRP is to evaluate the security of supply, and determine the least-cost supply option by considering various demand side management and supply-side options. The IRP also aims to provide information on the opportunities for investment into new power generating projects.

The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010. The first and interim IRP was developed in 2009 by the Department of Energy. The initial four years of this plan was promulgated by the Minister of Energy on 31 December 2009, and updated on 29 January 2010. The Department of Energy released the Final IRP in March 2011, which was accepted by Parliament at the end of March. This Policy-Adjusted IRP is recommended for adoption by Cabinet and subsequent promulgation as the final IRP. In addition to all existing and committed power plants (including 10 GW committed coal), the plan includes 9.6 GW of nuclear; 6.3 GW of coal; 17.8 GW of renewables (including 8,4GW solar); and 8.9 GW of other generation sources.

4.1.4 Electricity Regulation Act, 2006

Under the National Energy Regulator Act, 2004 (Act No 40 of 2004), the Electricity Regulation Act, 2006 (Act No 4 of 2006) and all subsequent relevant Acts of Amendment, NERSA has the mandate to determine the prices at and conditions under which electricity may be supplied by licence to Independent

Power Producers (IPPs). NERSA has recently published a request for qualification and proposals for new generation capacity under the IPP procurement programme, and is in the process of updating and developing its process in relation to the awarding of electricity generation licences.

3.2. Regulatory Hierarchy for Energy Generation Projects

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

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

» *Department of Energy:* 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 of South Africa (NERSA):* 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 Environmental Affairs (DEA):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. DEA 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.
» *South African National Roads Agency Limited (SANRAL):* This department is responsible for all National road routes.
» *Department of Agriculture:* This department is responsible for agriculture and fishery matters.

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

» *Eastern Cape – Department of Economic Development and Environmental Affairs (DED&EA).* This department is the commenting authority for this project.
» *Department of Transport and Public Works -Eastern Cape.* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Eastern Cape, both Municipalities i.e. *Kouga Local Municipality* and District Municipalities i.e. *Cacadu Municipality* play a role.

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.

There are also numerous non-statutory bodies such as Wind Energy Associations and environmental lobby groups that play a role in various aspects of planning and the environment that will influence wind energy development.

3.3 Legislation and Guidelines that have informed the preparation of this EIA Report

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

» National Environmental Management Act (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)
» EIA Regulations, published under Chapter 5 of the NEMA (GN R543, GN R544 and GN R546 in Government Gazette 33306 of 18 June 2010)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:

* 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)
* Public Participation in the EIA Process (DEA, 2010)
* Integrated Environmental Management Information Series (published by DEA)

» International guidelines – the Equator Principles and the International Finance Corporation and World Bank Environmental, Health, and Safety Guidelines for Wind Energy (2007)

Several other Acts, standards, or guidelines have also informed the project process and the scope of issues addressed and assessed in the EIA Report. A review of legislative requirements applicable to the proposed project is provided in the table in Table 4.1.

Table 3.1: Relevant legislative permitting requirements applicable to the Wind Energy Facility Project EIA

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Legislation			
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed project	National Department of Environmental Affairs – lead authority. Provincial Environmental Department - commenting authority.	This EIA report is to be submitted to the DEA and Provincial Environmental Department in support of the application for authorisation.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised. In terms of NEMA, it has become the legal	Department of Environmental Affairs (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.		
National Environmental Management: Waste Act (Act No 59 of 2008)	» The purpose of this Act is to reform the law regulating waste management in order to protect health and the environment by providing for the licensing and control of waste management activities. » The Act provides listed activities requiring a waste license	Provincial Environmental Authorities.	Waste licence could be required in the event that more than $100m^3$ of general waste or more than $35m^2$ of hazardous waste is to be stored on site at any one time. The volumes of waste generated during construction and operation of the facility are not expected to be large enough to require a waste license.
Environment Conservation Act (Act No 73 of 1989)	In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Eastern Cape province have not yet	National Department of Environmental Affairs Provincial Environmental Department - commenting authority. Local authorities Local Municipality	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to be undertaken in accordance with SANS 10328 – this has been undertaken as part of the EIA process (refer to Appendix L). There are noise level limits which must be adhered to.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	adopted provincial regulations in this regard. Allows the Minister of Environmental Affairs to make regulations regarding noise, among other concerns		
National Water Act (Act No 36 of 1998)	Water uses must be licensed unless such water use falls into one of the categories listed in S22 of the Act or falls under general authorisation in terms of S39 and GN 1191 of GG 20526 October 1999.	Department of Water Affairs	As no water use (as defined in terms of S21 of the NWA) will be associated with the proposed project, no water use permits or licenses are required to be applied for or obtained, if no drainage lines crossed.
National Water Act (Act No 36 of 1998)	In terms of Section 19, 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 (as regulator of NWA)	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
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 provisions of the Act. Requirements for Environmental Management Programmes and Environmental Management Plans are set out in Section 39 of the Act.	Department of Mineral Resources	If borrow pits are required for the construction of the facility, a mining permit or right is required to be obtained.
National Environmental Management: Air Quality Act (Act No 39 of 2004)	Sections 18, 19 and 20 of the Act allow certain areas to be declared and managed as “priority areas” in terms of air quality.	National Department of Environmental Affairs – air quality	No permitting or licensing requirements applicable for air quality aspects.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	Declaration of controlled emitters (Part 3 of Act) and controlled fuels (Part 4 of Act) with relevant emission standards. Section 34 makes provision for: (1) the Minister to prescribe essential national noise standards - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or (b) for determining – (i) a definition of noise (ii) the maximum levels of noise (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.	Local Municipality - Noise	The section of the Act regarding noise control is in force, but no standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities. An atmospheric emission licence issued in terms of section 22 may contain conditions in respect of noise. This will however, not be relevant to the facility, as no atmospheric emissions will take place. The Act provides that an air quality officer may require any person to submit an atmospheric impact report if there is reasonable suspicion that the person has failed to comply with the Act.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain kinds of development including » the construction of a road, power line, pipeline, canal or other similar linear development or barrier exceeding 300 m in length; » any development or other activity which will change the character of a site	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains. Heritage Western Cape	Section 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 a heritage resource may be affected. A permit may be required should identified cultural/heritage sites on

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	exceeding 5 000 m^2 in extent. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided. Standalone HIAs are not required where an EIA is carried out as long as the EIA contains an adequate HIA component that fulfils the provisions of Section 38. In such cases only those components not addressed by the EIA should be covered by the heritage component.		site be required to be disturbed or destroyed as a result of the proposed development.
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking of certain fauna (including cutting, chopping, taking, gathering, uprooting, damaging or destroying). Schedule 3 lists endangered flora and Schedule 4 lists protected flora. An article 26 to 47 regulates the use of wild animals.	National Department of Environmental Affairs	Compliance requirements

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of Section 57, the Minister of Environmental Affairs 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 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. the developer has a responsibility for: » The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations). » Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby	National Department of Environmental Affairs	As the applicant 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 undertaken as part of the previously EIAs undertaken for the power station site. A specialist flora, fauna and wetland's assessment has been undertaken for the proposed project (refer to Appendix F). A permit may be required should any protected plant species on site be disturbed or destroyed as a result of the proposed development.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity. » Limit further loss of biodiversity and conserve endangered ecosystems.		
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. Declared Weeds and Invaders in South Africa are categorised according to one of the following categories: » Category 1 plants: are prohibited and must be controlled. » Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread. » Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the flood line of watercourses and wetlands. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that	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 implemented. The permission of agricultural authorities will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	such plants must be controlled by the methods set out in Regulation 15E.		
National Veld and Forest Fire Act (Act 101 of 1998)	In terms of Section 21 the applicant would be obliged to burn firebreaks to ensure that should a veld fire occur on the property, that it does not spread to adjoining land. In terms of section 12 the applicant must ensure that the firebreak is wide and long enough to have a reasonable chance of preventing the fire from spreading, not causing erosion, and is reasonably free of inflammable material. In terms of section 17, the applicant must have such equipment, protective clothing and trained personnel for extinguishing fires.	Department of Water Affairs	While no permitting or licensing requirements arise from this legislation, this act will find application during the operational phase of the project. Due to the fire prone nature of the area, it must be ensured that the landowner and developer are part of the local Fire Protection Agency.
National Forests Act (Act No 84 of 1998)	Protected trees: According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that ‘ no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister’. Forests: Prohibits the destruction of indigenous trees in any natural forest without	Department of Water Affairs	A permit or license is required for the destruction of protected tree species and/or indigenous tree species within a natural forest.

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	a licence.		
Integrated Coastal Zone Management Act (Act No. 24 of 2008)	The purpose of the Act is to establish a system of integrated coastal and estuarine management in the Republic, including norms, standards and policies, in order to promote the conservation of the coastal environment, and maintain the natural attributes of coastal landscapes and seascapes, and to ensure that development and the use of natural resources within the coastal zone is socially and economically justifiable and economically sustainable; to define rights and duties in relation to coastal areas; to determine the responsibilities of organs of state in relation to coastal areas; to prohibit incineration at sea; to control dumping at sea, pollution in the coastal zone, inappropriate development of the coastal environment and other adverse effects on the coastal environment; to give effect to South Africa's international obligation in relation to coastal matters; and to provide for matters connected therewith. The Act provides for integrated management of the coastal zone and contains a number of Chapters dealing with various components.	Department of Environmental Affairs: Marine and Coastal Management Directorate	Sections of the Act that may affect the current project area as follows: » A coastal protection zone is defined in which development is restricted or controlled. A relatively arbitrary distance of 1000 m is defined in the act as constituting this coastal protection zone, but sections of the act (sections 26 to 29) set out procedures whereby the various coastal areas may be specifically demarcated on a case-by-case basis. » Assessing the environmental impact of activities which may detrimentally affect the coastal zone will be done in terms of the general environmental impact assessment regulations which were promulgated in terms of Chapter 5 of NEMA. Section 63 of Act 24 of 2008 provides the factors and criteria which the competent authority must consider when issuing environmental authorisations for

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			activities affecting the coastal zone.
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARS) 1997	Any structure exceeding 45m above ground level or structures where the top of the structure exceeds 150m above the mean ground level, the mean ground level considered to be the lowest point in a 3km radius around such structure. Structures lower than 45m, which are considered as a danger to aviation shall be marked as such when specified. Overhead wires, cables etc., crossing a river, valley or major roads shall be marked and in addition their supporting towers marked and lighted if an aeronautical study indicates it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport – CAR Part 139.01.33 relates specifically to appropriate marking of wind energy facilities.	Civil Aviation Authority (CAA)	While no permitting or licence requirements arise from the legislation, this act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in the CAR Part 139.01.33.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site and in what operational context they are used, stored or handled. If applicable, a license is required to be

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; » Group IV: any electronic product; » Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		obtained from the Department of Health.
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	Provincial Department of Transport (provincial roads) South African National Roads Agency Limited (national roads)	An abnormal load/vehicle permit may be required to transport the various components to site for construction. These include: » Route clearances and permits will

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
	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.		be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. » Transport vehicles exceeding the dimensional limitations (length) of 22m. » Depending on the trailer configuration and height when loaded, some of the power station components may not meet specified dimensional limitations (height and width).
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic. Sections 2- 4 provide general principles for land development and conflict resolution.	Provincial Environmental Department - commenting authority. Saldanha Local Municipality.	The applicant must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			establish a land development area must comply with procedures set out in the DFA.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements and procedures. Applies for subdivision of all agricultural land or for the registration of a lease for longer than 10 years.	Consent of Minister of Agriculture to subdivide, or register long lease or servitude, in respect of agricultural land.	Subdivision will have to be in place prior to any subdivision approval in terms of 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.
Promotion of Access to Information Act (Act No 2 of 2000)	» All requests for access to information held by state or private body are provided for in the Act under S11.	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act may find application during through the project EIA.
Promotion of Administrative Justice Act (Act No 3 of 2000)	» In terms of Section 3 the government is required to act lawfully and take procedurally fair, reasonable and rational decisions » Interested & affected parties have right to be heard	National Department of Environmental Affairs (DEA)	No permitting or licensing requirements. This act will find application during through the project EIA.
Provincial Legislation / Policies / Plans			
Cape Land Use Planning Ordinance (No 15 of 1985)	Details land subdivision and rezoning requirements and procedures	Local authority, i.e. Kouga Local Municipality	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

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
			appropriate zone will be required. Rezoning is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.
Eastern Cape Provincial Growth and Development Programme	Section 5 of the PGDP (2004-2014) identifies six strategic objective areas of the PGDP. Of these the infrastructure programme is of relevance to the study. The report notes that development of infrastructure, especially in the former homelands, is a necessary condition to eradicate poverty.	Eastern Cape Department of Economic Development & Environmental Affairs (DEDEA)	Infrastructure development, in turn, must have strong growth promotion effects on the agriculture, manufacturing and tourism sectors by improving market access and by "crowding in" private investment. Poverty alleviation should also be promoted through labour-intensive and community based construction methods.
Cacadu District Municipality Integrated Development Plan	The strategic priories that are relevant to the project are as follows: » Identification of Economic Opportunities » Provision and Maintenance of Infrastructure » Enhancement of Skills and Education Systems » Sustainable Resource Management and Use	Cacadu District Municipality	The IDP development priorities highlighted in the Cacadu IDP are as follows: » Priority 1: Infrastructure Investment » Priority 2: Capacity Building and Support to Local Municipalities » Priority 3: Economic Development » Priority 4: Community Development

Legislation / Policy / Guideline	Applicable Requirements	Relevant Authority	Compliance requirements
Local Legislation / Policies / Plans			
Kouga Local Municipality Integrated Development Plan (2007-2012)	The Kouga Local Municipality Integrated Development Plan (IDP) (2007-2012) identifies 5 Key Priority Areas (KPA) in line with the National standards to address the municipality's development objectives: » Infrastructure and Basic Services; » Socio-economic Development; » Institutional Transformation; » Good Governance and Public Participation; » Financial viability and Management.	Kouga Local Municipality	The IDP objectives that are relevant to the proposed project include: » Communities of Kouga have access to safe and convenient road networks. The road networks should support tourism, people's access to economic activities, as well as access to education, health and social service; » All formal households have access to reliable and affordable electricity as well as streetlights, which supports safety and access for emergency services in Kouga, by 2012; » Economic growth is stimulated in the Kouga region, and sustainable employment has been facilitated by creating a 5% growth in job creation by 2011; » Kouga Municipality manages the available land in a sustainable manner that makes land available for development initiatives and economic growth that meets legal requirements.

Legislation / Policy / Guideline	**Applicable Requirements**	**Relevant Authority**	**Compliance requirements**
Standards			
Noise Standards	Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noise from a Wind Energy Facility. They are: » SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. » SANS 10210:2004. 'Calculating and predicting road traffic noise'. » SANS 10328:2008. 'Methods for environmental noise impact assessments'. » SANS 10357:2004. 'The calculation of sound propagation by the Concave method'. The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes.	Local Municipality	The recommendations that the standards make are likely to inform decisions by authorities, but non-compliance with the standards will not necessarily render an activity unlawful per se.

3.3.1. Draft Future Regulations and Guidelines

» ***District Municipality Guidelines and Policies:***

The Cacadu District Municipality is currently in the process of working towards the development of a guiding document for the province, to be entitled '*Towards Positioning the Eastern Cape as the Epicentre of Renewable Energy in South Africa'.* This is being facilitated through Renewable Energy working group workshops which aims at encouraging dialogue between major role-players to ensure that the region takes full advantage of the opportunities in the renewable energy sector. At this stage, three focus areas have been identified:

1. Renewable Energy component manufacturing
2. Regulatory environment
3. Research, development and training

As part of the Regulatory environment, the municipality is intending to develop an efficient enabling system for renewable energy decisions. This will include a provincial strategic environmental assessment and municipal mechanisms to ensure appropriate zoning of renewable energy facilities and to provide infrastructural and other support.

As part of the initiative to plan for renewable energy, the Cacadu District Municipality is currently developing a *Land Use and Locational Policy for Renewable Energy Projects*. This policy is intended to be a tool and guideline to assist Local Authorities in decision-making as a point of departure for land use applications in the Cacadu District.

» ***Noise Control Regulations***

In terms of section 25 of the Environment Conservation Act (No 89 of 1989), the national noise-control regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996, legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Western Cape and Gauteng provinces, but the Eastern Cape province have not yet adopted provincial regulations in this regard.

APPROACH TO UNDERTAKING THE EIA PHASE CHAPTER 5

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

The EIA Phase for the proposed Oyster Bay 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 environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations. This chapter serves to outline the EIA process that was followed.

5.1. Phase 1: Scoping Study

The Scoping Study, which was concluded in March 2011 with the acceptance of the Scoping Report by DEA, 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 Oyster Bay Wind Energy Facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs).

The draft Scoping Report compiled was made available at public places for I&AP review and comment from 22 November 2010 to 10 January 2011. 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 Final Scoping Report was submitted to the National Department of Environmental Affairs (DEA) and the Eastern Cape Department of Economic Development and Environmental Affairs (DEDEA) on 02 February 2011. The Final Scoping Report was accepted by the DEA, as the competent authority. In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project in line with the Plan of Study for EIA as stated in the Scoping Report.

5.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, a number of issues requiring further study for all components of the project were highlighted. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aims to achieve the following:

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

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

The EIA process followed for this project is described below.

5.3. 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 this Draft EIA Report in accordance with the requirements of the Regulation 32 Government Notice No R385 of 2006.

These tasks are discussed in detail below.

5.3.1. Authority Consultation

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

» Submission of a Final Scoping Report (February 2011) following a public review period (and consideration of stakeholder comments received).
» Discussions with DEA and DEDEA in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.

The following was also undertaken as part of this EIA process:

» Submission of a Final Environmental Impact Assessment (EIA) Report following the public review period.
» Provision of an opportunity for DEA and DEDEA representatives to visit and inspect the proposed site.
» Consultation with **Organs of State** that may have jurisdiction over the project (The table below (last updated 02 November 2011) shows the organs

of state that were consulted during the EIA phase and the details of how each were contacted as well as whether comments have been received.

Contact Person	Department	Consultation	Comments received
Ward Councillor - Ward 1 (Zolani Mayoui)	Kouga Local Municipality	» Meeting held on 20 September 2011	» Reply Forms are attached to Appendix E » Comments are in the minutes of the meeting (Refer to Appendix E)
Elvis Olivier	Kouga Local Municipality - Office of the Municipal Manager	» Delivery of a copy of the Draft EIA Report » Meeting held on 21 September 2011	» Comments are in the minutes of the meeting (Refer to Appendix E)
Municipal Manger,	Cacadu District Municipality	» Delivery of a copy of the Draft EIA Report	No comments received
Ncumisa Magugu	Case Officer - EC Department of Economic Development & Environmental Affairs	»	No comments received
Glen Thom as	EC Department of Agriculture and Land Affairs	» Delivery of a copy of the Draft EIA Report	No comments received
Mariagrazia Galimberti	SAHRA	» Delivery of a copy of the Draft EIA Report	No comments received
Lizelle Stroh	Civil Aviation Authority	» Email Notification	No comments received
Johan van Zyl	Eskom Transmission - Southern Grid	» Delivery of a copy of the Draft EIA Report	No comments received
P Mente	EC department of roads and Transport	» Delivery of a copy of the Draft EIA Report	No comments received
Anneliza Collett	National Department of Agriculture, Forestry and Fisheries	» Delivery of a copy of the Draft EIA Report	No comments received
Andrew Lucas	Eastern Cape – Department of Water Affairs	» Delivery of a copy of the Draft EIA Report	No comments received

A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. A record of the authority consultation in the EIA phases is included within **Appendix E**.

5.3.2. Public Involvement and Consultation: EIA Phase

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

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

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to **Appendix C** for a listing of recorded parties). Adjacent landowners and powerline route landowners were identified and informed of the project (refer to landowner map in **Appendix E**) as far as reasonably possible through the following mechanisms:
» Registered mail / email using a stakeholder letter and Background Information Document (BID).
» A meeting for landowners which was held on 17 October 2011
» Written notification and consultation with the Agri Tsitsikamma Farmers Union to inform members on the proposed powerline corridors.

Proof documents are attached to Appendix E.

While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been on-going for the duration of the EIA process and the project database has been updated on an on-going basis.

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

» Focus group meetings (stakeholders invited to attend)

» Public meeting (advertised in the local press: The Herald and St Francis Chronicle)
» Written, faxed or e-mail correspondence

Records of all consultation undertaken are included within **Appendix E.** In summary, the public participation process for this project has included the following key steps/activities to date:

Scoping Phase	Advertisement of EIA Process – First round of adverts	November 2010
	Focus group meetings and public meeting	December 2011
	Advertisement of Public Meeting & availability of EIA report for public review – Second round of adverts	November 2010
	Distribution of Background Information Document (BID) and written notice	November 2010
	Focus group & site meeting for key stakeholders	
	Public review period for DSR	
	Public meeting & stakeholder meeting	
EIA Phase	Advertisement of public review period for Draft EIA Report & Public meeting -	September – October 2011
	Public meeting & stakeholder meetings	
	Notification of registered I&APs on the final EIA report submitted to DEA & availability from Savannah Environmental	November 2011

5.3.4. Identification and Recording of Issues and Concerns

Issues and comments raised by I&APs to date over the duration of the EIA process have been synthesised into a Comments and Response Report (refer to **Appendix E** for the Comments and Response Report compiled from comments received during both the Scoping Phase and current EIA Phase).

The Comments and Response 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.

5.3.5. Assessment of Issues Identified through the Scoping Process

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

Area of Expertise	Specialist	Refer Appendix
Ecology: flora, fauna and wetlands	David Hoare of David Hoare Consulting cc	Appendix F
Avifauna	Andrew Pearson of Endangered Wildlife Trust (EWT)	Appendix G
Geology	Iain Paton of Outeniqua Geotechnical Services cc	Appendix H
Visual	Lourens du Plessis of MetroGIS	Appendix I
Heritage – Archaeology	Johan Binneman of Eastern Cape Heritage Consultants	Appendix J
Agricultural potential, wetlands and land use	Johan van der Waals of Terrasoils	Appendix K
Noise	Morne de Jager of MENCO	Appendix L
Social Impact	Tony Barbour (Environmental Consultant and Researcher)	Appendix M
Desktop Palaeontology	John Almond	Appendix N
Public involvement process	Shawn Johnston of Sustainable Futures ZA	N/A

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the wind energy facility. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;

  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
  * Assigned a score of 2 is improbable (some possibility, but low likelihood);
  * Assigned a score of 3 is probable (distinct possibility);
  * Assigned a score of 4 is highly probable (most likely); and
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
- The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
- The **status**, which is described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

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

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

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

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

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

» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As RES 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 O.

5.3.6. Assumptions and Limitations

Wind energy facilities are a fairly new development in South Africa and have not been implemented on a large scale in the country, to date. Therefore certain gaps in knowledge, assumptions and uncertainties are likely to occur during the EIA process. These are discussed below.

In conducting this EIA process, the following general assumptions have been made:

» The technical motivation as to the selection of the proposed development site (including details pertaining to the wind resource, etc.) provided by RES is sufficient and defendable.
» Only one site is available for the establishment of the proposed facility and will be considered in the EIA, and no other sites are available to be included as alternative sites in the EIA. This is based on the detailed wind analysis (with specific measurements on site) which has been done to date, as well as on land availability, access to the site, grid connectivity, etc. It is assumed that the pre-feasibility study undertaken by RES will be sufficient to motivate the selection of the site to DEA.
» It is assumed that the development site identified by RES represents a technically suitable site for the establishment of a wind energy facility and associated infrastructure.
» It is assumed that the Melkhout substation can accommodate the additional power generated from the wind energy facility.
» The EIA study was conducted based on a preliminary layout of the wind energy facility provided by RES. It is understood that this layout is preliminary at this stage, but it is assumed that the layout is approximately 80% accurate.

Details of specific assumptions, limitations and/ gaps in knowledge for each of the environmental aspects / specialist studies undertaken are briefly highlighted below (refer to specialist studies contained in Appendix F- N for more details).

5.3.7. Public Review of Draft EIA Report and Feedback Meeting

The Draft EIA report was made available for public review from **05 September 2011 to 04 October 2011** at the following locations:

» www.savannahSA.com
» Humansdorp Public Library
» St Francis Bay Library
» Jeffrey's Bay Public Library

All registered I&APs were notified of the availability of the report and public meeting by letter. Adverts were also placed in the Herald and St Francis Chronicle newspapers (refer to **Appendix D**).

In order to provide feedback of the findings of the studies undertaken and receive comments to address in the draft EIA report, a public feedback meeting was held during the public review period of the Draft EIA Report. All interested and affected parties were invited to attend the **public feedback meeting** (held on **20 September 2011** at the **Oyster Bay Community Hall** from **18:00 to 20:00**).

5.3.8. Final Environmental Impact Assessment (EIA) Report

The final stage in the EIA Phase entailed the capturing of responses from I&APs on the Draft EIA Report in order to refine the report. This Final EIA report was submitted to the decision-making Authorities, and it is this Final report upon which a decision by DEA is made regarding the proposed project.

DESCRIPTION OF THE AFFECTED ENVIRONMENT CHAPTER 6

This chapter of the EIA Report provides a description of the environment that may be affected by the proposed wind energy facility on a site north of Oyster Bay, Eastern Cape Province. 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 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 reports contained within Appendices F – N.

6.1 Regional Setting

The main urban centres within the study area are Jeffrey's Bay, Kruisfontein and Humansdorp to the north east of the site, Kareedouw to the west and Sea Vista and Cape St Francis to the south east. Oyster Bay, to the south of the site, is a smaller town. The average population density within the region is 30 people per km.[6]

A number of roads are found in the study area and include the N2 national road, the R62, R102, R332 and R330 arterial routes and a number of lower order secondary roads which also traverse the site.

Industrial type infrastructure within the broader area includes two major Distribution Power Lines (one running in a north south direction, and the other in an east west direction) as well as three Distribution Substations (i.e. Diep River, St. Francis Bay and Melkhout).

A small industrial area is demarcated within Humansdorp, and a railway line follows the R62 from Kareedouw in the west to Jeffrey's Bay, where after it swings to the north.

In addition, the proposed RedCap Kouga wind energy facility (which received an environmental authorisation) lies adjacent to the proposed wind energy facility on its eastern side, and stretches across a total area of more than 35km to the west and east of the site.

The study area has a pastoral character. Cape St Francis and Oyster Bay are coastal holiday towns and tourist destinations. The Oyster Bay site lies near to the south-eastern seaboard of the country and is located in a rural/agricultural area that is located

[6] Department of Environmental Affairs and Tourism (DEAT), 2001. *Environmental Potential Atlas (ENPAT) for the Eastern Cape Province*

on the coastal plain in the area between the N2 National Road to the north and the coast to the south. The urban settlements in the vicinity of site include the coastal towns of Oyster Bay (~5 km south of the site), St. Francis Bay (~22 km east of the site), and Jeffery's Bay (~ 39 km east of the site). The town of Humansdorp is located ~23 km north east and inland from the site. The town of Humansdorp serves as the main service center for the agricultural sector in the region, specifically the dairy and livestock sector. The Impofu Dam borders on the site's northern boundary.

6.2 Location of the Proposed Wind Energy Facility

The study area is accessed via the N2 between Port Elizabeth and Plettenberg Bay and then the R102 via Humansdorp and then gravel roads towards Oyster Bay (see Figure 6.1). The closest community to the site is Oyster Bay. The proposed development site encompasses a surface area of approximately 23km².

The proposed project site is located within Ward 1 of the Kouga (EC108) Local Municipality, ~ 6 km north of the small coastal town of Oyster Bay. The Impofu Dam borders on the northern boundary of part of the site. The Kouga Local Municipality is one of 10 local municipalities that fall within the greater Cacadu District Municipality (DC10).

The site consists of the following farms (Figure 6.1):

- » Kruisfontein 681 Portions 10 and 12;
- » Rebok Rant 715 Portions 0, 2, 3, 4 and Remainder;
- » Klein River 713 Portion 3;
- » Ou Werf 738 Portions 1 and 3;
- » Klippedrift 732 Portion 5.

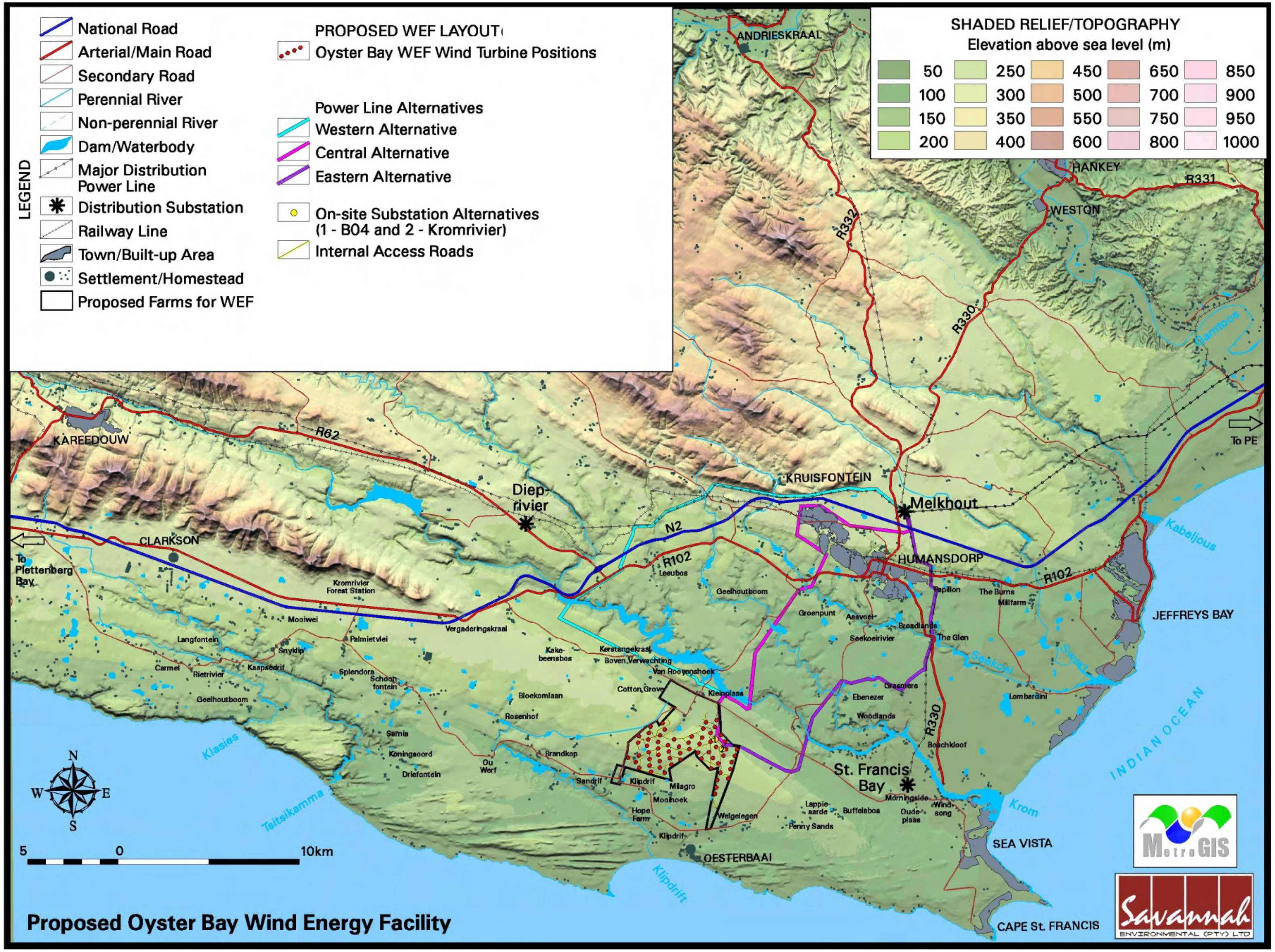

Figure 6.1: Locality map of the site, showing the alternative power line options (purple, green & yellow lines) connecting to the Melkhout Substation

6.3 Residential Areas in the Broader Study Area

The site occurs ~ 23 km south west of the town of Humansdorp and ~39 km west of the coastal settlement of Jeffery's Bay, which is the largest town in the area and seat of the Kouga Local Municipality (KLM). Jeffery's Bay, is an established economic hub that serves as a regional commercial and services centre with a population of approximately 40 000. Jeffery's Bay, St. Francis Bay and Oyster Bay are all important local and internationally recognised tourist destinations within the KLM. The activities in these coastal towns are largely centred on ocean-related sports activities.

Figure 6.2: View of Indian Ocean from Oyster Bay

Jeffery's Bay, Oyster Bay and Cape St Francis are internationally recognised surfing destinations. These towns experience a large influx of holiday makers over the Christmas and other school holiday periods. The coastal towns in the area are therefore well-known holiday destinations.

The wind energy facility site itself is located on private, agricultural land and there are a number of farmsteads and one school located around or near to the proposed site. The location of the farmsteads is illustrated in **Figure 6.3.**

Figure 6.3: Location of farmsteads and labourers cottages with respect to the proposed wind energy facility footprint

6.4 Land use

The aerial photograph interpretation of the site yielded a number of land uses. The land uses include extensive grazing, grazing of improved pastures and irrigation of improved pastures. Table 6.1 provides the areas covered by each of these land uses on the site.

Table 6.1: Land use areas and percentage for the survey site

Land Use	Area (hectares)	Percentage
Grazing	1257	60.4
Improved Pastures	303	14.6
Irrigated Agriculture	23	1.1
Wetland / Potential Wetland	499	24.0

The location of the farmsteads is illustrated in **Figure 6.4**.

Figure 6.4: Location of farmsteads and labourer's cottages in relation to the proposed facility footprint

In terms of future land uses, Eskom has proposed to establish a nuclear power station at Thuyspunt, located to the west of Oyster Bay, the EIA for the nuclear power station has been completed, however; a final decision on the facility has not been taken by the relevant environmental authorities. A number of other wind energy facility projects are also proposed in the Kouga Local Municipality. These include:

» Happy Valley which is north west of Humansdorp
» Deep River which is south west of Humansdorp (recently authorised)
» Jeffery's Bay, near Jeffery's Bay
» Tsitsikamma which is to the north west of the Oyster Bay site
» RedCap Kouga WEF to the north east of Oyster Bay (recently authorised)

Despite the relatively small total population within the Kouga Local Municipality, the area is one of the fastest growing regions in the country. This growth has been largely driven by property market in the form of residential estate developments with some commercial and industrial developments (Kouga Local Municipality website, 2011). However, the global financial crisis of 2008-2009 has resulted in a significant down-turn in the property market.

The main forms of agriculture in the Kouga Local Municipality are game farming, deciduous fruit and dairy farming (Kouga Local Municipality IDP, 2007-2012). The dominant land use within the proposed wind energy facility site and the surrounding area is stock and dairy farming. The topography of the proposed site and surrounding area is gently undulating with an overall north south trending slope from the Tsitsikamma Mountain, in the north, down, towards the Indian Ocean in the south.

Figure 6.5: View over the site from the north east

6.5 Conservation / Protected Areas

Large areas within the region have been given over to conservation, or remain in a natural state. A number of protected areas of differing status exist within the study area (Refer to **Figure 6.6**). These protected areas, which include both private and public nature reserves, game farms, and conservation areas (and are not limited to those which have been formally proclaimed), include the following:

- Game Farms:
  - Jumanji Game Farm (11km north west of the proposed WEF at its closest point);
  - Thaba Manzi Game Farm (11km north east of the proposed WEF at its closest point);
  - Lombardini Game Farm (15km north east of the proposed WEF at its closest point).

- National Heritage Sites:
  - Kromrivierspoort National Heritage Site (12km north-west of the proposed WEF at its closest point);
  - Thuyspunt National Heritage Site (2km south east of the proposed WEF at its closest point);
  - Kabeljous Rivier National Heritage Site (25km north east of the proposed WEF at its closest point);

  - Klasies River Cave National Heritage Site (18km west of the proposed WEF at its closest point).

- Provincial Nature Reserves:
  - Huisklip Nature Reserve (15km west of the proposed WEF at its closest point);
  - Kareedouw Nature Reserve (31km north west of the proposed WEF at its closest point);
  - Kabeljous River Nature Reserve (25km north east of the proposed WEF at its closest point).

- Other Reserves:
  - Rebelsrus Private Nature Reserve (7km south east of the proposed WEF at its closest point);
  - A number of small coastal reserves, including Seal Point Nature Reserve, Seal Bay Nature Reserve and the Irma Booysen Flora Reserve at Cape St Francis;
  - State Forest (14 north-west of the site, as well as in small patches along the coastline).

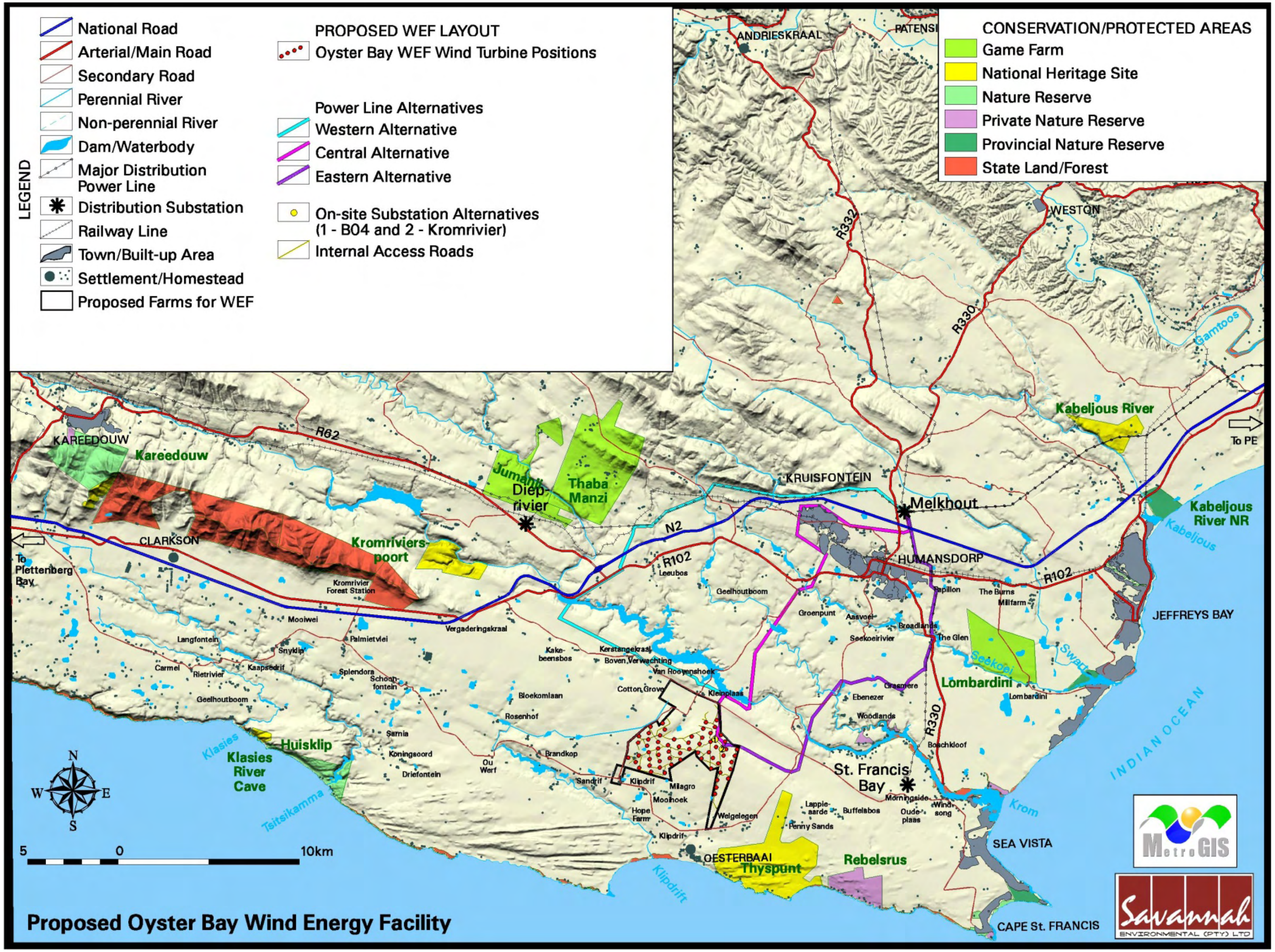

Figure 6.6: Conservation and Protected Areas in the broader study area

6.6 Climatic Conditions

The site falls within the marine temperate climatic region of South Africa which is characterised by frontal weather, leading to changeable, often overcast and moderate conditions. Seasonal variation in temperatures is generally mild, but snow can occur at high altitudes on the mountain ranges to the north of the study area. Midday temperatures typically range between 15°C and 25°C and mean annual precipitation between 1900 and 1973 is 686mm. The Weinert Climatic N-number for the area, which is approximately 2, indicates that the climate is semi-humid and chemical weathering processes is dominant.

The study area has warm summers and mild winters. The average daily minima for the coldest months are above freezing. There are, on average, three days of frost per year. The proximity of the coast ameliorates all climate extremes, but the site is in the first range of low mountains inland of the coast and is therefore affected by the proximity of these mountains.

A weak bimodal pattern of rainfall exists in the study area with a slightly higher proportion of spring and autumn rainfall. Rainfall may, however, fall at any time of the year. The mean annual rainfall in the study area is estimated to be approximately 650 mm (Dent *et al*. 1989). In grasslands, all areas with less than 400 mm are considered to be arid grasslands. The study area can therefore be considered to be relatively moist.

6.7 Topography

The study area is located on gently undulating terrain between the Krom and Klipdrif Rivers with altitude ranging from 60m AMSL in the south to 190m AMSL in the north. The site is characterised as a fairly undulating character. There are a number of drainage lines in the area. The area generally slopes in a south-westerly direction towards the Indian Ocean (See Figure 6.1).

The study area occurs on land that ranges in elevation from 0m a.s.l. (at the coast) to about 900m a.s.l. at the tops of the local hills. The topography is classed as slightly undulating plains along the river valleys and coastline, low mountains in the north of the study area, and moderately undulating plains in the area between the two.

The terrain surrounding the site is predominantly flat, but is incised by a large number of perennial rivers, including the Klasies, the Tsitsikamma, the Klipdrift, the Krom, the Seekoie, the Swart and the Kabeljous Rivers. The Krom River is the largest of these.

6.8 Geology in the Study Area

The site is entirely underlain by rocks of the Table Mountain Group, which is dominated by hard, resistant sandstone and quartzite with subordinate shale. The site is situated across a northwest-southeast trending anticline, exposing the older Peninsula Formation (lower member of the Table Mountain Group) in the central part of the site with the younger Cedarberg and Goudini Formations on the northern and southern sides of the site (see **Figure 6.7**). The limbs of the anticline dip at between 35 to 80° and the fold axis plunges to the southeast. This folding is a result of compressional deformation during the Permo-Triassic collision of the Pan-African and African plates. There are no significant geological faults in the immediate vicinity of the study area and the region is considered to be seismically stable.

Hard, resistant quartzite rock of the Peninsula Formation outcrops on surface over the majority of the site and gravelly sandy soil tends to fills the interstitial spaces between the outcrops. Softer, more highly weathered sandstone and shale occur in the northern area and these latter rocks are covered by thicker soil overburden (with possible clay development), formed as a result of in situ weathering.

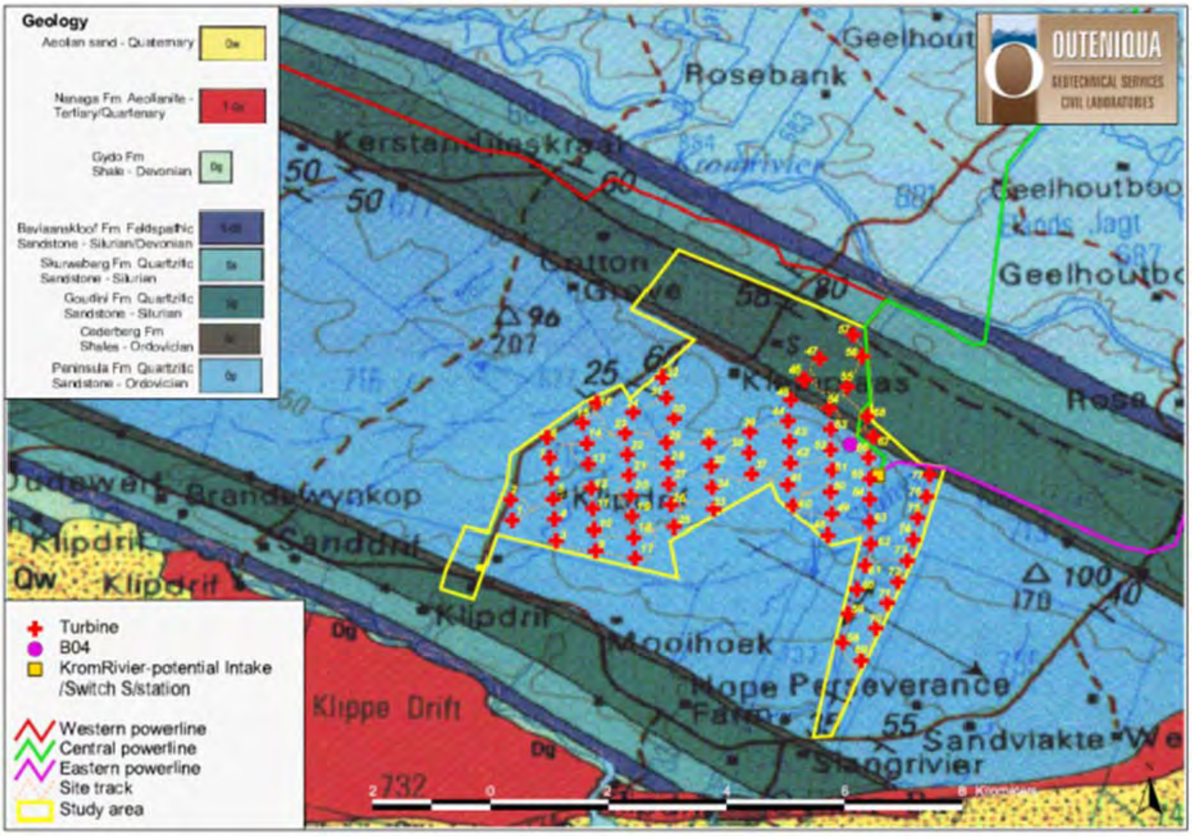

Figure 6.7: Geological map of the site showing position of proposed infrastructure

6.9 Hydrology

The study area drains into tributaries of the Klipdrif and Krom Rivers. Rainfall infiltration rates are low due to the presence of rock outcrops, shallow rock or low permeability soils and a significant percentage of rainfall will tend to lie on surface or end up as run-off. The presence of significant surface ponding was noted in localised depressions and flat areas. Significant run-off was also noted along roads and natural drainage lines and this has implications for water erosion potential.

The site is on the watershed between the Krom and Klipdrif Rivers, both of which flow into the sea relatively close to the site. There are a number of small streams dissecting the landscape. The ones in the northern third of the site drain into the Krom River and the ones in the southern two-thirds of the site drain into the Klipdrif River. The Klipdrif River flows through the southern part of the site.

6.10 Soil and Agricultural Potential

6.10.1 Land Types

The following land types (Land Type Survey Staff, 1972 - 2006) occur in the areas as follows (**Figure 6.8**):

» Turbine development: Bb75, Ha47
» Power lines – western section: Bb75, Bb78, Bb80, Ca81, Ca83, Ca86
» Power lines – central section: Bb75, Ca81, Ca84, Ca85, Ca86
» Power lines – eastern section: Bb75, Bb79, Ca81, Ca84, Ca85, Ca86

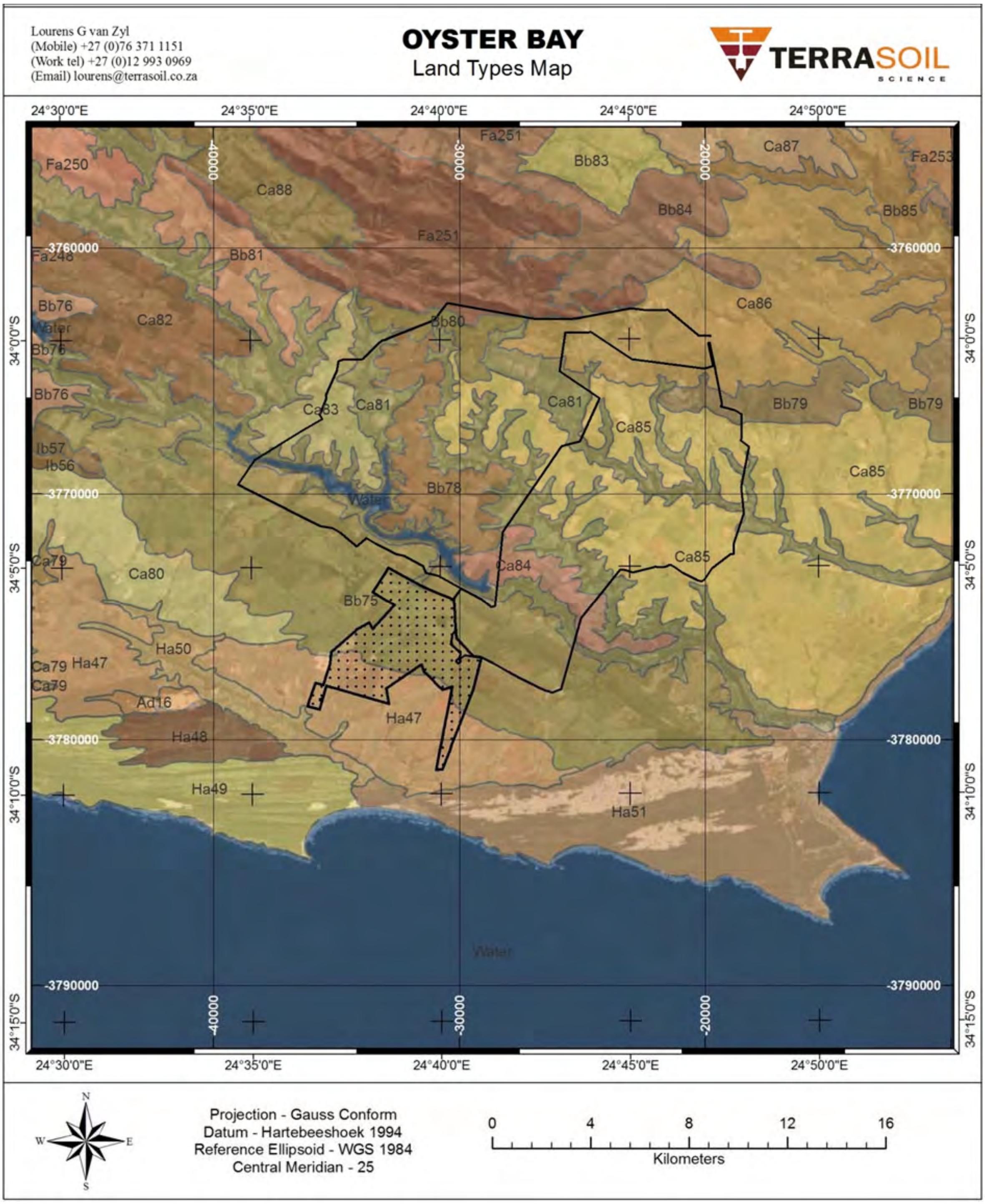

Figure 6.8: Land type map of the survey site

» ***Land Type Bb75***

Soils: Predominantly deep, bleached (and leached) sandy soils with white to light yellow-brown colours. Podzols occur occasionally throughout the landscape. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

» **Land Types Bb78, Bb79, Bb80**

Soils: Almost exclusively shallow, bleached (and leached) sandy soils with white grey colours. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to low carrying capacity and dominant vegetation.

Agricultural potential: Low in the natural state but medium if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

» **Land Types Ca81, Ca83, Ca84, Ca85 and Ca86**

Soils: Predominantly shallow, bleached (and leached) sandy soils with white to light yellow-brown colour with a limited occurrence of duplex structured soils of varying degrees of wetness (as expressed in morphological “signs of wetness”). Podzols occur scattered to a limited degree in the landscape. Wetland character is expressed in the form of organic matter darkened A-horizons in the sandy soil profiles or morphological “signs of wetness” in high clay content subsoils.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure where soils allow for free drainage.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present (on suitable soils). Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

» **Land Type Ha47**

Soils: Predominantly deep, bleached (and leached) sandy soils with white to light yellow-brown colours. Podzols occur occasionally throughout the landscape. Wetland character is mainly expressed in the form of organic matter darkened A-horizons in the sandy soil profiles.

Land capability and land use: In the natural state the soils are predominantly used for extensive grazing purposes due to relatively low carrying capacity and dominant vegetation. Irrigated agriculture occurs in areas with water and irrigation infrastructure.

Agricultural potential: Medium to low in the natural state but medium to high if irrigation infrastructure is present. Irrigated agriculture consists predominantly of improved pastures for cattle production. The soils are prone to severe leaching due to their sandy nature and nutrient and fertilizer application management is critical for sustained yields and prevention of surface and ground water pollution and eutrophication.

6.10.2 Soil Types

A generalised soil map of the areas is provided in **Figure 6.9**. The soils on the site can be divided into two main groups namely 1) shallow and rocky soils an 2) deep sandy soils.

The total area within the survey site covered by the shallow and rocky soils is 1022 ha. The dominant soils occurring within this area are of the Mispah (Orthic A-horizon / Hard Rock) and Glenrosa (Orthic A-horizon / Lithocutanic B-horizon) forms as well as numerous rock outcrops. **Figure 6.9** provides an indication of the areas covered in these soils as well as the profiles as identified on the site.

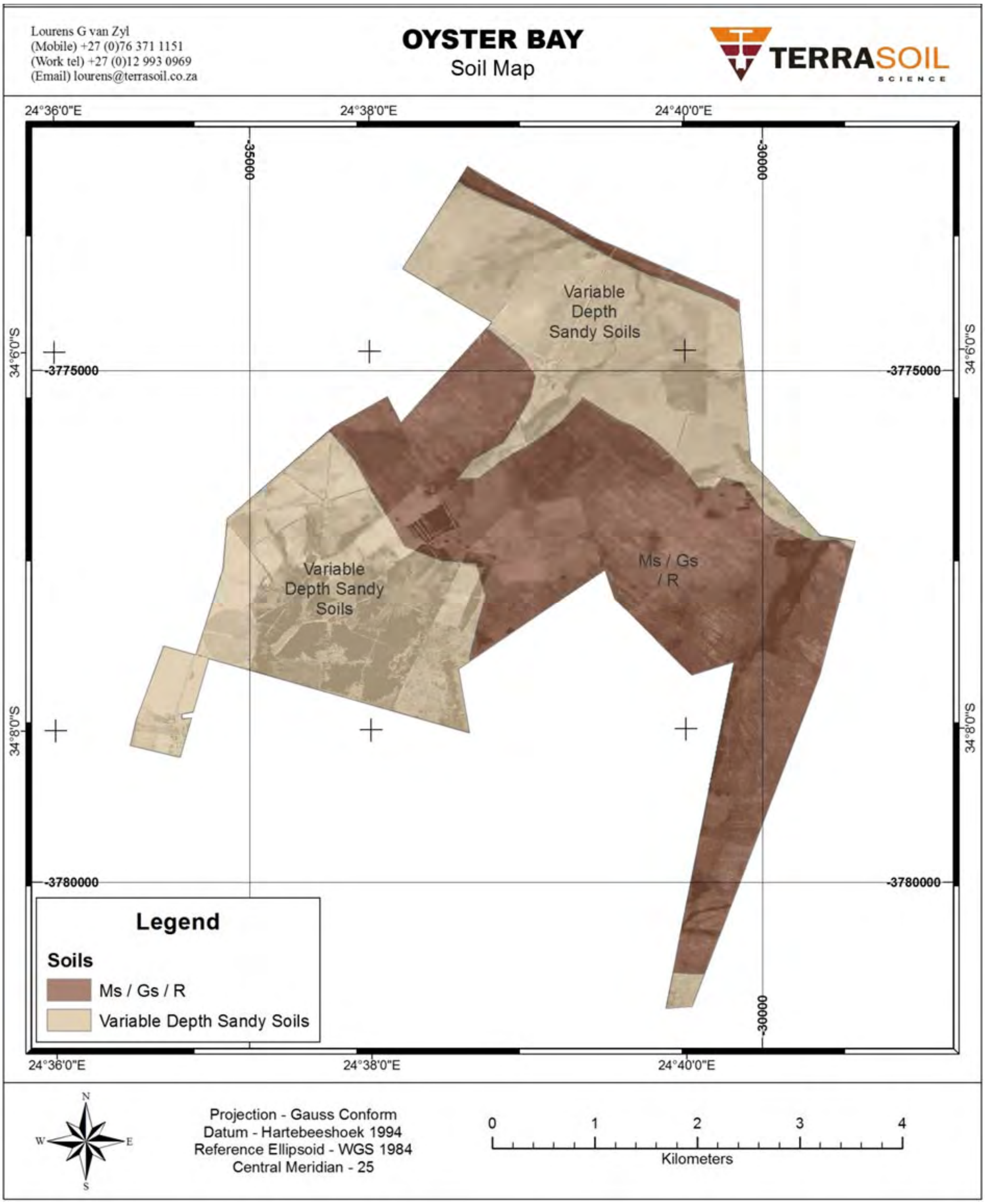

Figure 6.9: Generalised soil map of the survey site

Figure 6.10: Shallow exposed soil profile on the survey site

Figure 6.11: Rock outcrops and loose boulders on shallow soils

Figure 6.12: Shallow soils and rock outcrops in the foreground with a wetland area in the background

» **Deep Sandy Soils**

The areas dominated by deep bleached sandy soils (1060 ha) exhibit a relatively large degree of variation in soil form. The main soils forms that occur within this landscape include: Fernwood (Orthic A-horizon / E-horizon / Unspecified), Longlands (Orthic A-horizon / E-horizon / Soft Plinthic B-horizon), Wasbank (Orthic A-horizon / E-horizon / Hard Plinthic B-horizon), Kroonstad (Orthic A-horizon / E-horizon / G-horizon), Cartref (Orthic A-horizon / E-horizon / Lithocutanic B-horizon), Constantia (Orthic A-horizon / E-horizon / Yellow-brown Apedal B-horizon), Lamotte (Orthic A-horizon / E-horizon / Podzol B-horizon / Unconsolidated material with signs of wetness), Houwhoek (Orthic A-horizon / E-horizon / Podzol B-horizon / Saprolite), Westleigh (Orthic A-horizon / Soft Plinthic B-horizon) and Katspruit (Orthic A-horizon / G-horizon).

A very good example of a Constantia / Lamotte soil form was encountered and photographed in a fresh road cutting on the southern edge of the survey site (**Figures 6.13** and **6.14**). Further evidence of the widespread nature of these soils is seen in **Figure 6.15** in an eroded channel (where the cattle exhibit remarkably similar colouration).

Although the site has a large degree of variation in soil form the soils tend to act similarly in terms of their land use and agricultural characteristics (within limits). The essence is that the soils have a very low nutrient storage and holding capacity as well as low water holding capacity in the sandy layers. This has a major impact on the management of the soils in that fertilizer applications have to be such that the minimum is allowed to leach through the profile into the groundwater. In order to do this the land user has to apply small quantities frequently. This is especially critical for the irrigated agriculture (**Figures 6.16 – 6.18**).

Figure 6.13 Fresh road cutting on the southern edge of the site

Figure 6.14: Profile of the Constantia / Lamotte form in a fresh road cutting on the southern edge of the site

Figure 6.15 Profile of the Constantia / Lamotte form in an eroded channel with the cattle surprisingly exhibiting similar colouration

Figure 6.16: Irrigation of improved pastures

Figure 6.17 Cattle grazing on the improved pastures

Figure 6.18 Management of the improved pastures

6.10.3: Agricultural Potential

The agricultural potential of the site is directly linked to the soils. The shallow and rocky soils are predominantly of **low** potential and the deeper sandy soils are of **medium** potential. The potential of the sandy soils is limited due to their sandy nature leading to low nutrient and water holding capacity. This is especially relevant in an area with variable rainfall (**Figure 6.19**). In the cases where irrigation infrastructure has been established the potential of the soils increases to **high**. The high potential comes at a price in the form of distinct risks of nutrient leaching leading to losses in agriculture and to eutrophication of water sources (groundwater). The agricultural use is limited to grazing with improved pastures under irrigation.

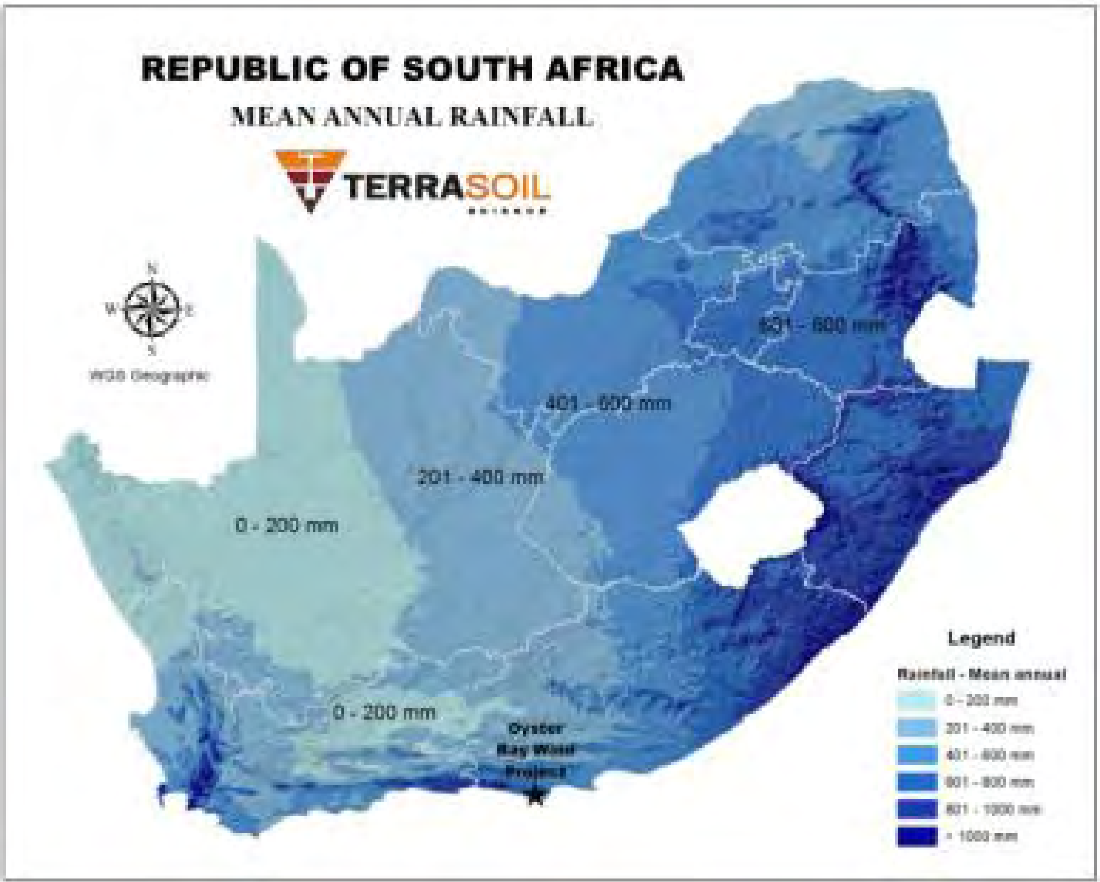

Figure 6.19: Rainfall map of South Africa indicating the survey site

6.11 Ecological Profile

6.11.1 Vegetation

Vegetation may be described at various hierarchical levels from Biome, to broad Vegetation Type and down to Plant Community level associated with local habitat conditions. There are three general descriptions of the vegetation in the study area. Acocks (1953) published the first comprehensive description of the vegetation of South Africa, which was updated in 1988. This was followed by an attempted improvement (Low & Rebelo 1998) which became widely used due to the inclusion of conservation evaluations for each vegetation type, but is often less rigorous than Acocks's original publication. More recently, a detailed map of the country was produced (Mucina *et al.*, 2005). A companion guide to this map (Mucina & Rutherford 2006), containing up-to-date species information and a comprehensive conservation assessment of all vegetation types, has just been published. According to this most recent vegetation map of the country the infrastructure could potentially affect a number of different vegetation sites. The site of the wind energy facility these are discussed in more detail below and shown in **Figure 6.20**

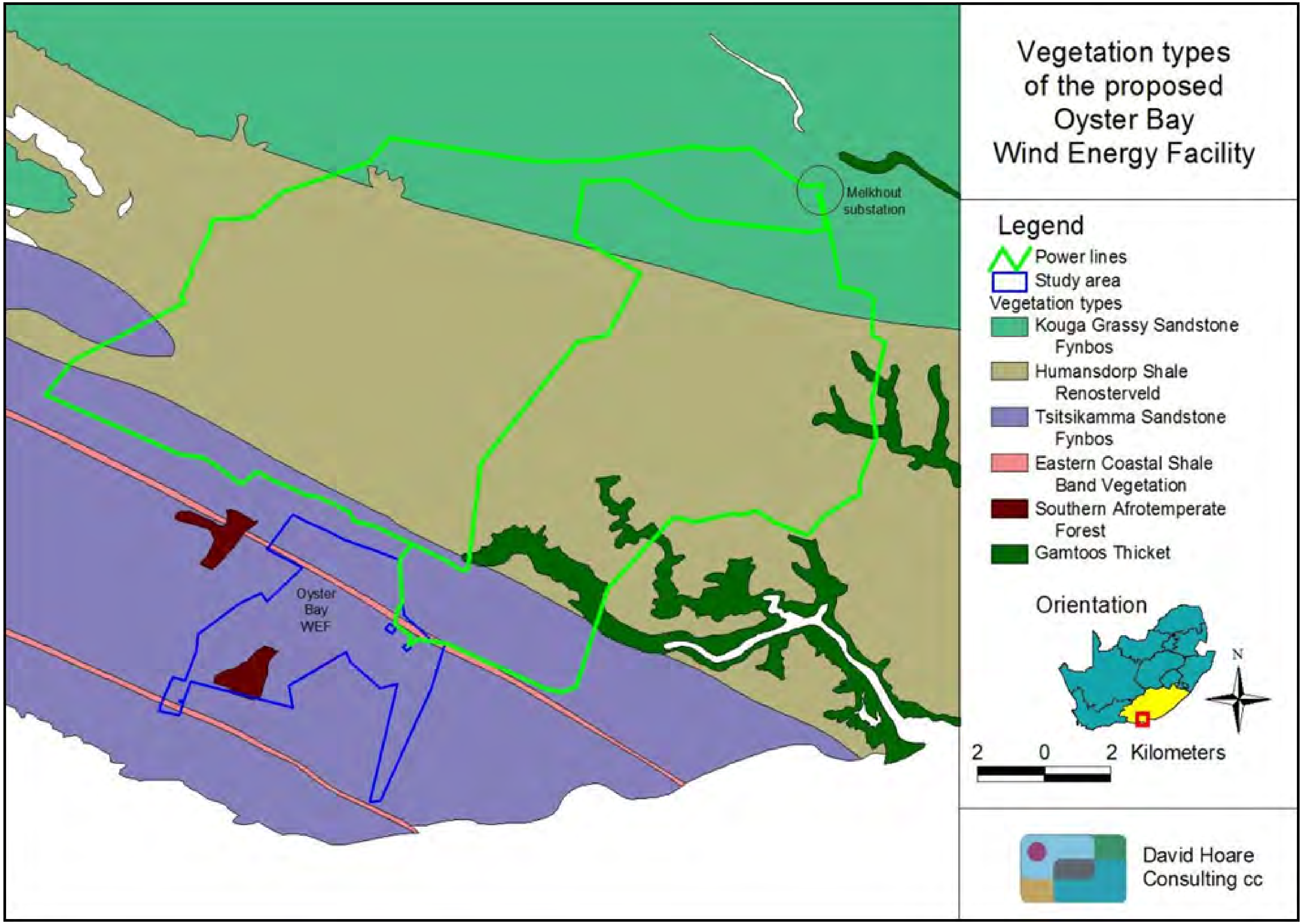

Figure 6.20: Vegetation types of the study site and surrounding areas

- ***Tsitsikamma Sandstone Fynbos*** is found along the Tsitsikamma Mountains from Uniondale to Cape St Francis (Rebelo et al. 2006). This landscape consists of relatively low mountains with gentle to steep slopes. The vegetation type occurs on both the northern and southern slopes of the mountains. It is a medium-dense, tall proteoid shrubland over a dense, moderately tall ericoid-leaved shrubland (Rebelo et al. 2006). This vegetation type occurs throughout the site under assessment (Figure 2).

- ***Eastern Coastal Shale Band Vegetation*** occurs on the shale bands in the eastern Outeniqua, Langkloof, Tsitsikamma and Kareedouw Mountains and along the southern Cape coastal plains to around Oyster Bay (Rebelo et al. 2006). These shale bands form narrow strips 80 - 200 m wide that are smooth and relatively flat. The vegetation type ranges from thicket to renosterveld and fynbos, including all structural types, although they are often grassy in character (Rebelo et al. 2006). This vegetation type occurs in two narrow bands through the study area (Figure 2), both of which have been transformed by cultivation.

- ***Southern Afrotemperate Forest*** occurs in Western Cape, Eastern Cape and Northern Cape, with the largest complex in the southern Cape along the narrow coastal strip between Humansdorp in the east and Mossel Bay (Mucina & Geldenhuys 2006). The vegetation type is a tall, multilayered afrotemperate forest dominated by yellowwoods (*Afrocarpus falcatus* and *Podocarpus latifolius*), *Ocotea bullata*, *Olea capensis* subsp. *macrocarpa*, *Pterocelastrus tricuspidatus*, *Platylophus trifoliatus*, *Cunonia capensis*, *Heeria argentea*, *Metrosideros angustifolia*, *Podocarpus elongatus* and *Rapanea melanophloeos* (Mucina & Geldenhuys 2006). This vegetation type is indicated on the vegetation map as occurring as a patch in the central part of the site (Figure 2). This patch is, however, an area of alien vegetation and the vegetation map is incorrect. The other patch to the west/north-west of the site (see Figure 2) is also alien vegetation.

- ***Humansdorp Shale Renosterveld*** occurs, across its geographic range, in three swathes, one of which extends from Jeffreys Bay near the coast inland past Humansdorp to the lower reaches of the Dieprivier near Two Streams (Rebelo et al. 2006). The vegetation type occurs on moderately undulating plains and undulating hills. It is a vegetation composed of low, medium dense graminoid, dense cuppressoid-leaved shrubland, dominated by renosterbos (Rebelo et al. 2006). There are both grassland shrubland and grassland forms of the renosterveld. Thicket patches are common on termitaria and fire-safe enclaves. This vegetation type occurs as a small sliver in the central areas across which the power lines are proposed to traverse.

- ***Kouga Grassy Sandstone Fynbos*** is found in the Western and Eastern Cape from Uniondale to Uitenhage, including the low mountains and flats north of Humansdorp

(Rebelo et al. 2006). It is low shrubland vegetation with sparse, emergent tall shrubs and dominated by grasses in the undergrowth, or grassland with scattered ericoid shrubs (Rebelo et al. 2006). It is found in the northern parts of the region under study, close to the mountains, and includes the Melkhout substation.

» ***Gamtoos Thicket*** occurs in the Eastern Cape in the coastal basin of the Gamtoos River valley, south of the Baviaanskloof Mountains and along some smaller river valleys (Hoare et al. 2006). It occurs on low mountain slopes in steeply sloping areas and on low ridges (Hoare et al. 2006). It is a tall dense thicket, where both the trees and shrubs and the succulent component are well represented (Hoare et al. 2006). Few distinct strata can be differentiated within this vegetation, with upper and lower canopy species intertwined (Hoare et al. 2006).
» ***Southern Cape Dune Fynbos*** occurs in the Western and Eastern Cape from Wilderness and Buffels Bay near Knysna to Oyster Bay (Rebelo et al. 2006). The vegetation type occurs on the coastal dune cordons, often with steep slopes. It is a fynbos heath vegetation dominated by sclerophyllous shrubs with rich restio undergrowth (Rebelo et al. 2006). This vegetation type occurs to the south of the site and will not be affected by the proposal.

6.11.2 Conservation status of broad vegetation types

The vegetation types of South Africa have been categorised according to their conservation status which is, in turn, assessed according to degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. On a national scale these thresholds are as depicted in **Table 6.2**, as determined by best available scientific approaches (Driver et al. 2005). The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

» ***Tsitsikamma Sandstone Fynbos*** is classified in Mucina *et al*. (2006) as Vulnerable.
» ***Eastern Coastal Shale Band Vegetation*** occurs is classified in Mucina *et al*. (2006) as Endangered.
» ***Southern Afrotemperate Forest*** is classified in Mucina *et al*. (2006) as Least Threatened.
» ***Humansdorp Shale Renosterveld*** is classified in Mucina *et al*. (2006) as Endangered.
» ***Kouga Grassy Sandstone Fynbos***is classified in Mucina *et al*. (2006) as Least Threatened.
» ***Gamtoos Thicket***is classified in Mucina *et al*. (2006) as Least Threatened/.
» ***Southern Cape Dune Fynbos*** is classified in Mucina *et al*. (2006) as Least Threatened.

Table 6.3: Conservation status of different vegetation types occurring in the study area, according to Driver *et al*. 2005 and Mucina *et al*. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al.* 2005; Mucina *et al.*, 2006	Draft Ecosystem List (NEMBA)
Tsitsikamma Sandstone Fynbos	23	40	33	Vulnerable	Not listed
Eastern Coastal Shale Band Vegetation	27	16	64	Endangered	Vulnerable
Southern Afrotemperate Forest	34	60	3	Least Threatened	Not listed
Humansdorp Shale Renosterveld	29	0	61	Endangered	Endangered
Kouga Grassy Sandstone Fynbos	23	19	9	Least threatened	Not listed
Gamtoos Thicket	19	6	14	Least threatened	Not listed
Southern Cape Dune Fynbos	36	16	17	Least Threatened	Not listed

6.11.3 The Cape Floristic Region

The study area occurs within the Cape Floristic Region (CFR) which is recognised as one of the principal centres of diversity and endemism in Africa (van Wyk & Smith 2001). Moreover, it is one of the earth's 25 hotspots, i.e. geographical areas that contain the world's greatest plant and animal diversity while also being subjected to high levels of pressure from development and/or degradation (Mittermeier *et al*. 2000). The Cape Floristic region is also the only hotspot that encompasses an entire Floristic Kingdom. This region has the greatest extratropical concentration of plant species in the world, with 9000 plant species, 6210 of which are endemics (Cowling & Pierce 2000). Diversity and endemism are high at the generic and familial level as well, with five of South Africa's 12 endemic plant families.

The characteristic and most widespread vegetation of the Cape Floristic Region (CFR) is fynbos, consisting of hard-leaved, evergreen, fire-prone shrubs. Other vegetation types occurring in the CFR are Renosterveld, Succulent Karoo, Subtropical Thicket and Afromontane forest, although only Fynbos and Renosterveld are considered to be the main vegetation types in the CFR. Fynbos is associated with the nutrient poor soils of the Cape fold Belt mountains. It is very species rich, with over 75% of the CFR species associated with it, including all the endemic families and most of the endemic genera (van Wyk & Smith 2001). The vegetation type is characterized by a preponderance of Restionaceae, Ericaceae and Proteaceae and a paucity of annuals and grasses. Fynbos is rich in geophytes, notably from the families Liliaceae, Iridaceae and Orchidaceae, and is thought to harbour the richest geophyte flora in the world (Cowling & Richardson 1995). Many different types of Fynbos vegetation are recognised: a total of 78 fynbos and 38 renosterveld vegetation types have been mapped in the recently compiled vegetation map of South Africa (Mucina, Rutherford & Powrie 2005) of a total of 435 vegetation types of the whole country (more than a quarter of the total).

The Fynbos Biome and the CFR are largely concurrent and also match the boundaries of the two main vegetation types found in the Fynbos Biome, fynbos and renosterveld.

Permanent and complete transformation of habitat has affected 33% of the CFR hotspot, which includes the Oyster Bay site. Less than 20% of the total area covered by the CFR hotspot can be considered close to the pristine state in the sense that it is entirely free of alien plants and subjected to appropriate fire and grazing regimes (Cowling & Pierce 2000). The study area is within this hotspot area near its eastern extent and, although the hotspot contains a wide variety of vegetation types, the study area contains a number of vegetation types that are typical of the areas of concern within the hotspot.

6.11.3 Plant Species of Conservation Concern

Lists of plant species previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1 of the ecology report (**Appendix F**). Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

The species on this list were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration, there were ten species recorded in the quarter degree grid in which the study area is located that are listed on the Red List that could occur in habitats that are available in the study area. According to IUCN Ver. 3.1 (IUCN, 2001) two of these are listed as Endangered, six as Vulnerable and two as Near Threatened (see Table 6.3 for explanation of categories). All except two of these species are highly likely to occur on site; the site is at the locality where the species have been previously recorded or the species have been recorded just adjacent to the site in similar habitats.

Table 6.4: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	**Definition**	**Class**
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well-known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient
LC	Least Concern	Least Concern

6.11.4 Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3 of the ecology report (**Appendix F**). Those that have a geographical distribution that includes the study area include:

» *Curtisia dentate*
» *Ocotea bullata* (occurs in montane forest)
» *Pittosporum viridiflorum* (occurs along forest margins, in bush-clumps and in bushveld often in rocky outcrops)
» *Podocarpus falcatus* (found in Afromontane forest)
» *Podocarpus latifolius* f(ound in coastal and Afromontane forest)
» *Sideroxylon inerme subsp. Inerme (*usually only occurs in coastal areas, in dune thicket and forest, but may also occur on termitaria in bushveld)

Based on habitat preferences, any of these species could occur on or near the site. *Sideroxylon inerme* subsp. *inerme*, *Pittosporum viridiflorum*, *Podocarpus falcatus* and *Podocarpus latifolius* have been previously recorded in the grid in which the study site is located, as well as surrounding grids (see Appendix 4 of Ecology Report – **Appendix F)**. If any of these species occur in the study area, the most likely places would be in the thicket in the drainage lines or in woodland or forest patches.

6.11.5 Eastern Cape Biodiversity Conservation Plan (ECBCP)

There have been a number of regional conservation assessments produced within the Eastern Cape Province, including the following:

» Subtropical Thicket Ecosystem Programme (STEP)
» Succulent Karoo Ecosystems Programme (SKEP)
» National Spatial Biodiversity Assessment (NSBA)
» Eastern Cape Biodiversity Conservation Plan (ECBCP).

These studies identify patterns and processes that are important for maintaining biodiversity in the region. Unfortunately, many of these studies have been done using coarse scale satellite imagery that does not provide spatial or spectral accuracy at the scale of the present study. They are, however, useful for understanding broad issues and patterns within the area. The ECBCP has integrated all previous studies and is a useful reference for identifying conservation issues in the study area and surrounds.

The ECBCP identifies Critical Biodiversity Areas (CBAs), which are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (Berliner & Desmet 2007). The ECBCP identifies CBAs at different levels with decreasing biodiversity importance, as follows:

1. PA: Protected areas.
2. CBA 1: CR vegetation types and irreplaceable biodiversity areas (areas definitely required to meet conservation targets).
3. CBA 2: EN vegetation types, ecological corridors, forest patches that do not fall into CBA 1, 1 km coastal buffer, irreplaceable biodiversity areas that do not fall into CBA 1.
4. CBA 3: VU vegetation types.

Within and around the study area, the ECBCP identifies CBAs at three levels that occur within the study area and surroundings (**Figure 6.21**). It must be noted that this is a broad-scale map and does not necessarily represent local-scale patterns accurately. Areas where vegetation has been transformed to cultivation, alien trees or other factors may be represented as being within a particular CBA, whereas they are in fact, not sensitive.

The CBA 1 areas that fall within the study site are vegetation types of high conservation value, in this case Eastern Coastal Shale Band vegetation and Humansdorp Shale Renosterveld vegetation, both classified as Endangered. Note that Eastern Coastal Shale Band Vegetation no longer occurs in any intact form on site. The CBA 2 areas that fall within the study site are corridor areas, the forest patch (which has been identified as being alien vegetation) and vegetation identified in the STEP project as being important (Southern Cape Dune Fynbos). The corridor areas are important for a number of reasons, including the maintenance of ecological processes. The CBA 3 areas that fall within the study site are vegetation types of conservation importance (in this case Tsitsikamma Sandstone Fynbos). Despite the Oyster Bay site falling into these CBAs the vegetation is largely transformed due to cattle and sheep farming. Only remaining patches of natural vegetation are sensitive, not all areas that are transformed as well.

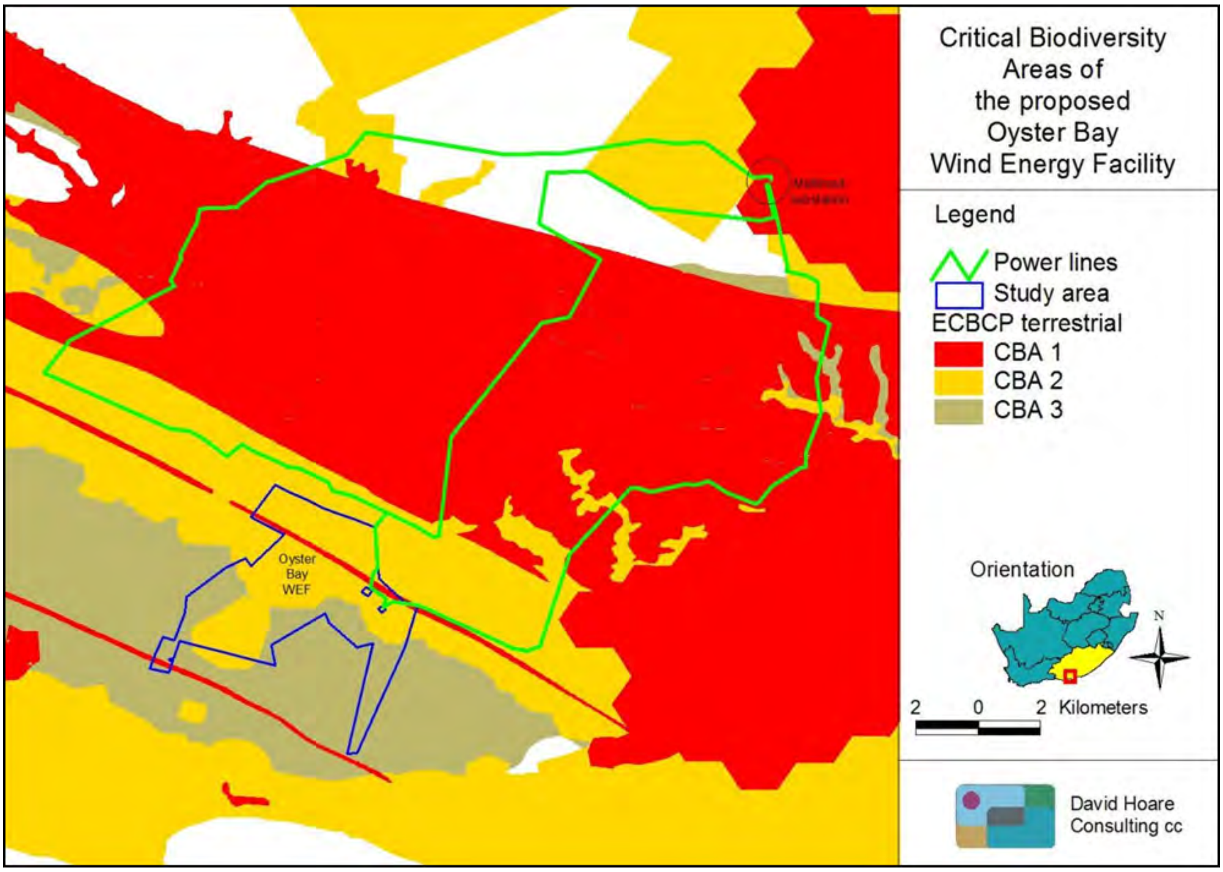

Figure 6.21: Important biodiversity areas of the study area (from ECBCP).

6.11.6 Fauna

All Red List vertebrates (mammals, reptiles, amphibians, fish) that could occur in the study area are listed in Appendix 2 of the Ecology Report (**Appendix F**). Those vertebrate species with a geographical distribution that includes the study area and habitat preference that includes habitats available in the study area are discussed further.

There are a number of mammal species of conservation concern that have a distribution that coincides with the study area. Only four of these are considered to have a possibility of occurring on site as a result of habitats available, i.e. the Brown Hyaena, the Fynbos golden mole and the Natal Long-fingered Bat, all listed as Near Threatened[7], and Duthie's Golden Mole, listed as vulnerable. There are two reptiles and no amphibian species of conservation concern that have a distribution that includes the study area and which could occur on site. The two reptile species are the Spotted Rock Snake (Rare) and the Yellow-bellied House Snake (Near Threatened). There is therefore no threatened (CR, EN or VU) reptile or amphibian species that are likely to occur on site (see Table 3 for explanation of conservation categories).

6.11.7 Wetlands

The wetland distribution is linked to the topography of the site and its associated drainage features. The wetlands identified during the aerial photograph interpretation are more extensive than the drainage features indicated on the contour map. The explanation is straight forward in the sense that sandy soil areas often exhibit extensive seepage wetland zones that are also reflected in vegetation distribution. The wetlands occur throughout the site within the grazing areas and sometimes on the edge of irrigated fields. The locations of wetlands on the site are shown in **Figure 6.22.**

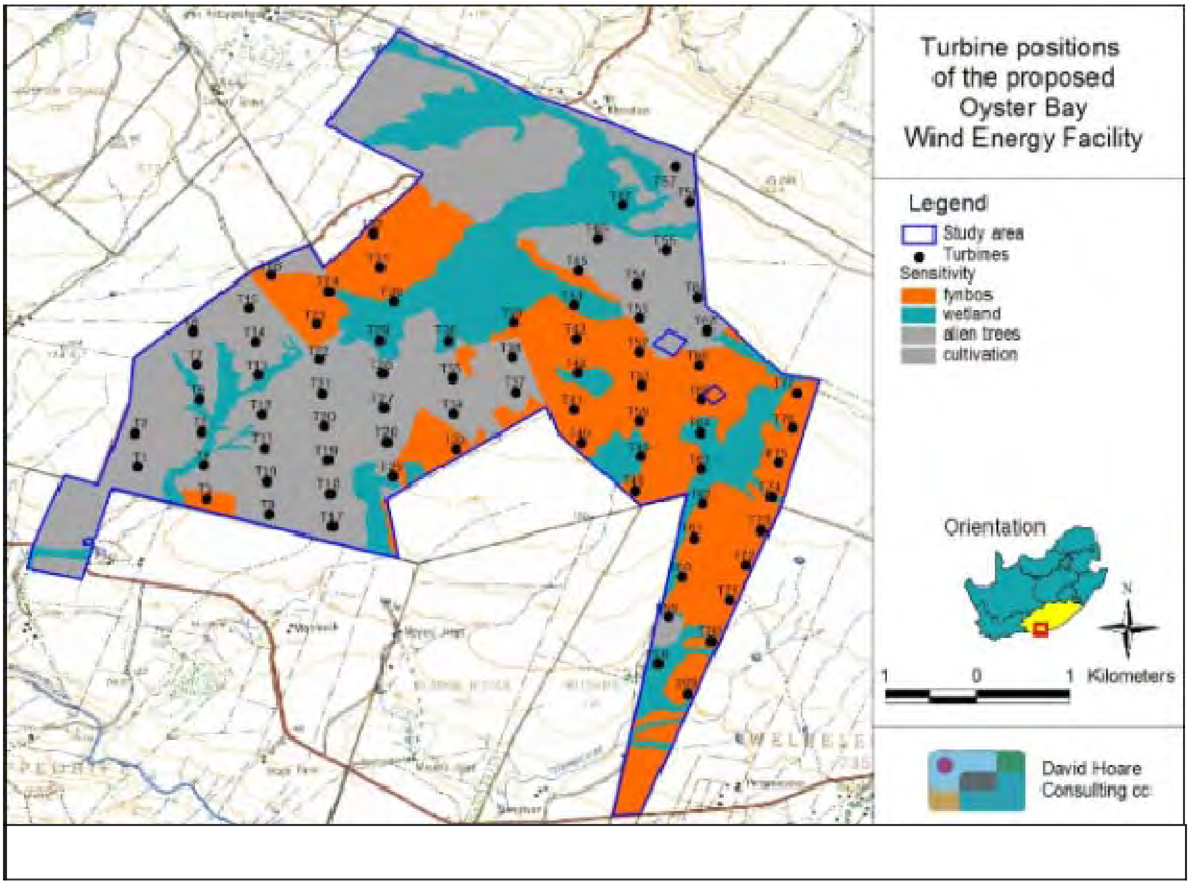

Figure 6.22: locations of wetlands on the site in relation to wind turbine layout

[7] Note that there are a number of species previously listed in a threatened category that, according to the IUCN, are now listed as Least Concern (see Appendix 2).

6.12 Avifauna

The following bird habitat classes were recorded within the survey area during the monitoring:

» Grassland: Open areas covered predominantly by grassland up to about 30m in height with very little scrub (2-3%), which is located on what is presumably old agricultural fields;
» Wetlands: Includes both man-made dams and natural seasonal wetlands which, when dry, consist of short grassland (< 30cm – to be confirmed by future monitoring);
» Scrub: Mostly natural (often degraded) fynbos of various densities up to one metre in height, some of which is situated on what are presumably old agricultural fields, but also against slopes which is unsuitable for cultivation.
» Agriculture: This is the dominant habitat in the study area, and consists mostly of dry-land pastures resembling very short grassland (up to 10cm in height) and irrigated pivots. A few lands with planted crops (maize) are also present, as well as a few stands of exotic trees.

See **Figure 6.23** below for a habitat map of the study area, based on the habitat classes defined above.

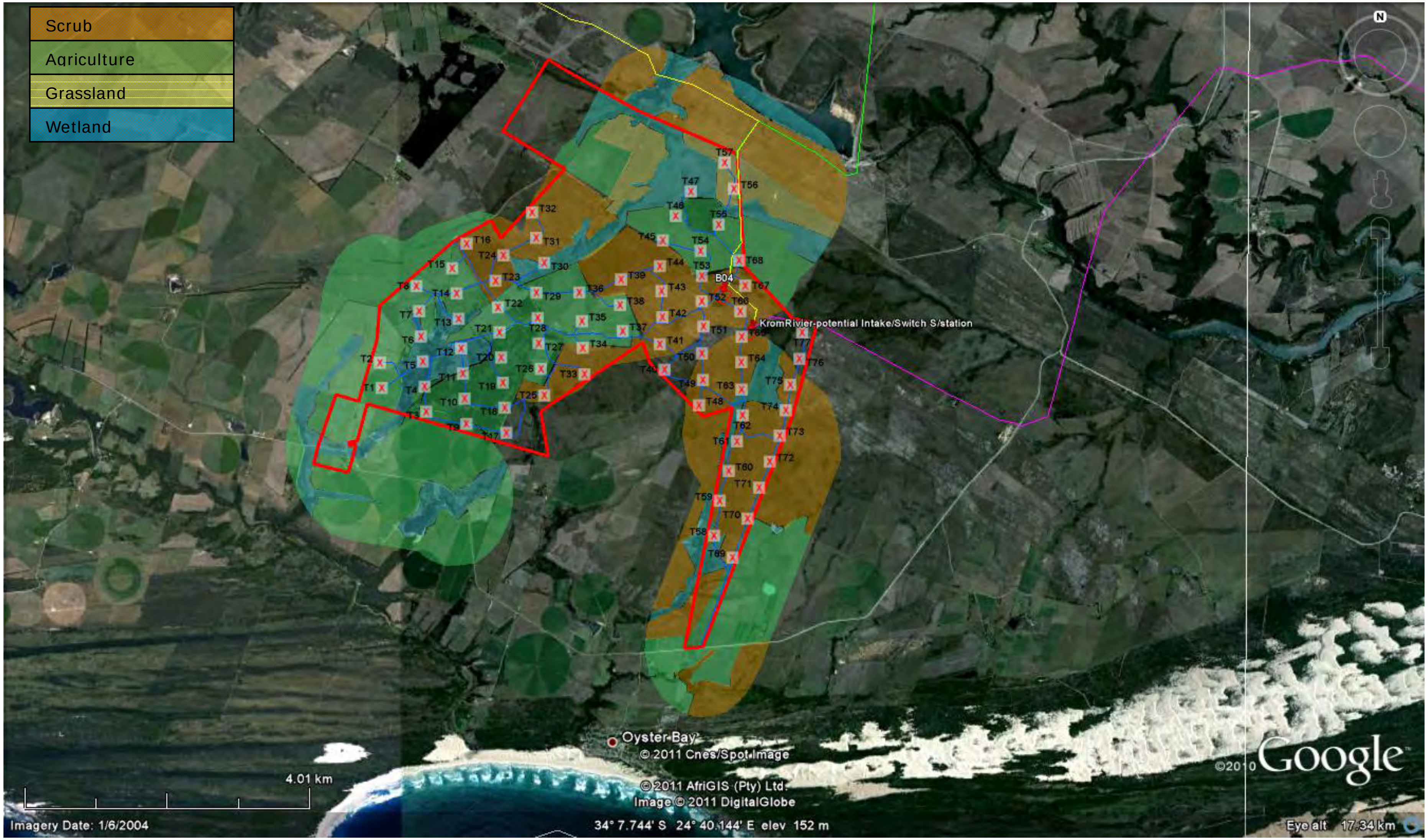

Figure 6.24: Habitat recorded in the survey area (a 1km buffer zone around the survey transects).

Within the survey area approximately 17% of the habitat is classified as wetland, 22% as agriculture, 35% as scrub and 4% as grassland. The priority bird species that have been recorded on the site to date (transect counts and VP observations) are listed in **Table 6.4** below. The non-priority species (transect counts) are listed in the avifauna report.

Table 4: Priority bird species recorded on site during 1 replicate of winter transect surveys (20.95km) and 60 hours of VP observations

Priority Species	Birds per kilometre
Black-winged Lapwing	0.76
Denham's Bustard	1.05
Jackal Buzzard	0.29
Temminck's Courser	0.29
African Marsh-Harrier	Recorded at VPs only
White-bellied Korhaan	Recorded at VPs only
African Fish-Eagle	Recorded at VPs only
Blue Crane	Recorded at VPs only
Jackal Buzzard	Recorded at VPs only
Lanner Falcon	Recorded at VPs only

6.13 Bats

It has been evaluated that there is one Near Threatened bat species that could occur site or in the surrounding areas, the Natal Long-fingered Bat. Natal Long-fingered Bat is occurs in caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore. It has been previously recorded in neighbouring grid to north. Other bat species that could occur in the broader study area are listed in **Table 5.**

Table 5: Bat species that could potentially occur in the broader study area

Common name	Order / Family	Taxon	Habitat	Status	Likelihood of occurrence
Temminck's hairy bat	Chiroptera / Vespertilionidae	*Myotis tricolor*	Caves in forests, shrubland, savanna, grassland, mountains; cave-dwelling aerial insectivore.	LC, (was NT)	**MEDIUM**, site within distribution range, but no records in grid or neighbouring grids.
Cape	Chiroptera /	*Rhinolophus*	Caves and subterranean	LC,	**MEDIUM**,

Common name	Order / Family	Taxon	Habitat	Status	Likelihood of occurrence
horseshoe bat	Rhinolophidae	*capensis*	habitats; fynbos, shrubland and Nama-karoo in western and south-western parts of South Africa	(was NT)	not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Geoffroy's horseshoe bat	Chiroptera / Rhinolophidae	*Rhinolophus clivosus*	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	LC, (was NT)	**MEDIUM**, not previously recorded in grid, but overall geographical distribution includes this site & recorded in grid to north.
Swinny's horseshoe bat	Chiroptera / Rhinolophidae	*Rhinolophus swinnyi*	Caves, oldmines and subterranean habitats; roosts singly or in groups of up to five; in south of its range it appears to be associated with Afromontane forest.	LC, (was EN)	**LOW,** not previously recorded nearby, overall distribution does not include this area, but published data indicates that there is a possibility of it occurring in the southern Cape

6.14 Social and Economic Profile

6.14.1 Cacadu District Municipality

The Cacadu District Municipality (CDM), DC10, is the largest (58 243 km^2) of the six (6) District Municipalities in the Eastern Cape Province. The District is situated in the western portion of the Province, bordering the Western Cape, Northern Cape and two other District Municipalities in the Eastern Cape, namely Chris Hani District Municipality and Amathole District Municipality.

The District consists of nine (9) local municipalities (Category B Municipalities) and four other portions collectively known as the District Management Area (DMA). Two of the four areas are National Parks, namely the Addo Elephant National Park and the Tsitsikamma National Park. These parks are managed by South African National Parks. The District wholly borders the Nelson Mandela Metropolitan Municipality (NMMM), and consequently, land access to the NMMM is via the CDM.

The Cacadu District covers approximately one third of the Eastern Cape's land area, however it only houses 5.4% of the provinces' population. The main population concentrations are in Makana, Kouga and Ndlambe, with more than 50% of residents in the District residing in these Municipalities. The remaining Municipalities all have less than 50 000 inhabitants per Municipality. **Figure 6.24** illustrates the population figures for each of the nine local municipal areas.

Due the relatively small population size and large geographical area, the population density was 5.6 persons per km^2 in 2001 in the Cacadu District Municipality. This is significantly lower than that of the Eastern Cape and South Africa (both 32 in 2001). There is a 72.6% Urbanisation level for the Cacadu District.

6.14.2 Kouga Local Municipality

The Kouga Local Municipality (EC108) is a Category-B Municipality[8], which forms part of the greater Cacadu District Municipality (DC10, category-C Municipality), is located in the southern coastal region of the Eastern Cape approximately 80km west of the Nelson Mandela Metropolitan area (Port Elizabeth). The largest towns within the Municipality are Jeffrey's Bay and Humansdorp and administrative centre of the Municipality is located in Jeffrey's Bay. The municipality is divided into 10 administrative wards.

[8] A category-B municipality is defined as a municipality that shares executive and legislative authority in its area with a category- C municipality within whose area it falls

The municipality is approximately 2 419 km² in size (~4% of the greater Cacadu District Municipality) and bordered in the in the north by the Sundays River and Baviaans Local Municipalities, in the east by the Nelson Mandela Metropolitan area (Port Elizabeth), in the south by the Indian Ocean and in the west by the Kou-Kamma Local Municipality.

The population the Kouga Municipality is estimated at 73 274 (Community Survey, 2007) with an annual growth rate of ~2.4% per annum (Kouga Local Municipality IDP, 2007-2012). The population constitutes approximately 18% of the greater Cacadu District. The population density within the Municipality is estimated at 30.3 people/km^2 (Community Survey, 2007). The majority of the population (~75%) lives in the urban nodes while ~25% live in rural villages or homesteads (Kouga Local Municipality IDP, 2007-2012).

The age profile of the population reveals that approximately 66% of the population falls within the economically active age bracket 15 to 65 years of age. The dependency ratio[9] is, however, is 0.5 which means that every 2 working individual supports 1 non-working/unemployed individual.

Just under half of the population is classified as Coloured (47.7%) followed by Black African (33.4%) and White (18.7). These demographics are reflected in the dominant languages within the Municipality, with 64.9% of the population Afrikaans speaking, 29% isiXhosa speaking and 4.9% English speaking.

The level of education within the Municipality is relatively high. Just over 10% of the population (~ 1 in 10) has no schooling, while over 20% have Std 10/Grade 12 certificate. Approximately 6% of those with a Grade 12 qualification go on to obtain an education at University/Technikon level.

Unemployment within the Municipality is estimated at 15.4% (2001) which in below the Eastern Cape average of ~32% (Eastern Cape State of the Environment Report, 2004), while ~42% of the population are listed as 'not economically active'. The largest sectors in terms of employment within the municipality in 2001 were Agriculture, Forestry & Fishing (~9%), Community Service (~8%%), Wholesale and Retail (4%) Construction (~3%) and Manufacturing (~2%). The 2001 Census data listed 73% as Undetermined.

[9] The dependency ratio is calculated as the number of 0 to 14-year olds, plus the number of 65-year olds and older, divided by the number of people in the 15 to 64-year old age cohort. This is to give a rough indication of dependency.

6.14.3 Kouga Local Municipality – Ward 1

The majority of the proposed project is located in Ward 1 of the Kouga Local Municipality. Ward 1 constitutes ~24% (579.6 km^2) of the total area of the Municipality (2 419 km^2). The ward is predominantly rural and agricultural in terms of land use. The largest settlement is St. Francis Bay.

6.14.4 Population

According to Census 2001 data, the total population of Ward 1 was 4 967 in 2001. More recent data could not be sourced, but it is assumed that the population has increased given the positive population growth rate (2.5%) between 1996 & 2010 noted in the Kouga IDP (2007-2012).

Ward 1 had a relatively large White population group that makes up almost half (~47%) of the Ward's total population. The Black African (~27%) and Coloured (~25%) population groups each account for around a quarter of the total population in Ward 1. This is due to the large White component of population that lives in the town of Cape St. Francis Bay.

6.14.5 Age distribution

The youth cohort (<15 years) in Ward 1 is moderate to low at ~21%. The post-retirement cohort (>64) in Ward 1 is moderate at ~12%. The dependency ratio in Ward 1 is 0.48 in Ward 1, which means that 2 working individual support approximately 1 non-working/unemployed individual.

6.14.6 Education levels

According to 2001 Census data, approximately 18.3% (corresponding to an absolute total of 657 people) of the population of Ward 1 aged 15 and older were estimated to be functionally illiterate / innumerate in 2001. This percentage is linked to the largely unskilled rural agricultural labour force in Ward 1. However, Ward 1 does have a relatively skilled labour force reflected in the fact that 29% of the population have a Std 10/Grade 12 qualification and ~18% have a tertiary level of education. The majority of these higher figures are likely to be linked to the large White component of population that lives in the town of Cape St. Francis Bay.

Given the strong correlation between education and skills levels the potential for local job creation appears to be reasonable for all of the potential employment categories associated with the project, namely low skills, medium skilled and skilled employment opportunities.

6.14.7 Employment levels

The employment statistics for ward 1 indicate that approximately 53% of the population was employed in 2001. The unemployment rate for Ward 1 was estimated at ~10%, which is relatively low with respect to the provincial and national and averages.

6.14.8 Household income

Approximately 76% of households in Ward 1 were living on less than the accepted South African R1 600/ month minimum subsistence level in 2001. Significantly, the ‘no formal income’ category was the most pronounced at ~43%. Approximately 22% of household heads in Ward 1 were earning an income clustered in the R800-R3200/ month range.

6.14.9 Sectoral employment

In terms of the proportional employment per economic sector by head of household for Ward 1 within the Kouga Local Municipality, just under a quarter (~26%) of formal employment is provided by the Agricultural sector followed by the Wholesale and Retail sector (~17%), the Construction sector (~12%) and the Community Services sector (~10%).

6.15 Archaeology

6.15.1 Literature Review

The oldest evidence of the early inhabitants in the region are large stone tools, called hand axes and cleavers which can be found in the river gravels which capped the hill slopes in the region, and on the calcrete floors exposed in the dune systems along the coast towards Cape St Francis (Laidler 1947; Deacon & Geleijnse 1988; Binneman 2001, 2005). The time period is known as the Earlier Stone Age and the stone tools belong to the Acheulian Industry, dating between approximately 1,5 million and 250 000 years old.

After this period, the Acheulian hand axes and cleavers were replaced by a totally different looking stone tool industry, the so-called flake and blade industries of the Middle Stone Age (MSA). The time period, between 120 000 - 30 000 years ago, also witness the emergence of the first modern humans (Homo sapiens sapiens). The oldest remains of anatomically modern humans in the world (some 110 000 years old) comes from the Klasies River complex of caves some seven kilometres west of the proposed development (Singer & Wymer 1982; Rightmire & Deacon 1991; Deacon 1992, 1993, 2001; Deacon, H. J & Shuurman, R. 1992). The archaeological deposits at the Klasies River Caves (1-5) date to 120 000 years old. Although humans were already anatomically modern by 110 000 years ago, they were not yet fully exhibiting 'modern behaviour' and only developed into culturally modern behaving humans between 80 000 and 70 000 years ago. This occurred during cultural phases known as the Still Bay and Howieson's Poort time periods/stone tool traditions. The Howison's Poort is well represented at Klasies River Cave 2 (Deacon & Wurz 1996; Wurz 1999).

No caves and shelters in the region have been excavated yet with deposits dating between 25 000 and 5 000 years ago. Nevertheless, from sites farther along the coast and adjacent Cape Mountains, we know that the past 20 000 years, called the Later Stone Age (LSA), introduced several ‘new’ technological innovations. Others became more common, such as rock art, burials associated with grave goods, painted stones, new microlitic stone tool types, some fixed to handles with mastic, bow and arrow, containers, such as tortoise shell bowls and ostrich eggshell flasks (sometimes decorated), decorative items, bone tools and many more (Deacon & Deacon 1999).

The period between 20 000 and 14 000 years ago experienced extremely cold climatic conditions and had a great influence on the environment, the people and animals. During the Last Glacial Maximum (the last ice age) vast areas were exposed along the coast which created favourable conditions for grassland and grazing animals (also inland). The remains from archaeological sites indicated that there were several large grazing animal species which are now extinct, for example the giant buffalo, the giant hartebeest and the Cape horse. After 14 000 years ago the climate started to warm up again and the sea level rose rapidly. By 12 000 years ago the sea was close to modern conditions and the previously exposed grassland also disappeared due to the rising sea level, causing the extinction of many grassland species including the giant buffalo, hartebeest and the Cape horse (Deacon & Deacon 1999).

Between 10 000 and 8 000 years ago the environment became bushier and gave rise to territorial smaller type browsing animals that lived in small groups or pairs. Most of the large Last Glacial grazing animals disappeared from the archaeological deposits during this time period from sites in the region. A characteristic of the past 8 000 years, also known as the Wilton time period, was the large number of small (microlithic) stone tools in the shelters and open-air middens of the region. However, by 4 500 years ago these stone tools were replaced at the Klasies River Caves by large quartzite stone tools, labelled the Kabeljous Industry (Binneman 2001. 2005). The first real change in the socio-economic landscape came some 2 000 years ago when Khoi pastoralists settled in the region. They were the first food producers and introduced domesticated animals (sheep, goats and cattle) and ceramic vessels to the region (Binneman, 2001, 2005).

Figs 6.25 Earlier Stone Age hand axes observed on an exposed ferricrete palaeosol near a dam (top row) and weathered Middle Stone Age stone tools observed among the sandstone outcrops on the ridge overlooking the coast (bottom row).

6.15.2 Pre-colonial archaeological cultural landscape

» The Cape St Francis/Klippepunt cultural landscape and significance of place

Cultural landscapes, *... are cultural properties and represent the "combined works of nature and of man". They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal* (UNESCO, Operational Guidelines for the Implementation of the World Heritage Convention, 2008).

The concept of cultural landscapes comprises different fields and definitions (well-discussed in the literature and will not be repeated here). This report only discusses the pre-colonial cultural landscape which includes the Earlier, Middle and Later Stone Age. These different fields are present throughout the region. Should other fields need to be investigated, then specialists in those fields must be appointed.

The significance of the pre-colonial archaeology between Cape St Francis in the east and Klippepunt in the west, has been illustrated by research over many years (see the desktop study and brief literature review above), and more recently by a Heritage Impact Assessment conducted at Thyspunt for the proposed nuclear power facility (ACO 2010). The Thyspunt/Cape St Francis area is one of the richest and best preserved archaeological sites in South Africa. The importance of the archaeology of the region was maintained by SAHRA. However, Thyspunt is only a small part of the much larger and elaborate pre-colonial cultural landscape which is situated between Cape St Francis in the east to Klasies River in the west.

The proposed Oyster Bay development is also situated close to other significant archaeological rich areas, such as the Brandewynkop dunes (Lange Fontein dunes). These dunes are small exposed remnants of the Plio-Pleistocene Geelhoutboom dune bypass system west of the Tsitsikamma River. A modern day example is the fast disappearing shifting dune system between Oyster Bay and the St Francis Bay coast (Deacon & Geleijnse 1988). The Geelhoutboom dunes are rich in delicately worked symmetrical Middle Pleistocene Acheulian bifaces and Middle and Later Stone Age stone tools and features. The bulk of the artefacts in this area are from the Middle Stone Age and densities of upwards of 50 artefacts per square metre have been observed. The exposures which are several kilometres in length and several hundred metres in width, is the largest artefact scatter observed along this part of the south-eastern Cape coast (Deacon & Geleijnse 1988). The archaeological context for these dunes is similar to that of the Geelhoutboom dunes (Deacon & Geleijnse 1988; personal observations, 1980s).

Approximately 20 kilometres south-west from the Oyster Bay Wind Energy Facility site is the Klasies River complex of caves (1-5) and several open air shell middens. This is one of the most significant archaeological cave complexes in the world, and home to the oldest anatomically modern human skeletal remains (*Homo sapiens sapiens*) (Singer & Wymer 1982; Rightmire & Deacon 1991; Deacon 1992, 1993, 1995, 2001; Deacon, H. J & Shuurman, R. 1992; Deacon & Deacon 1999). The archaeological deposits at the Klasies River Caves (1-5) date to 120 000 years old (Deacon & Geleijnse 1988). The immediate coastal zone between the Tsitsikamma River and Klippepunt has never been researched/surveyed in any detail. However, several visits over the years demonstrated that this stretch of coast is similar to the Thysbaai coast and exceptionally rich in shell middens and other features. Large complexes of shell middens were observed especially at the Tsitsikamma River mouth and Klippepunt area.

The region east of the Oyster Bay Wind Energy Facility site (See **Figure 2.6**) is a unique cultural landscape, rich in pre-colonial archaeological sites and remains (see Binneman 1985, 1996, 2001, 2005; Nilssen 2006).

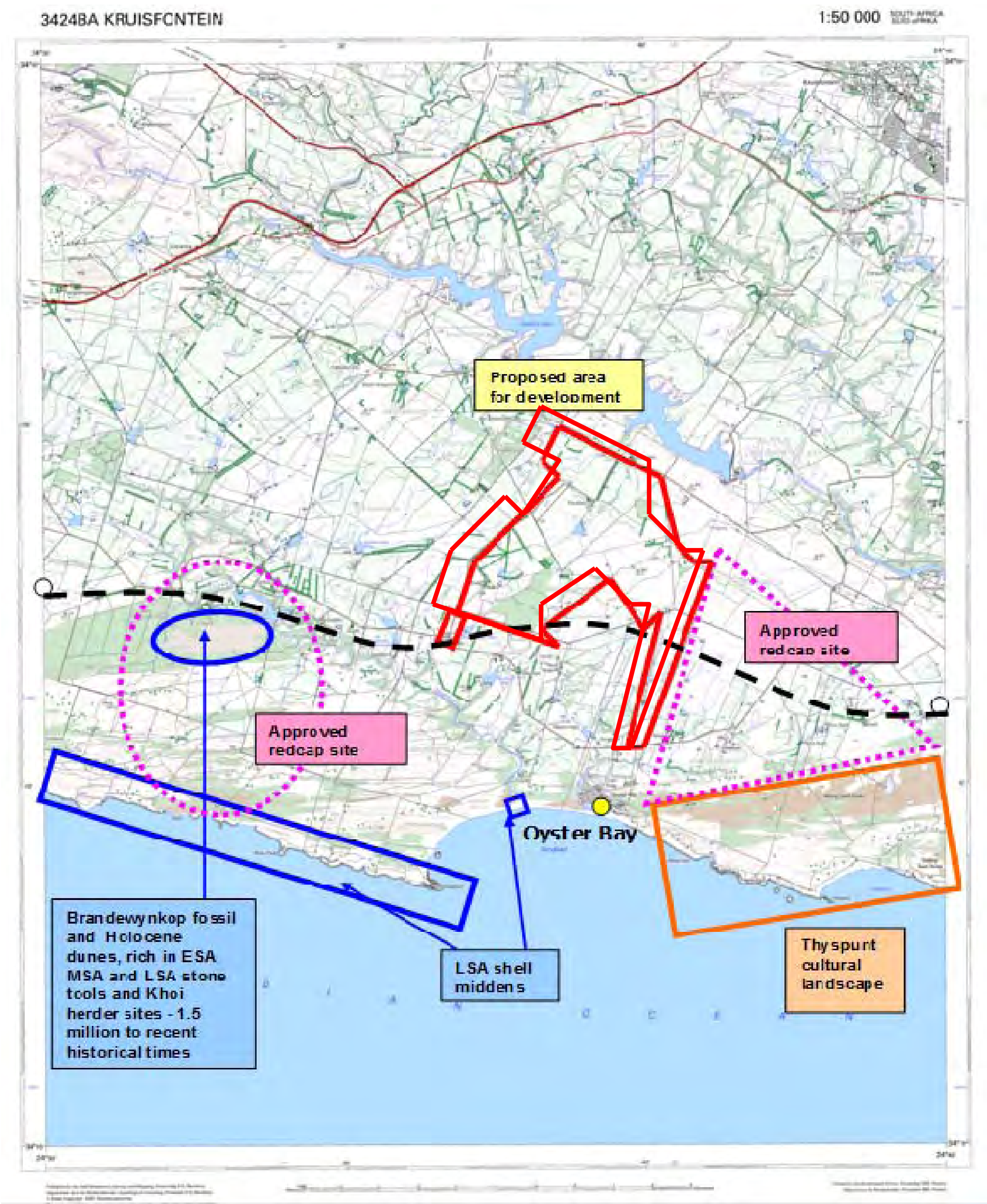

Figure 2.26: 1:50 000 Map indicating the location of the proposed Oyster Bay Wind Energy

Facility in relation to other proposed wind farm developments, the adjacent areas with archaeological sites and the Thyspunt cultural landscape.

6.16 Palaeontology

A brief review of the fossil assemblages recorded from the various major geological formations represented within the broader Oyster Bay study area is given here. Most of these rock units are only sparsely fossiliferous to unfossiliferous. However, rich and scientifically important fossil assemblages have been recorded from the Cedarberg and Baviaanskloof Formations of the Table Mountain Group as well as the Gydo Formation at the base of the Bokkeveld Group. The palaeontological sensitivity of these three rock units may well have been seriously compromised in the Oyster Bay study region near Humansdorp as a result of high levels of tectonic deformation (*e.g.* cleavage formation) as well as deep chemical weathering since the fragmentation of Gondwana some 120 million years ago. Furthermore, the outcrop areas of the mudrock-rich sedimentary successions that are most likely to yield fossil remains are narrow and ill-defined, and are probably largely mantled in a veneer of superficial deposits such as soil, alluvium and gravels that may shield the fossiliferous bedrocks from significant disturbance during development.

6.16.1 Fossils in the Table Mountain Group

Body fossils (shells, teeth, bones *etc*) are so far unknown from the **Peninsula Formation** but a modest range of shallow marine to nearshore fluvial and / or estuarine trace fossils have been recognised, mainly from the Western Cape outcrop area (*e.g.* Rust 1967, Potgieter & Oelofsen 1983, Broquet 1990, 1992, Almond 1998a,b, Braddy & Almond 1999, Thamm & Johnson 2006). These traces include trilobite resting and feeding burrows (*Cruziana*, *Rusophycus*), arthropod trackways (*e.g. Diplichnites, Palmichnium*) that are variously attributed to eurypterids, crustaceans or trilobites, palmate, annulated feeding burrows (*Arthrophycus*), dense assemblages (“pipe rock”) of vertical dwelling burrows of unknown suspension feeders (*Skolithos, Trichichnus*), vertical columns or cones of densely reworked sediment (*Metaichna* / possible *Heimdallia*), and several types of horizontal burrows (*Palaeophycus,* possible *Aulichnites*). Recessive weathering of trace-rich heterolithic intervals is undoubtedly responsible for under-recording of fossils within the Peninsula Formation. It is likely that relatively unweathered samples of fine-grained muddy sediments within these heterolithic intervals may eventually yield microfossil assemblages (*e.g.* organic-walled acritarchs) of biostratigraphic and palaeonvironmental significance.

Apart from vague meniscate backfilled burrows from late glacial or postglacial dropstone argillites in the Hex River Valley, no fossil remains have been described from the **Pakhuis Formation** (Almond 2008).

An exceptionally important and interesting biota of soft-bodied (*i.e.* unmineralised) and shelly invertebrates, primitive jawless vertebrates and microfossils has been recorded since the middle 1970s from finely laminated, black mudrocks of the **Soom Member**, forming the lower, mudrock-dominated portion of the **Cedarberg Formation**. This is one of only two so-called soft-body *Lagerstaette* of Late Ordovician age recorded worldwide (the other example was recently discovered in Canada; Young *et al.,* 2007). The "Soom Shale" is between 10-15m thick, and fossils occur sporadically throughout the succession, from 1m above the base upwards. This biota has been extensively reviewed by Aldridge *et al*. (1994, 2001) and Selden and Nudds (2004) while much new information remains to be published (See review in Almond 2008 and refs. therein). The macrofossils include a range of macroalgae, shelly invertebrates (*e.g.* inarticulate brachiopods, conical-shelled nautiloids and other molluscs, crustaceans, unmineralised trilobites and eurypterids or "water scorpions") and several groups of primitive jawless fish (*e.g.* anaspids, conodonts). Important microfossil groups include chitinozoans, spore tetrads of land plants and marine acritarchs. A further interesting category of fossils recorded from the Soom Member of Kromrivier are bromalites. These are the various fossilised products of ancient animal guts such as droppings (coprolites), regurgitates and stomach contents that sometimes contain the comminuted remains of recognisable prey animals such as conodonts or brachiopods (Aldridge *et al*., 2006). The majority of Soom fossils have been collected from a handful of localities, most of which lie on the Clanwilliam sheet within the central to northern Cedarberg (Gray *et al*. 1986, Cocks & Fortey 1986, Theron *et al*. 1990, Aldridge *et al*. 1995). New fossiliferous localities have recently been identified in the Clanwilliam area, while well preserved trilobite trace fossils (*Rusophycus*) have been collected from thin tempestite sandstones towards the base of the Soom Member in the Hex River Mountains by Almond (unpublished obs., 2011).

A low diversity shelly faunule, dominated by articulate and inarticulate brachiopods together with a small range of trace fossils is recorded from the heterolithic **Disa Member** that forms the upper portion of the Cedarberg Formation. Marine invertebrate fossils have been recorded from the Disa Member in the Groot Winterkoek mountains near Porterville, some 30km southeast of Piketberg, while important post-glacial trace fossil assemblages are known from the Clanwilliam region (Rust 1967b, Cocks *et al.* 1970, Cocks & Fortey 1986, Almond 2008).

The fossil record of the **Goudini** and **Skurweberg Formations**, dominated by braided fluvial sandstones, is very sparse indeed. This reflects major global regression (low sea levels) during the Silurian Period, peaking during the latter part of the period (Cooper 1986). Sporadic, low diversity ichnoassemblages from thin, marine-influenced stratigraphic intervals have been recorded from all three Nardouw formations in the Western Cape by Rust (1967a, 1981) and Marchant (1974). There are also scattered, often vague reports of trace fossils in geological sheet explanations and SACS reports (*e.g.* Malan *et al.* 1989, De Beer *et al.* 2002). Most involve "pipe rock" (*Skolithos* ichnofacies) or various forms of horizontal epichnial burrows, including possible members of the *Scolicia* group which may be attributable to gastropods. Also recorded are typical Early Silurian palmate forms of the annulated burrow *Arthrophycus*, poorly preserved "bilobites" (bilobed arthropod scratch burrows), gently curved epichnial furrows and possible arthropod tracks (Almond 2008). It is possible that more diverse ichnoassemblages (and even microfossils from subordinate mudrock facies where these have not been deeply weathered or tectonised) may eventually be recorded from the more marine-influenced outcrops of the Eastern Cape Fold Belt.

A distinctive marine shelly invertebrate faunule of Early Devonian, Malvinokaffric aspect characterises the upper portion of the **Baviaanskloof Formation** from the Little Karoo eastwards along the Cape Fold Belt. It is dominated by the globose, finely-ribbed articulate brachiopod *Pleurothyrella africana*. Rare homalonotid trilobites, a small range of articulate and inarticulate brachiopods, nuculid and other bivalves, plectonotid "gasteropods" and bryozoans also occur within impure brownish-weathering wackes (Boucot *et al*. 1963, Rossouw *et al*. 1964, Johnson 1976, Toerien & Hill 1989, Hill 1991, Theron *et al.* 1991, Almond *in* Rubidge *et al*. 2008). In many cases fossil shells are scattered and disarticulated, but *in situ* clumps of pleurothyrellid brachiopods also occur. This shelly assemblage establishes an Early Devonian (Pragian / Emsian) age for the uppermost Nardouw Subgroup, based on the mutationellid brachiopod *Pleurothyrella* (Boucot *et al*. 1963, Theron 1972, Hiller & Theron 1988). Trace fossils include locally abundant, mud-lined burrows (*Palaeophycus*, *Rosselia*) and rare giant rusophycid burrows of Devonian aspect (*R. rhenanus*) that are attributed to homalonotid trilobites. Recently, dense assemblages of primitive vascular plants with forked axes and conical terminal "sporangia" that are provisionally ascribed to the genus *Dutoitia* have been collected from Baviaanskloof Formation mudrocks near Cape St Francis, Eastern Cape, *i.e.* very close to the Oyster Bay study area (Dr Mark Goedhart, Council for Geoscience, Port Elizabeth, pers. comm., 2008; Robert Gess pers. comm., 2011; *cf* Hoeg 1930, Anderson & Anderson 1985).

6.16.2 Fossils in the Lower Bokkeveld Group (Ceres Subgroup)

The most important fossil groups recorded from the lower Bokkeveld Group (Ceres Subgroup) include shelly marine invertebrates and traces (burrows *etc*), together with rare fish remains, primitive vascular plants, trace fossils (burrows, borings *etc*) and microfossils (*e.g.* foraminiferans, ostracods, palynomorphs). The overall palaeontological sensitivity of this stratigraphic unit is generally considered to be high to very high (Almond *et al*. 2008), but may be compromised locally by cleavage and weathering (*cf* Haughton et al. 1937, p. 23).

The Lower Bokkeveld Group is especially well known for its rich fossil assemblages of **marine invertebrates** of Early to Mid-Devonian age. The main invertebrate taxa concerned are trilobites, brachiopods, molluscs and echinoderms. Numerous more minor groups are also recorded - corals, conulariids, hyolithids, tentaculitids *etc* - making the Bokkeveld Group one of the palaeontologically most important Devonian units in the southern hemisphere. Fossil invertebrates are especially diverse and abundant within the mudrock-dominated formations, although low-diversity sandstone-hosted fossils assemblages also occur. Shells are generally preserved as external and internal moulds and casts (*e.g.* Schwarz 1906, Reed 1925, Du Toit 1954, Cooper 1982, Oosthuizen 1984, Hiller 1995, Hiller & Theron 1988, Theron & Johnson 1991, Jell & Theron 1999, Thamm & Johnson 2006, Almond 2008). Remarkably rich marine trace fossil assemblages are also known from the lower Bokkeveld Group, especially in nearshore facies (Almond 1998a, 1998b).

The only **vascular plants** recorded from the Ceres Subgroup are a small range of dichotomously branching, leafless forms known as psilophytes (*e.g. Dutoitia*) and primitive lycopods or “club mosses” such as *Palaeostigma*. The material is generally transported (washed offshore from the land), poorly preserved, and has mainly been recorded from the eastern outcrop area of the Bokkeveld Group (Plumstead 1967, 1969, Theron 1972, Anderson and Anderson 1985).

Very sparse **fossil fish** remains have been recorded from the Ceres Subgroup (Gydo and Tra Tra Formations), several retaining their original phosphatic bony material. They comprise acanthodians (“spiny sharks”), primitive sharks, placoderms, and bony fish or osteichthyans, but so far no agnathans (Almond 1997, Anderson *et al*. 1999a, 1999b). The material is fragmentary but of considerable palaeontological significance since so little is known about Early Devonian ichthyofaunas of the ancient supercontinent Gondwana.

So far, the great majority of published records of fossils from the Ceres Group refer to the much better known western outcrop areas in the Western Cape. In the Eastern Cape Province, where the potentially fossiliferous mudrocks are frequently highly deformed, cleaved, and often deeply weathered or covered by dense vegetation, the fossil known record is still rather sparse and understudied. Most of the early geological mapping surveys revealed very few useful fossil records – essentially a scattering of poorly preserved, often deformed marine shells and locally abundant trace fossils (*e.g.* Haughton 1928, 1935, Haughton *et al*., 1937, Engelbrecht *et al*., 1962). Apart from probable records of the primitive vascular plant *Dutoitea*, most early records of plant material and arthropods from the Bokkeveld Group in the Eastern Cape (such as those from near Port Alfred) are probably more correctly assigned to the younger lower Witteberg Group (*e.g.* Anderson & Anderson 1985).

Within the western part of the Eastern Cape Province, only a handful of productive fossil localities within the Ceres Subgroup have been recorded so far. Most notably, these include the Cockscomb area between Willowmore and Steytlerville, Klein Kaba near

Alexandria, and the Uitenhage North area (*e.g.* Theron 1972, Johnson 1976, Hiller 1980, Oosthuizen 1984, Toerien & Hill 1989, Le Roux 2000). As is the case to the west, shelly fossils are most abundant in the mudrock-dominated formations, including the Gydo, Voorstehoek and Tra Tra Formations. Indeed, the Voorstehoek Formation in the Eastern Cape may prove quite productive, although the assignation of some faunal records to this unit requires confirmation (*e.g.* Hiller 1980, Oosthuizen 1984, Hiller 1990). Useful faunal lists for the rich Gydo Formation biota at the Cockscomb Mountains and the unconfirmed Voorstehoek Formation biota at Klein Kaba are given by Oosthuizen (1984, Table III and p.138 respectively). The Cockcomb biota is preserved as moulds within early diagenetic nodules of phosphatic or other composition (*cf* Browning 2008). It includes a wide range of trilobites, brachiopods, bivalves, gastropods, crinoids, a possible echinoid, corals, abundant well-preserved conulariids, ostracods and various problematic groups (*e.g.* hyolithids, tentaculitids and other tubular fossils). The Klein Kaba faunule listed by Oosthuizen (1984) is dominated by a number of articulate brachiopods, but also comprises gastropods, bivalves, nautiloids, trilobites , crinoids, conulariids, various tubular fossils and traces.

6.16.3 Fossils within Caenozoic superficial deposits

Sparse fossil remains have been recorded from Tertiary or younger silcretes (*i.e.* silica-cemented pedocretes) of the Grahamstown and equivalent formations by Roberts (2003) and earlier authors. These include a small range of trace fossils (*e.g.* rhizoliths or plant root casts and invertebrate burrows such as *Skolithos*), charophyte algae (calcareous stoneworts), reed-like wetland plants resembling the extant *Phragmites* (*fluitjiesriet*), and reworked Late Permian silicified wood from the Beaufort Group (See also Adamson 1934, Du Toit 1954, and Roberts *et al.,* 1997). Silicified termitaria might also be expected here, although termite activity is inhibited by waterlogged soils that probably prevailed in areas where silcrete formation occured.

Neogene to Recent alluvial deposits may also contain fossil remains of various types. In coarser sediments (*e.g.* conglomerates) these tend to be robust, highly disarticulated and abraded (*e.g*. rolled bones, teeth of vertebrates) but well-preserved skeletal remains of plants (*e.g.* wood, roots) and invertebrate animals (*e.g.* freshwater molluscs and crustaceans) as well various trace fossils may be found within fine-grained alluvium. Human artefacts such as stone tools that can be assigned to a specific interval of the archaeological time scale (*e.g.* Middle Stone Age) can be of value for constraining the age of Pleistocene to Recent drift deposits like alluvial terraces. Ancient alluvial “High Level Gravels” tend to be coarse and to have suffered extensive reworking (*e.g.* winnowing and erosional down-wasting), so they are generally unlikely to contain useful fossils.

ASSESSMENT OF IMPACTS: WIND ENERGY FACILITY & ASSOCIATED INFRASTRUCTURE — CHAPTER 7

Environmental impacts associated with the proposed wind energy facility are expected to be associated with the construction, operation and decommissioning of the facility. The significance of impacts associated with a particular wind farm is dependent on site-specific factors, and therefore impacts can be expected to vary significantly from site to site.

The construction 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 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 were identified through the scoping evaluation. Potentially significant impacts identified have now been assessed within the EIA phase of the study. The EIA process has involved input from specialist consultants, the project 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 dependent on site-specific factors, and therefore impacts vary significantly from site to site.

This chapter serves to assess the identified potentially significant environmental impacts associated with the proposed wind turbines and associated infrastructure (substation, power line, access road/s to the site, internal access roads between turbines, underground electrical cabling between turbines, turbine foundations), and to make recommendations regarding preferred alternatives for consideration by DEA, as well as for the management of the impacts for inclusion in the draft Environmental Management Plan (refer to **Appendix O**).

In order to assess the impacts associated with the proposed wind energy facility, it is necessary to understand the extent of the affected area. The affected area primarily includes the turbines, substation and associated access roads. A wind energy facility is dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A study area of approximately 23km^2 is being considered as a larger study area for the construction of the proposed wind energy facility. The area to be occupied by turbines and associated infrastructure is illustrated **in Figure 7.1** below, and would include:

» A **wind energy facility** including up to **80 wind turbines**, appropriately spaced to make use of the wind resource on the site. The facility is proposed to have a generating capacity of up to 160 MW, depending on the final turbine selected for implementation. The facility would be operated as a single facility with each turbine being between 1,8MW and 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades between 45 to 55m long attached to the hub.
» Possibly a small transformer outside each turbine tower, depending on the type of turbine deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
» Crane hardstandings (approximately 60x 40m depending on turbine choice, crane choice and geotechnical considerations).
» Cabling between the components, laid approximately 1 m underground where feasible. In as far as possible, cabling will follow the internal access roads.
» Internal roads (approximately 5-6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» An on-site substation to facilitate the connection between the facility and the grid. Two options are being considered, namely:
  * Option 1: the B04 and
  * Option 2: KromRivier Intake/Switching Substation

  This proposed substation will have a high-voltage (HV) yard footprint of approximately 120m x 120m.
» A new 132kV overhead power line to connect to Eskom's existing Melkhout (132kV) substation which is approximately 20km from the site. Three corridor options are under consideration for this power line

» **Operations and service building area** for control, maintenance and storage (approximately 20 x 40m depending on turbine choice).

The assessment presented within this chapter of the report is on the basis of a preliminary layout provided by RES. This layout indicates 77 turbines and associated temporary and permanent infrastructure.

It must be noted that the assessment of issues presented within this chapter (and within the specialist studies attached within Appendices F – N) consider the worst-case scenario in terms of potential impacts. RES has indicated a commitment to the implementation of practical and appropriate mitigation measures where required in order to avoid or reduce impacts, as well as to the implementation of Environmental Best Practice during construction and operation of the facility. This has already been demonstrated in the avoidance of identified sensitive areas within the preliminary facility layout. Therefore, actual impacts associated with the proposed facility are likely to be of lower significance (i.e. significance with mitigation) than indicated within this section of the report, with mitigation & application of the EMP (Appendix O).

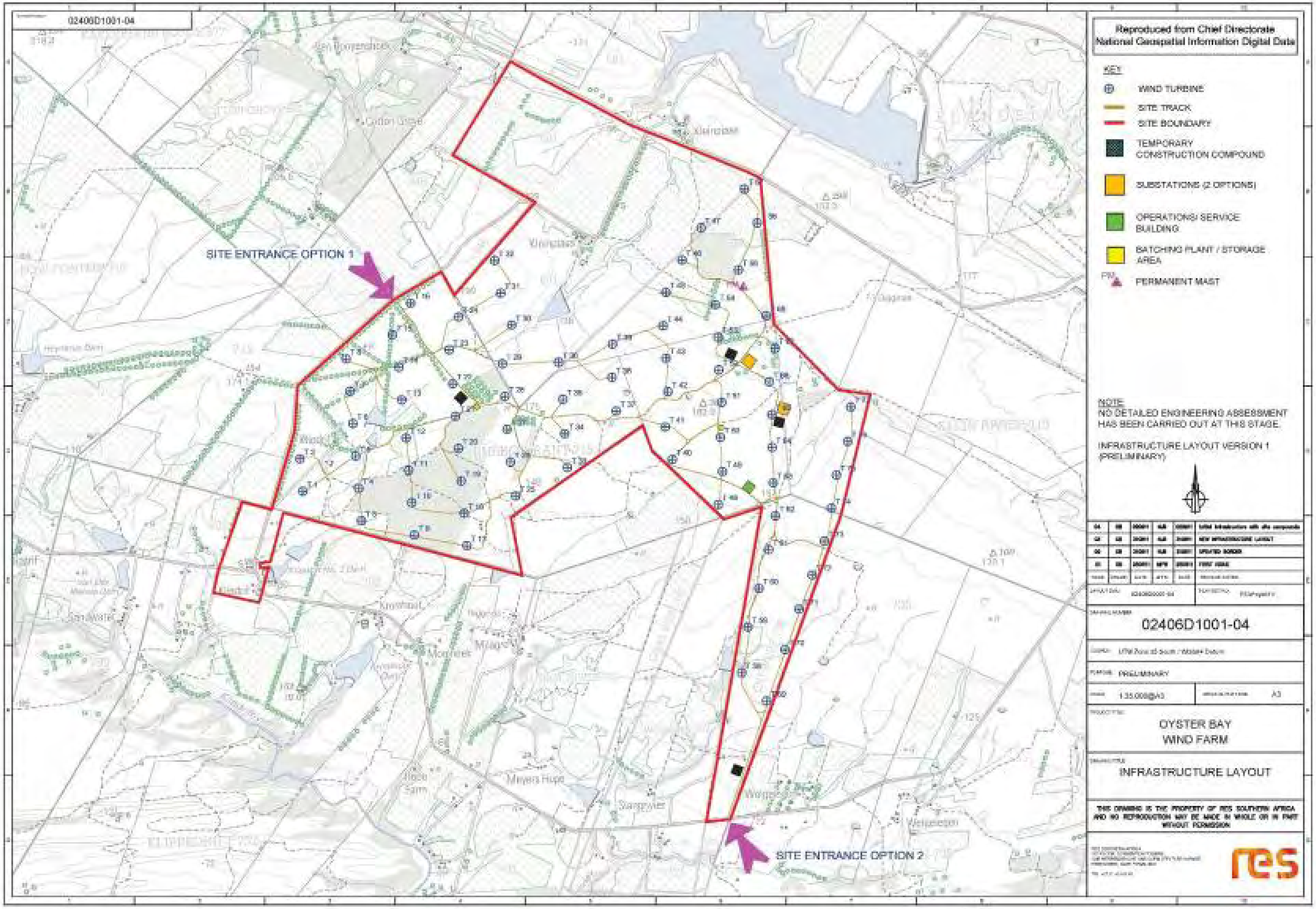

Figure 7.1: Layout of the wind energy facility and associated infrastructure

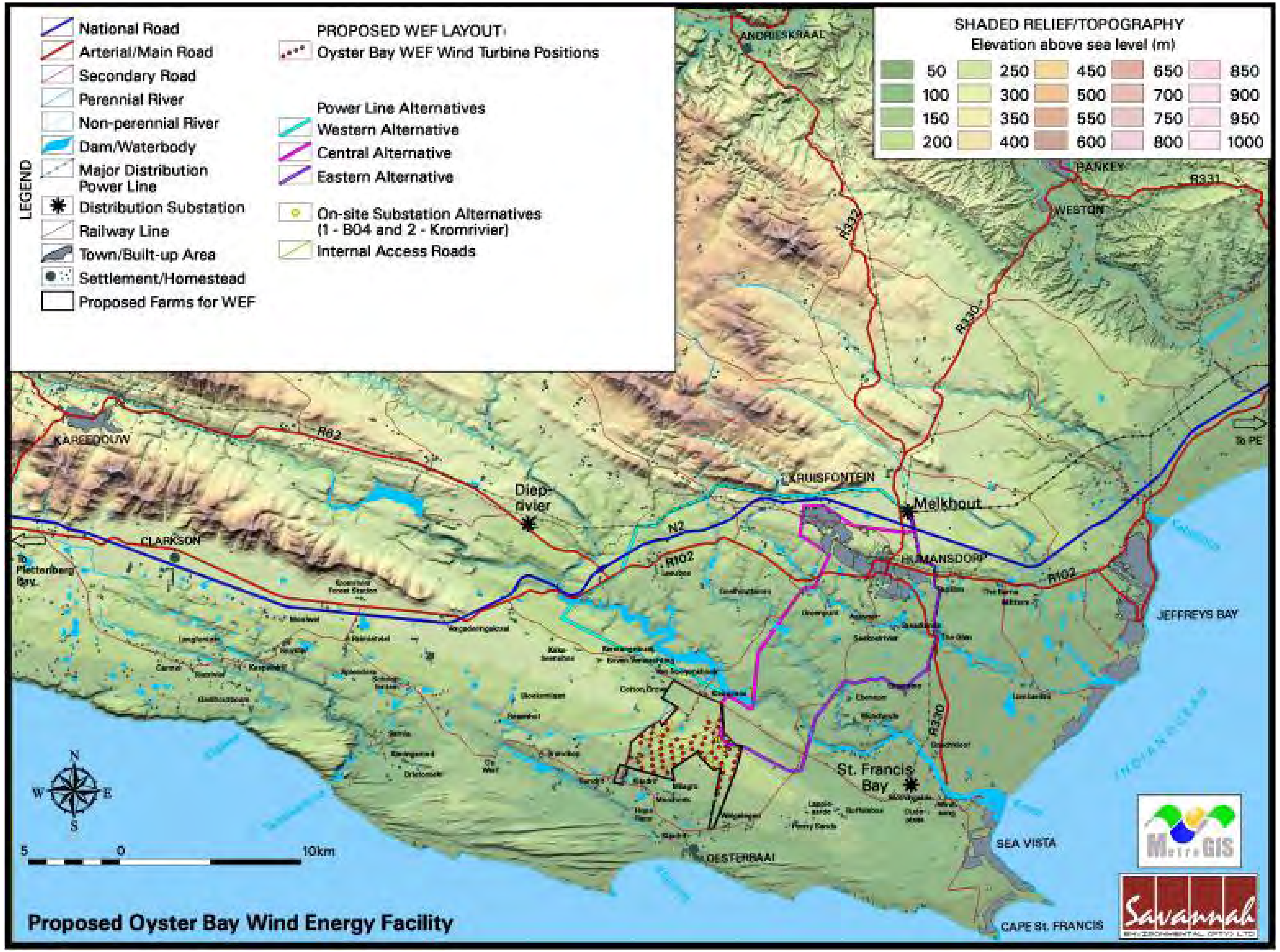

Figure 7.2: Three Alternative power line corridors to Melkhout substation

7.1 Assessment of Potential Impacts on Ecology

The ecological sensitivity assessment identified those parts of the study area that could have high conservation value or areas sensitive to disturbance. Areas of potentially high ecological sensitivity are shown in **Figure 7.3**. Areas containing untransformed natural vegetation, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to have low sensitivity. A map of remaining natural habitats and areas important for maintaining ecological processes in the study area is shown in **Figure 7.3**. Relatively fine-scale mapping was used to provide information on the location of sensitive features.

Any natural vegetation within which there are features of conservation concern have been classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH). The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 “irreplaceable biodiversity areas” would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 “corridor areas” would qualify for inclusion into this class.

The following areas occur on the site:

» **Ares of high ecological sensitivity**

i. All of the drainage lines on site are classified as having high sensitivity .They are protected according to the National Water Act (Act 36 of 1998). Ecologically, they are areas that provide high value ecosystem goods and services.

ii. All areas of fynbos on site. These are potential habitat for the Endangered plant species, *Disa lugens* var. *lugens*, the Vulnerable plant species, *Bobartia macrocarpa*, and the Near threatened plant species, *Pauridia minuta*. They are also considered to have high intrinsic biodiversity value, including high species richness, high habitat variability and high probability of containing species of narrow distribution and/or ecological amplitude.

» **Ares of low ecological sensitivity**

i. Areas where no natural vegetation occurs. This includes cultivated lands, previously cultivated areas with secondary vegetation, areas dominated by alien trees, and areas of buildings, roads and bare ground.

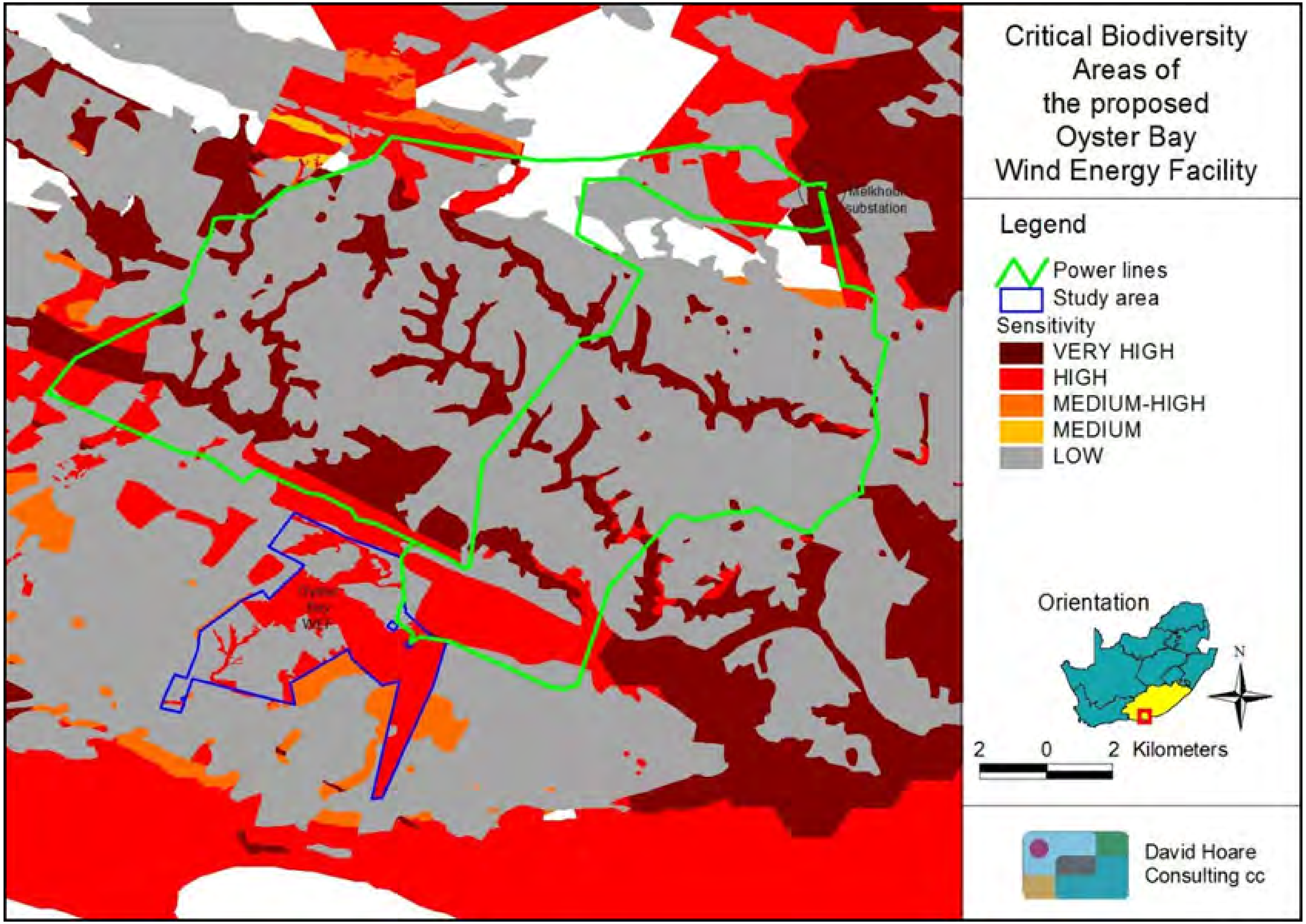

Figure 7.3: Sensitivity of ecology on the site (vegetation, fauna habitat, wetlands)

7.1.1 Loss or fragmentation of indigenous natural vegetation

The most common vegetation on site is Tsitsikamma Sandstone Fynbos, which is classified as Vulnerable. The site also falls within the Cape Floristic Region and includes areas classified as important corridors or habitats in the ECBCP. The natural vegetation on site is not in pristine condition, and many areas are transformed by agriculture. There are however some areas where natural fynbos occurs. Vegetation structure and species composition have been affected by livestock grazing on site. However, fynbos has an intrinsically high biodiversity value.

Construction of infrastructure associated with the proposed wind energy facility may lead to direct loss of vegetation. This will lead to localised or more extensive reduction in the overall extent of fynbos vegetation. Where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Consequences of the impact occurring may include:

- » negative change in conservation status of habitat (Driver et al. 2005);
- » increased vulnerability of remaining portions to future disturbance;
- » general loss of habitat for sensitive species;
- » loss in variation within sensitive habitats due to loss of portions of it;
- » general reduction in biodiversity;
- » increased fragmentation (depending on location of impact);
- » disturbance to processes maintaining biodiversity and ecosystem goods and services; and
- » loss of ecosystem goods and services.

Twenty-nine of the 77 turbines within the preliminary layout are situated within areas that have some natural vegetation on site. The northern alternative for a substation location is situated within an area of high ecological sensitivity and the southern alternative is located in an area of low sensitivity. There are some existing tracks on site, but most the internal access roads required for the wind energy facility will need to be built, and therefore internal access roads and underground cable alignments will be situated within natural vegetation on site in some cases.

7.1.1.1 Impact Tables - Impact on indigenous natural vegetation types – wind energy facility and associated infrastructure

Nature: **Loss of habitat within indigenous natural vegetation types**		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	permanent (5)	permanent (5)
Magnitude	moderate (6)	Moderate to low (5)
Probability	definite (5)	definite (5)
Significance	**medium (60)**	**medium (55)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

(1) Avoid unnecessary impacts on natural vegetation surrounding the turbines., by moving turbines located in areas of high ecological sensitivity as shown in **Figure 7.3**
(2) Impacts should be contained to within the footprint of the turbines and associated laydown area.
(3) Rehabilitate any disturbed areas immediately to stabilise landscapes.
(4) Consider implementing biodiversity offsets, such as stewardship programmes, alien removal or vegetation rehabilitation, to compensate for loss of indigenous natural vegetation.

Cumulative impacts:

Soil erosion, alien invasions, damage to wetlands may all lead to additional loss of habitat that will exacerbate this impact on the site. The development of the recently authorised RedCap Kouga Wind Farm adjacent to this site could lead to cumulative impacts on the natural vegetation on a regional scale – see relevant sections below on cumulative impacts.

Residual Impacts:

Some loss of vegetation will definitely occur.

7.1.2. Impacts on threatened plants

Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, and possibly even local extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

» fragmentation of populations of affected species;
» reduction in area of occupancy of affected species; and
» loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances.

There are three Red List plant species that have a geographic distribution that includes the site and which have a high chance of occurring in the study area, this includes:

» *Disa lugens var. lugens- Endangered*
» *Bobartia macrocarpa - Vulnerable*
» *Pauridia minuta* - Near Threatened

Most of the species that have a high probability of occurring on site would occur within natural fynbos vegetation. The impact will be due primarily to construction activities. The northern alternative for a substation location is situated within an area of high ecological sensitivity and the southern alternative is located in an area of low sensitivity. There are some existing tracks on site, but most the internal access roads will need to be built as existing access roads are not in the areas proposed for the wind turbines. Therefore, internal access roads and underground cable alignments situated within areas of HIGH ecological sensitivity could impact on habitat for threatened plant species.

7.1.2.1 Impact Table - Impact on threatened plants

Nature: Impacts on threatened plants		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Highly improbable (1)
Significance	**Medium (42)**	**Low (10)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: (1) Disturbance of indigenous vegetation must be kept to a minimum, by relocation of wind turbines and associated infrastructure from areas of high ecological sensitivity as far as possible. (2) Where disturbance is unavoidable, disturbed areas should be rehabilitated as quickly as possible. (3) Prior to construction and once final infrastructure positions are known, the footprint of each turbine must be searched for populations of potentially affected plant species of concern. (4) If any populations are found in these areas, move infrastructure to avoid impact. (5) If not possible to relocate infrastructure, a permit is required in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.		
Cumulative impacts: Soil erosion, habitat loss, alien invasions, change in runoff and drainage may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be low if control measures are effectively applied		

7.1.3 Impacts on Wetlands

Construction may lead to some direct or indirect loss of or damage to seasonal marsh wetlands or drainage lines or impacts that affect the catchment of these wetlands. Without mitigation, this could lead to localised loss of wetland habitat and may lead to downstream impacts that affect a greater extent of wetlands or impact on wetland function. Where these habitats are already stressed due to degradation and transformation, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat. Physical alteration to wetlands can have an impact on the functioning of those wetlands. Consequences may include:

» increased loss of soil;
» loss of or disturbance to indigenous wetland vegetation;
» loss of sensitive wetland habitats;
» loss or disturbance to individuals of rare, endangered, endemic and/or protected species that occur in wetlands;
» fragmentation of sensitive habitats;
» impairment of wetland function;
» change in channel morphology in downstream wetlands, potentially leading to further loss of wetland vegetation; and
» reduction in water quality in wetlands downstream of road.

The site contains a number of streams and drainage lines in which wetlands occur. Twenty of the proposed 77 turbines within the preliminary layout are currently positioned within mapped wetland areas or within 50 m of such features. These are turbine numbers 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74. One of the major wetland systems on site constitutes part of the catchment for two estuaries on the coast downstream of the site (the Klipdrif and Krom River estuaries). Neither of the two alternative substation sites are within 50 m to any mapped wetland area. No impacts on wetlands are therefore expected to arise from construction or operation of the substation at either position. Internal access roads and underground cable alignments cross wetlands in a number of places on site, which is inevitable in order to access certain parts of the site.

7.1.3.1 Impact Table - Impact on Wetlands

Nature: Damage to wetland areas resulting in hydrological impacts		
	Without mitigation	**With mitigation**
Extent	local and surroundings (2)	local and surroundings (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	moderate (6)	Minor (2)
Probability	Definite (5)	Improbable (2)
Significance	**high (65)**	**low (18)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	
Irreplaceable loss of resources?	Yes	
Can impacts be mitigated?	To some degree	
Mitigation: (1) As far as possible, relocate turbines 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74 a minimum of 50 metres away from wetland areas.		

(2)	Control stormwater and runoff water and inhibit erosion.
(1)	Obtain a permit from DWA should any wetland or water resource be impacted upon.
Cumulative impacts: Soil erosion and alien plant invasions may lead to additional impacts on wetland habitats that will exacerbate this impact.	
Residual Impacts: Despite proposed mitigation measures, it is expected that this impact will still occur to a small degree.	

7.1.4. Impacts on threatened animals and associated habitat

Threatened animal species are affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction. Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species, and possibly even local extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

» fragmentation of populations of affected species;
» reduction in area of occupancy of affected species; and
» loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species' overall survival chances. There are three mammal species of conservation concern that could potentially be affected by the proposed wind energy facility:

» The Brown Hyaena (listed as Near Threatened). However, the Brown Hyaena is a mobile animal that is likely to avoid the site during construction and re-appear afterwards. This species is therefore unlikely to be affected by construction or operation of the proposed infrastructure.
» Fynbos Golden Mole (listed as Near Threatened). The Fynbos Golden Mole is found in lowland fynbos and Knysna forest, also in urban areas. It prefers sandy soils with a deep litter layer. The dune area south of the site is probable habitat for this species, but it could also occur within areas of sandy soil on site.

» Duthie's Golden Mole (listed as Vulnerable). Duthie's Golden Mole occurs in alluvial sand and sandy loam. The dune area south of the site is probable habitat for this species as well, although, once again, this species could also occur within areas of sandy soil on site. The threatened status of this species (classified as vulnerable) and the narrow distribution of the species indicates that impacts on any populations could have a significant negative impact on the overall conservation status of the species.

The two mole species are not mobile and, if they occur on site, are likely to be affected by the construction of infrastructure since they are largely unable to move away during construction and are dependent on habitat remaining intact. In addition, there is one near threatened reptile species (the Yellow-bellied House Snake) that has a distribution that includes the study area and which could occur on site. The Yellow-bellied House Snake is unlikely to be able to move away during the construction phase, or is dependent on habitats on site remaining intact. This species, although listed as Near Threatened, occurs throughout a wide part of South Africa and the overall status of the species is very unlikely to be significantly affected by the complete loss of the site, which constitutes a very small fraction of its potential overall range. This species as a whole is therefore unlikely to be affected by construction of the proposed infrastructure.

7.1.4.1 Impact Table - Impact on threatened animals / habitat

Nature: Impacts on individuals of threatened animal species		
	Without mitigation	**With mitigation**
Extent	local (1)	local (1)
Duration	long-term (3)	short-term (1)
Magnitude	medium (6)	minor (2)
Probability	improbable (2)	Highly improbable (1)
Significance	**low (20)**	**low (4)**
Status (positive or negative)	negative	negative
Reversibility	Not reversible	Not reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	yes	
Mitigation: (1) Undertake a walk-through survey of areas with sandy soils once final infrastructure positions are known. (2) If any threatened animal populations are found in these areas, move infrastructure to avoid impact as far as possible.		
Cumulative impacts: Impacts that cause loss of habitat (e.g. soil erosion, alien invasions) may exacerbate this		

impact.
Residual Impacts:
Unlikely to be residual impacts.

7.1.5. Impacts on bats

Bats have been found to be particularly vulnerable to being killed by wind turbines. It has long been a mystery why they should be so badly affected since bat echo-location allows them to detect moving objects very well. A recent study in America has found that the primary cause for mortality is a combination of direct strikes and barotrauma (bats are killed when suddenly passing through a low air pressure region surrounding the turbine blade tips causing low pressure damage the bat's lungs, Baerwald *et al*. 2008). The relative importance of this impact on bat populations depends on which species are likely to be affected, the importance of the site for those species and whether the site is within a migration corridor for particular bat species.

The most vulnerable species are those that are already classified as threatened species, including those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species unless the impact occurs across a wide area that coincides with their overall distribution range. Loss of a population or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences include habitat fragmentation of populations of affected species and loss of genetic variation within affected species. These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

There is one Near Threatened bat species that could occur on site or in the surrounding areas, i.e. the Natal Long-fingered Bat. This is a cave-dwelling species that may form colonies of many hundreds of thousands of individuals. They roam up to 15 km from roosting sites to find prey at night. It has a wide distribution and the conservation status of the species will not be affected by construction on site or operation of the powerline.

7.1.5.1 Impact Table - Impact on bats

Nature: Impacts on individuals of bats		
	Without mitigation	**With mitigation**
Extent	regional (3)	local (3)
Duration	long-term (4)	long-term (3)
Magnitude	low (4)	minor (2)
Probability	probable (3)	probable (3)
Significance	**medium (33)**	**low (24)**
Status (positive or negative)	negative	negative
Reversibility	Reversible to some degree	Reversible to some degree
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: (1) Undertake a final survey of the area once final infrastructure positions are known to confirm the presence of possible roosting or foraging habitat for bats. (2) If deemed necessary on the basis of the final survey, implement an environmental monitoring programme to document the impact on bat species.		
Cumulative impacts: A number of wind energy facilities are proposed for this region. The cumulative impact of all these facilities would be significantly greater than one facility on its own.		
Residual Impacts: Will probably be some residual impacts.		

7.1.6. Establishment of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes high disturbance. Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins *et al*. 2003). Consequences of this may include:

» loss of indigenous vegetation;
» change in vegetation structure leading to change in various habitat characteristics;
» change in plant species composition;
» change in soil chemical properties;
» loss of sensitive habitats;
» loss or disturbance to individuals of rare, endangered, endemic and/or protected species;

» fragmentation of sensitive habitats;
» change in flammability of vegetation, depending on alien species;
» hydrological impacts due to increased transpiration and runoff; and
» impairment of wetland function.

A checklist of species previously recorded in the grid in which the site is located indicates that the following species are likely to invade the site, given the right conditions:

» *Acacia Cyclops*
» *Acacia saligna*
» *Acacia mearnsii*
» *Datura stramonium*
» *Hakea sericea*
» *Pinus pinaster*

The black wattle (*Acacia mearnsii*) and the pine tree (*Pinus pinaster*) were found on site, the former in large numbers in concentrated nodes. The potential therefore exists for extensive and diverse invasion of the site (as mitigation). The habitats most likely to be affected are watercourses and fynbos.

The wind turbine, substation, access roads and other infrastructure will create new nodes of disturbance within an otherwise pristine landscape. It is therefore expected that conditions favouring the establishment and spread of alien invasive plants will be greatly enhanced. Currently there are scattered individuals on site, except for *Acacia mearnsii*, which appears to have invaded some areas quite heavily in places on site and in the surroundings.

7.1.6.1 Impact Table - Alien vegetation growth due to disturbance

Nature: Establishment and spread of declared weeds and alien invader plants		
	Without mitigation	**With mitigation**
Extent	Site & surroundings (2)	Site & surroundings (2)
Duration	Long-term (4)	long-term (4)
Magnitude	moderate (6)	low (4)
Probability	Highly probable (4)	improbable (2)
Significance	**medium (48)**	**low (20)**
Status (positive or negative)	negative	negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some degree	
Mitigation: (1) Relocation of wind turbines from areas of high ecological sensitivity. rehabilitate disturbed areas as quickly as possible (2) Do not translocate soil stockpiles from areas with alien plants (3) Control any alien plants immediately to avoid establishment of a soil seed bank that would take decades to remove (4) Establish an on-going monitoring programme to detect and quantify any aliens that may become established		
Cumulative impacts: Soil erosion, habitat loss, damage to wetlands may all lead to additional impacts that will exacerbate this impact.		
Residual Impacts: Will probably be very low if control measures are effectively applied		

7.1.7 Comparative Assessment of Power Line Routings Ecology

There are three alternative power line corridors proposed. The proposed power line corridors are situated primarily in previously disturbed parts of the landscape, although approximately 20% of the power line routes still contain patches of natural fynbos and/or thicket vegetation.

The power line tower structures require a relatively small area of space. It is not expected that power line towers will have a major effect on natural vegetation on site, due to the small footprint of each tower structure. However, the associated access road along the servitude (if required) would potentially have a larger impact on the local ecology.

The known location of the Critically Endangered species (*Erica humansdorpensis*) is directly adjacent to a section of the power line servitude for the Western alternative and this species is very likely to be affected should the proposed power line be constructed within this corridor. The potential impact could therefore be high (could result in destruction of patterns and permanent cessation of processes) if this population is destroyed during clearing of the power line servitude (without mitigation / control measures). For the other species present in the area, the impact could potentially be of low magnitude and is unlikely to affect population processes. Due to the wide distribution of the species, loss of individual species on site is unlikely to affect population processes throughout the range of this species.

The western power line corridor makes 21 wetland crossings, the widest of which is approximately 300 m. The central power line corridor makes 16 wetland crossings, the widest of which is approximately 300 m. The eastern power line corridor makes 15 wetland crossings, the widest of which is approximately 600 m. According to the provided layout, it is probable that the impact on wetlands will occur for the western and central alignments and highly probable for the eastern alignment (due to the one crossing of approximately 600 m).

The potential impacts of the three power line alternatives are very similar, except for two specific issues:

» The presence of a population of a Critically Endangered plant species (*Erica humansdorpensis*) along the pathway of the Western route. Unless this population can be avoided by finding an alternative route past this local site, this route would potentially result in an impact of high significance on a threatened plant species. This would make the western route unacceptable from the point of view of impacts on threatened plant species.
» The Eastern route crosses a wetland (more than 500 m across). It would not be possible to cross this wetland without placing a tower structure within the wetland, which could potentially result in an impact of medium significance. This issue is easily overcome by shifting the alignment slightly to cross the wetland at a narrower point.

Taking the issues above into consideration, the Central and Eastern power line routes are favoured from an ecological perspective compared to the Western route.

7.1.8 Comparative Assessment of Substation Alternatives

Option 1 (northern substation) is situated within an area of high ecological sensitivity and Option 2 (southern substation) is located in an area of low sensitivity. Therefore substation Option 2 is preferred from an ecological perspective.

7.1.9. Cumulative impacts

To some extent a cumulative impact is a regional impact, rather than the local site scale impact, i.e. if something has a regional impact it also has a cumulative impact. The impacts of this type of development (even prior to mitigation) will be significantly less than for various existing and on-going agricultural operations in the region.

Cumulative impacts for this assessment will include any approved wind energy facilities in the area. There is one approved wind energy facility near the Oyster Bay Site, i.e. the RedCap Kouga wind energy facility. The RedCap Kouga site lies adjacent to the proposed wind energy facility near Oyster Bay, on its eastern side and western side. The development of two wind energy facilities in the same region could lead to cumulative impacts on the ecology of the area. However, these impacts are expected to be of a moderate significance, and can be effectively mitigated on site by redesigning the layout to avoid high sensitivity areas identified in **Figures 7.3**, and by formal conservation and active management of the natural areas on site. With the implementation of this mitigation, cumulative impacts on ecology as a result of the establishment of wind energy facilities in the area could be of an acceptable level.

7.119.Conclusions and Recommendations

Potential impacts on wetlands, protected trees, threatened plants and animals, and indigenous fynbos vegetation could occur on the site, particularly in areas of High sensitivity which are indicated in **Figure 7.3**. These are not necessarily “no-go” areas. If impacts on threatened and protected species are managed, it should be possible to develop within these areas of high sensitivity. However, it is recommended that wetlands should be avoided as far as possible.

The following recommendations are made:

» Turbines 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74 should be relocated in order to avoid / minimise impacts on wetlands. These turbines should be placed a minimum of 50 metres outside the outer edge of wetlands.
» A comprehensive search for threatened and near-threatened plant and animal populations must be undertaken within the footprint of the proposed infrastructure prior to construction, once the final position of infrastructure if

known. For plants, this must take place during an appropriate season to maximise the likelihood of detecting plants of conservation concern. If any plants or animals of conservation concern are found within areas proposed for infrastructure, localised modifications in the position of infrastructure must be made (if possible) to avoid such populations and a suitable buffer zone around them applied, where applicable. Where it is not possible to relocate infrastructure, a permit may be required to be obtained in terms of Chapter 7 of the National Environmental Management: Biodiversity Act to carry out a restricted activity involving a specimen of a listed threatened or protected species.

» Preferred substation site- Option 2
» The Central and Eastern power line corridors are acceptable from an ecological perspective. There is an issue with a single wetland on the eastern alignment, but this can be easily overcome with a small alignment modification. If this mitigation is implemented, the potential impacts are identical for both the eastern and central routes. The Western power line route passes a population of a critically endangered plant species, and is therefore not preferred from an ecological perspective.

7.2 Assessment of Potential Impacts on Avifauna

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

» Mortality due to collision with the wind turbines;
» Displacement due to disturbance;
» Habitat loss due to the footprint of the wind farm; and
» Mortalities from collisions with the associated power lines

Internationally, it is widely accepted that bird mortalities from collisions with wind turbines contribute a relatively small proportion of the total mortality from all causes. The US National Wind Coordinating Committee (NWCC) conducted a comparison of wind farm bird mortality with that caused by other man-made structures in the USA (Anon. (b) 2000). The NWCC did not conduct its own study, but analysed all of the research done to date on various causes of avian mortality, including commercial wind farm turbines. It reports that "data collected outside California indicate an average of 1.83 avian fatalities per turbine (for all species combined), and 0.006 raptor fatalities per turbine per year. Based on current projections of 3,500 operational wind turbines in the US by the end of 2001, excluding California, the total annual mortality was estimated at approximately 6,400 bird fatalities per year for all species combined". The NWCC report states that its intent is to "put avian mortality associated with wind power development into perspective with other significant sources of avian collision mortality across the United States". It further reports that: "Based on current estimates, windplant related avian collision fatalities probably represent from 0.01% to 0.02% (i.e. 1 out of every 5,000 to 10,000) of the annual avian collision fatalities in the United States". That is, commercial wind turbines cause the direct deaths of only 0.01% to 0.02% of all of the birds killed by collisions with man-made structures and activities in the USA.

Also in the USA, a Western EcoSystems Technology Inc. study found a range of between 100 million to 1 billion bird fatalities due to collisions with artificial structures such as vehicles, buildings and windows, power lines and communication towers, in comparison to 33,000 fatalities attributed to wind turbines. The study (see Anon. (a) 2003) reports that “wind plant-related avian collision fatalities probably represent from 0.01% to 0.02% (i.e. one out of every 5,000 to 10,000 avian fatalities) of the annual avian collision fatalities in the United States, while some may perceive this level of mortality as small, all efforts to reduce avian mortality are important”. A Finnish study reported 10 bird fatalities from turbines, and 820,000 birds killed annually from colliding with other structures such as buildings, electricity pylons and lines, telephone and television masts, lighthouses and floodlights (Anon. (a) 2003).

The investigation of potential impacts on birds caused by wind farms is a new field of study in South Africa, the primary source of information on bird occurrence, densities, flight patterns and habitat at the site is a bird monitoring programme that commenced in May 2011 and is on-going. The objective of the programme is to gather baseline data on bird usage of the site, and covers all four seasons over a 12-month period. The monitoring programme was designed in accordance with *“Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa”* (Jenkins *et al* 2011) by the Endangered Wildlife Trust (EWT) and BirdLife South Africa (BLSA). To date, 20.95km of transects have been surveyed, and 60 hours of vantage point observations have been completed.

Vegetation structure is more critical in determining bird habitat than actual plant composition (Harrison et.al. 1997). Therefore, the description of vegetation presented in this study concentrates on factors relevant to birds, and does not give an exhaustive list of plant species which occur in the study area. Within the study area, approximately 17% of the habitat is classified as wetland, 22% as agriculture, 35% as scrub and 4% as grassland. The priority bird species that have been recorded on the site to date (transect counts and VP observations) are listed in **Table 7.1**. The non-priority species (transect counts) are listed in the avifauna report.

Table 7.1: Priority bird species recorded on site during 1 replicate of winter transect surveys (20.95km) and 60 hours of Vantage Point (VP) observations

Priority Species	**Birds per kilometre**
Black-winged Lapwing	0.76
Denham's Bustard	1.05
Jackal Buzzard	0.29
Temminck's Courser	0.29
African Marsh-Harrier	Recorded at VPs only
White-bellied Korhaan	Recorded at VPs only
African Fish-Eagle	Recorded at VPs only
Blue Crane	Recorded at VPs only
Jackal Buzzard	Recorded at VPs only
Lanner Falcon	Recorded at VPs only

7.2.1 Bird Mortalities due to collisions with wind turbines

During the observation period on site, priority species were recorded flying over the study area. A total of 65 individual flights (single birds and flocks) were recorded, involving 102 individual birds. Of these, 35 flights were at low altitude (below rotor height), 19 were at medium altitude (i.e. approximately within rotor height) and 10 were at high altitude (above rotor height). The passage rate for priority species over the study area (all heights) was 1.71 birds/hour. For medium altitude flights only, the passage rate was 0.3 birds/hour.

The flight data collected so far for priority species over the proposed turbine area for the **winter** period show that:

» Of the priority species, Denham's Bustard and Jackal Buzzard are most often recorded flying at medium height;
» Flights take place during all wind conditions, but most medium height flights were recorded during moderate winds; and
» Most flights take place during south-westerly winds, followed by westerly winds.

Calculating an estimated collision rate (ECR) is a risky venture, because of the many assumptions that inevitably need to be made in order to arrive at a figure, due to the lack of actual data in this regard from South Africa. In this instance, an ECR for priority species per turbine for winter was calculated in the following manner:

» The number of birds which could be flying at medium altitude in the VP area during the winter period (mid-May to mid-August) was estimated. This was done by multiplying the passage rate for medium altitude (0.3 birds/h) with the potential flying time available for that period, assuming that each day will have an average of 8 hours potential flying time.
» The following formula was used: (90 days x 8 hours) x 0.3 = 216 birds.
» The total surface area that is covered by the VP area comes to approximately 4852 hectares, and within this area, the total surface area covered by the turbine rotors footprint (taken as a 50 m radius around the centre column) amounts to approximately 60 hectares (.781ha x 77 turbines), i.e. about 1.2%, which means that 98.8% of the airspace in the VP area can be considered safe from a collision risk perspective.

Based on this, it was conservatively assumed that at least 90% of all birds flying through the study area at turbine height, medium altitude would therefore be travelling through "safe" airspace, or conversely, it was assumed that up to 21 birds (10%) would potentially collide with turbines, if they take no evasive action. This figure was then multiplied by 0.02, on the assumption that 98% of these birds will take evasive action to avoid the turbines (SNH 2010). This gives an ECR of 0.42 birds, or 0.005 birds per turbine for the winter season (= 77 turbines). In other words, the potential/ estimated collision rate is less than 1 bird per wind turbine for the Oyster Bay site. Given the limitations to the bird study (See Avifauna report itself), it is imperative to use the figures above with caution, and use it as a rough indicator of collision risk.

In order to form a picture of the spatial distribution of priority species flights over the turbine area, a distribution map of flights was prepared. This was done by overlaying a 100 m x 100 m grid over the survey area. Each grid square was then given a weighting score taking into account the length of individual flight lines and the number of individual birds crossing the square (**Figure 7.4** for the map of medium altitude flights recorded during the winter observation period).

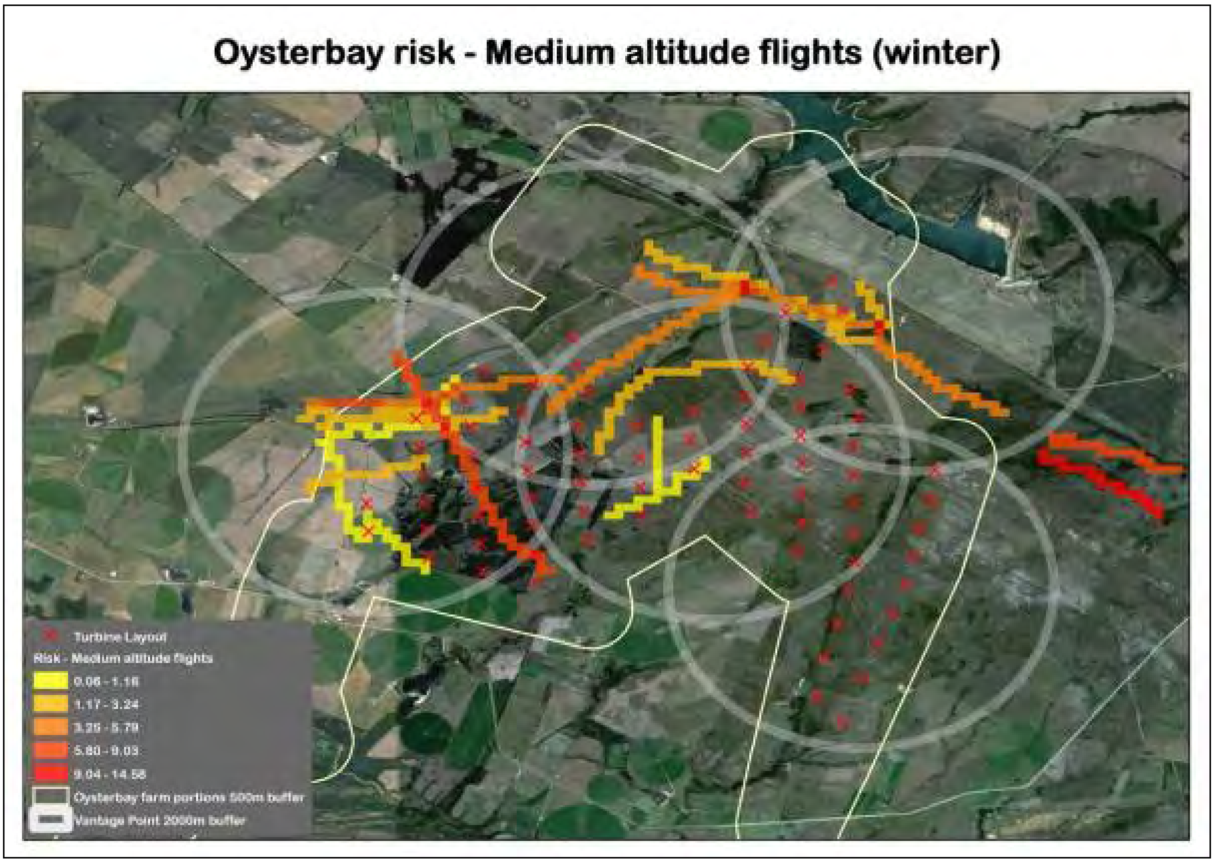

Figure 7.4: Spatial distribution of recorded medium height flights (priority species) over the proposed turbine area (60 hours of observation)

Due to the limited amount of bird monitoring that has been conducted on site to date, it would be risky to draw preliminary conclusions as far as priority species are concerned.

7.2.1.1 Impact Table - Bird Mortalities due to collisions with wind turbines

Nature: Bird collisions, particularly priority species, with the wind turbines		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (1)
Significance	**33 (Medium)**	**9 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources?	Yes	No
Can impacts be	Yes	

mitigated?		
Confidence	Low, due to lack of data	

Mitigation

» Pre-construction monitoring should continue for a 12-month period as planned, to establish an adequate baseline for comparative purposes.

» Once the turbines have been constructed, post-construction monitoring as per any accepted / endorsed bird monitoring guidelines / standards, to compare actual collision rates with predicted collision rates. If actual collision rates indicate unsustainable mortality levels, the following mitigation measures to be considered:

- ∗ If possible, negotiating appropriate off-set compensation for turbine related collision mortality
- ∗ As a last resort, halting operation of specific turbines during peak flight periods, or reducing rotor speed, to reduce the risk of collision mortality

Cumulative impacts:

It is impossible to say at this stage what the cumulative impact of all the proposed wind developments will be on birds, firstly because there is no baseline to measure it against, and secondly because the extent of actual impacts will only become known once a few wind farms are developed. It is therefore imperative that pre-construction and post-construction monitoring is implemented any accepted / endorsed bird monitoring guidelines / standards to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species.

Residual Impacts:

It is envisaged that mitigation will greatly reduce but not entirely eliminate collision mortality.

7.2.2 Displacement of Birds due to Disturbance

The three transects were counted once during the winter season. A total of 56 species were recorded, of which 4 are Priority species. Index of Kilometric Abundance (IKA = birds/km) was calculated for each species (see **Table 7.2** below). The 4 priority species are listed in **Table 7.2**.

Table 7.2: Species recorded during transect surveys (1 replicate)

Priority Species	Total count	Length	IKA
Black-winged Lapwing	16.00	20.95	0.76
Denham's Bustard	22.00	20.95	1.05
Jackal Buzzard	6.00	20.95	0.29
Temminck's Courser	6.00	20.95	0.29

The habitat in which birds were counted was also recorded, to get an indication of the relative importance of habitat classes from a bird usage perspective. An indication of habitat usage (winter) is given in **Table 7.3** below. Within the survey area (defined as a 1km buffer around the transects), approximately 17%

of the habitat is classified as wetland, 22% as agriculture, 35% as scrub and 4% as grassland.

Table 7.3: Habitat usage in the study area

Species	Agriculture		Scrub		Grassland		Wetland	
	Total count	%	Total count	%	Total count	%	Total count	%
All spp (total)	445	55.90%	247	31.03%	90	11.31%	14	1.76%
Non-priority spp	418	56.03%	243	32.57%	71	9.52%	14	1.88%
Priority spp	27	54.00%	4	8.00%	19	38.00%	0	0.00%
Priority Species								
Black-winged Lapwing	16	100.00%	0	0.00%	0	0.00%	0	0.00%
Denham's Bustard	4	18.18%	4	18.18%	14	63.64%	0	0.00%
Jackal Buzzard	4	66.67%	0	0.00%	2	33.33%	0	0.00%
Temminck's Courser	3	50.00%	0	0.00%	3	50.00%	0	0.00%

From the results of the transect surveys completed to date, the following preliminary conclusions can be drawn:

» The survey area is well-suited for Denham's Bustard and White-winged Lapwing.
» Agricultural land and grassland are emerging as important habitat for priority species – these accounted for 92% of priority species records to date, although it only makes up approximately 26% of the habitat surveyed.
» Interestingly, no White-bellied Korhaans were recorded on the transect counts. However, this is almost certainly set to change as the monitoring progresses, as the species was recorded during VP observations, and also by the author during previous site visits in the southern transect area.

It can only be speculated about the impact of potential displacement on terrestrial birds in the study area, particularly Denham's Bustard, White-bellied Korhaan, Blue Crane and White-winged Lapwing. If the birds are displaced, this potentially could be the most significant impact of the wind farm on birds. Very little published literature is available on the impact of wind farms on bustards, but the little that is available seems to indicate that displacement is likely (Langgemach 2008). The usual response of Denham's Bustards during the surveys is to flush in response to pedestrian and vehicle traffic. The potential for habituation is always there, but due to lack of research results, no unequivocal predictions can be made. As far as raptors are concerned, the chances of displacement are low, based on research results elsewhere (Madders and Whitfield 2008). This trend also seems to be supported by the results of the limited post-construction monitoring conducted at the existing four turbines at the Darling Wind Farm (Van Rooyen 2011). Blue Cranes might also be more tolerant, based on general observations in the study area where Blue Cranes breed and forage in close proximity to agricultural operations.

Figure 7.5: Picture of a Denham's Bustard, source: http://www.birdlife.org/news/news/2009/06/news_byte_12.html

BirdLife South Africa (BirdLife Partner) has formed a working group to aid the conservation of bustards within the country, as six of the country's ten species are listed in the South African Red Data Book.

7.2.2.1 Impact Table - Impact on birds due to disturbance

Nature :Displacement of birds due to disturbance, particularly for 4 priority bird species		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**33 (Medium)**	**33 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: » The pre-construction monitoring programme must continue as planned to provide baseline information for comparative purposes;		

» Post-construction monitoring should be implemented to assess the impact of displacement, particularly on priority species. Initially, a 12 month period of post-construction monitoring should be implemented, using the same protocol as is currently implemented. Thereafter, the need for further monitoring will be informed by the results of the initial 12-month period; » Should the results of the post-construction monitoring indicate significant displacement of priority species, if feasible, off-set compensation should be negotiated with developer to compensate for the loss of priority species habitat; and » During the construction period, activity should be restricted to the construction footprint itself. Access to the rest of the properties must be strictly controlled to prevent unnecessary disturbance of birds.
Cumulative impacts: It is impossible to say at this stage what the cumulative impact of all the proposed wind developments will be on birds, firstly because there is no baseline to measure it against, and secondly because the extent of actual impacts will only become known once a few wind farms are developed. It is therefore imperative that pre-construction and post-construction monitoring is implemented any accepted / endorsed bird monitoring guidelines / standards to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species.
Residual Impacts: Strict access control during the construction phase will prevent some disturbance, but the main source of disturbance related displacement will be the wind farm activities itself.

7.2.3 Loss of Avifauna Habitat

The scale of direct habitat loss resulting from the construction of a wind energy facility and associated infrastructure depends on the size of the project but, generally speaking, is likely to be as small per turbine base. Typically, actual habitat loss amounts to 2–5% of the total development area (Fox et al. 2006 as cited by Drewitt & Langston 2006). Direct habitat loss is not regarded as a major impact on avifauna compared to the potential impact of collisions with the turbines and, in particular, potential displacement due to disturbance.

The infrastructure footprint must be restricted to the minimum in accordance with the recommendations of the ecological specialist study (in terms of sensitive vegetation, habitat / wetlands – See Section 7.1).

7.2.3.1 Impact Table - Impact on avifauna habitat

Nature: Displacement due to habitat destruction		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**36 (Medium)**	**21 (Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: The infrastructure footprint must be restricted to the minimum in accordance with the recommendations of the ecological specialist study (in terms of sensitive vegetation, habitat / wetlands – See Section 7.1).		
Cumulative impacts: It is impossible to say at this stage what the cumulative impact of all the proposed wind developments will be on birds, firstly because there is no baseline to measure it against, and secondly because the extent of actual impacts will only become known once a few wind farms are developed. It is therefore imperative that pre-construction and post-construction monitoring is implemented any accepted / endorsed bird monitoring guidelines / standards to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species. Indications are that Denham's Bustard might be displaced from the wind energy facility site and the approved RedCap wind energy facility site.		
Residual Impacts: Some habitat destruction is inevitable in the areas where the wind farm infrastructure will be located.		

7.2.4 Electrocution / Collision of Birds by Power line

The proposed 132kV power line that will link the wind facility to the grid could pose a collision risk, irrespective of which of the three alternative alignments are used. Because of their size and prominence, power lines constitute an important interface between birds and people. Negative interactions between birds and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs & Ledger 1986a; Hobbs & Ledger 1986b; Ledger *et.al.* 1992; Verdoorn 1996; Kruger & Van

Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Electrocutions are not envisaged to be a problem on the proposed overhead power line network. Collisions, on the other hand, could be a major potential problem.

Collisions kill far more birds annually in southern Africa than electrocutions (Van Rooyen 2007). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Many of the collision sensitive species are considered threatened in southern Africa - of the 2369 avian mortalities on distribution lines recorded by the EWT since August 1996, 1512 (63.8%) were Red Data species (Van Rooyen 2007).

Power line collisions have long been recorded as a major source of avian mortality (Van Rooyen 2007). In the Overberg region of the Western Cape, which has a comparable suite of power line sensitive species to the study area, most numerous amongst power line collision victims are Blue Crane and Denham's Bustard (Shaw 2009), both of which occur in large numbers in the area where the proposed power line is situated. It has been estimated that as many as 10% of the Blue Crane population in the Overberg are killed annually on power lines, and figure for Denham's Bustard might be as high as 30% of the Overberg population (Shaw,2009), although this figure requires further verification. These figures represent a possible unsustainable source of unnatural mortality of birds in the Overberg region. Data gathered by the St Francis Bay Bird Club between 1999 and 2010 for the CAR project on Route EH03 indicates healthy populations of Blue Crane and Denham's Bustard in the study area (see **Table 7.4** and **Figure 7.6**).

Table 7.4: St Francis Bay Bird Club CAR counts on route EH03 (St Francis Bay Bird Club 2011)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
Blue Crane													
Summer	0	0	2	5	0	12	2	2	5	2	2	6	38
Winter	0	0	11	0	48	2	116	230	8	12	8	4	439
Denham's Bustard													
Summer	14	0	3	0	2	2	6	1	28	38	12	16	122
Winter	4	29	16	18	16	15	13	9	34	17	16	59	246

Figure 7.6: Location of St Francis Bay Bird Club CAR route EH03 (blue line)

The dynamics of the collision of birds with power lines is poorly understood. In the most recent study on this problem in the Overberg, Shaw (2009) identified cultivated land and region as the significant factors influencing power line collision risk for Blue Cranes. Lines that cross cultivated land pose a higher risk, as expected, as this is the preferred habitat of Blue Cranes in the Overberg. Interestingly, Shaw also found that collision rates in the Bredasdorp region are much higher than those around Caledon, which might be a function of the higher proportion of flocks, and a greater number of large flocks (50+ birds) in Bredasdorp, as opposed to Caledon in the winter. Collision rates are higher for birds in flocks, as they may panic, or lack visibility and room for manoeuvre because of the close proximity of other birds (APLIC, 1994). Other factors, such as proximity to dams (such as the Mpofu Dam near the site), wind direction and proximity to roads and dwellings did not emerge as significant factors, but she readily admits that her broad-scale analysis may have been too crude to demonstrate their effects. It is, for example, a well-known fact that cranes are particularly vulnerable to power lines skirting water bodies used as roosts, as they often arrive there or leave again in low light conditions (C Van Rooyen, pers. obs.).

7.2.4.1 Impact Table - Electrocution/ collision of birds with the Power line

Nature: Bird collisions, particularly priority species, with the proposed power line		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**44 (Medium)**	**33 (Medium)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, but not entirely	
Confidence	High	High
Mitigation: The power line should be marked with Double Loop Bird Flight Diverters on the earth wire of the line, five metres apart, alternating black and white.		
Cumulative impacts: The power line network in the study area is well developed, and is almost certainly a source of unnatural mortality for large terrestrial species, specifically Blue Cranes and		

Denham's Bustard. This power line will further increase the cumulative risk posed by the network.
Residual Impacts: It is envisaged that mitigation will reduce but not entirely eliminate collision mortality.

7.2.5 Comparative Assessment of Substation Alternatives

There are no differences in the significance of impacts for either of the proposed substation alternatives in terms of impacts of avifauna.

7.2.6 Comparative Assessment of Power Line Routings

From a potential avifaunal collision risk perspective, none of the proposed power line alignments emerge as a clear preferred alternative, as they all run through basically the same avifaunal habitat. However, the Eastern alignment is slightly preferred over the other two alignments for the following reasons:

» It is the shortest length of power line.
» It runs next to an existing overhead power line for approximately 10km. Evidence suggests that placing a new line next to an existing line reduces the risk of collisions to birds. The reasons for that are two-fold namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and have learnt to avoid it (APLIC 1994; Sundar & Choudhury 2005). Other transmission lines running parallel to the proposed alignments were therefore be treated as a risk reducing factor.

7.2.7. Cumulative impacts

It is impossible to say at this stage what the cumulative impact of all the proposed wind developments in the Overberg region will have on birds, firstly because there is no baseline to measure it against, and secondly because the extent of actual impacts will only become known once a commercial wind energy facility is developed in South Africa / the Overberg region. However the RedCap Kouga wind energy facility, which is adjacent to the RES site, has received an environmental authorisation. The cumulative effect of the two wind energy facilities on bird species of conservation concern may be moderate to high, without mitigation. It is therefore imperative that pre-construction and post-construction monitoring is implemented any accepted / endorsed bird monitoring guidelines / standards to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species. This will provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species. At this stage, indications are that displacement may emerge as a significant impact, particularly for species such as Denham's Bustard, White-bellied Korhaan and (possibly) Secretary bird.

7.2.8. Conclusions and Recommendations

The flight data collected so far for priority species over the proposed turbine area for the winter period show that:

» Of the priority species, Denham's Bustard and Jackal Buzzard are most often recorded flying at medium (rotor) height;
» Flights take place during all wind conditions, but most medium height flights were recorded during moderate winds; and
» Most flights take place during south-westerly winds, followed by westerly winds.

A preliminary estimated collision rate (ECR) of 0.42 birds, or 0.005 birds per turbine for the winter season (= 77 turbines) was calculated with the available data, subject to several important qualifications. It is imperative to approach this figure with caution, and see it at best as very rough indicator of collision risk.

Due to the limited amount of monitoring that has been conducted to date, it would be risky to draw preliminary conclusions as far as priority species are concerned. At this stage of the investigations, the following management actions are recommended to reduce the risk of collisions by priority species:

» Pre-construction monitoring should continue for a 12-month period as planned, to establish an adequate baseline for comparative purposes.
» It is therefore imperative that pre-construction and post-construction monitoring is implemented any accepted / endorsed bird monitoring guidelines / standard.
» The power line should be marked with Double Loop Bird Flight Diverters on the earth wire of the line, five metres apart, alternating black and white.

The following management actions are proposed to minimize the impact of displacement on birds:

» The pre-construction monitoring programme must continue as planned to provide baseline information for comparative purposes;
» Post-construction monitoring should be implemented to assess the impact of displacement, particularly on priority species. Initially, a 12-month period of post-construction monitoring should be implemented, using the same protocol as is currently implemented. Thereafter, the need for further monitoring will be informed by the results of the initial 12-month period;

» Should the results of the post-construction monitoring indicate significant displacement of priority species, appropriate – if feasible - off-set compensation should be negotiated with the developer to compensate for the loss of priority species habitat; and
» During the construction period, activity should be restricted to the construction footprint itself. Access to the rest of the properties must be strictly controlled to prevent unnecessary disturbance of birds.

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

A soil sensitivity map for the site is shown in **Figure 7.7**. Areas of high sensitivity include wetlands and pivot system irrigated agricultural land which no turbines should be located on.

The construction of turbines, buildings, roads and power lines could lead to physical degradation of soil. During the operation of the wind energy facility soil impacts could include soil contamination / soil erosion by vehicles doing maintenance on site.

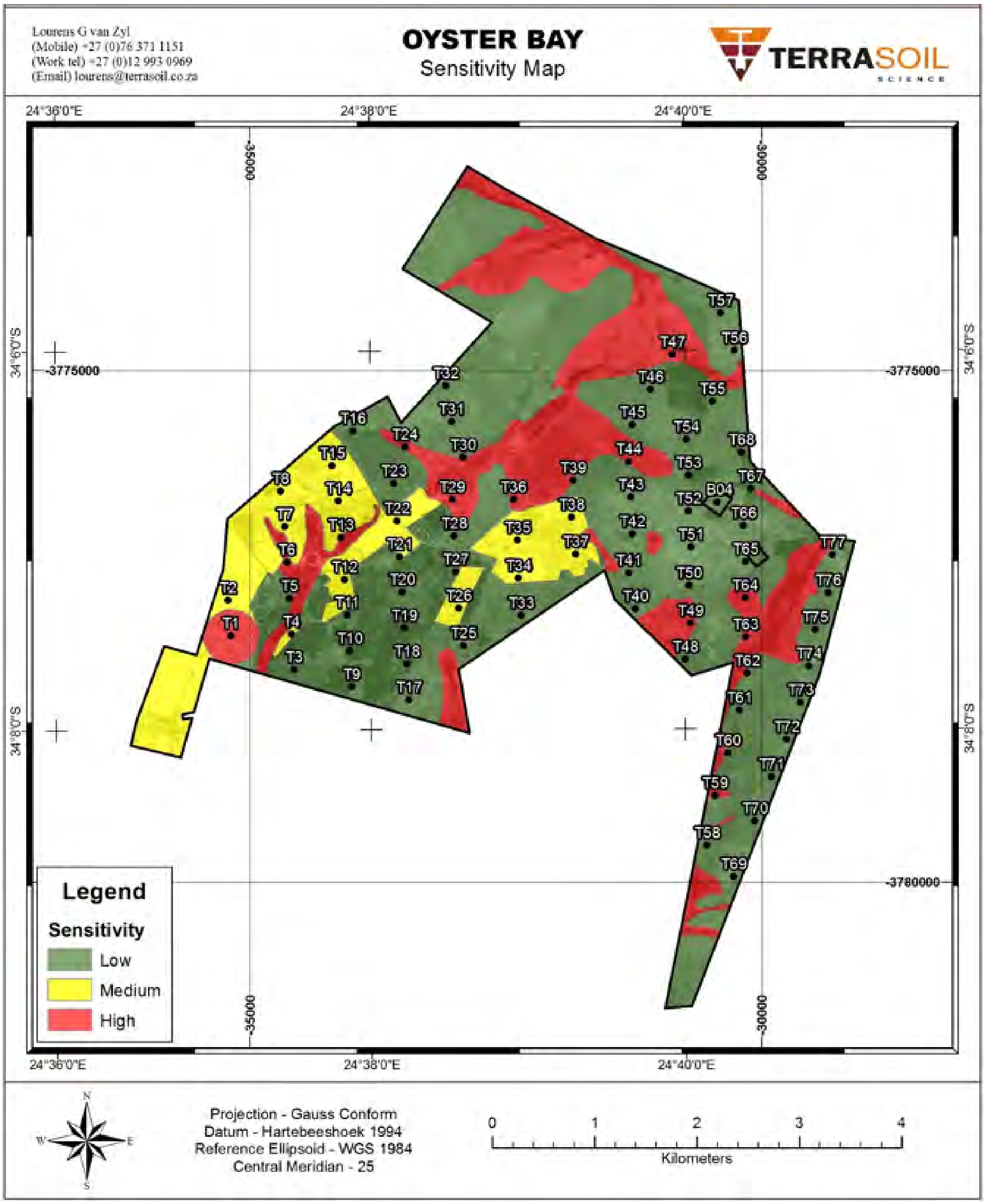

Figure 7.7: Soil / Land-Use Sensitivity Map for the site

7.3.1 Impact on the project on Agricultural Potential

The agricultural potential of the site is directly linked to the soils. The shallow and rocky soils are predominantly of **low** potential and the deeper sandy soils are of **medium** potential. The potential of the sandy soils is limited due to their sandy nature leading to low nutrient and water holding capacity. This is especially relevant in an area with variable rainfall. In the cases where irrigation infrastructure has been established the potential of the soils increases to **high** – only the section of Farm Rhebokrant which has a pivot irrigation system and therefore does not have any wind turbines located on it, thereby mitigation the impact on agricultural land that is utilised. The current land use of cattle production on irrigated fields has impacted negatively on wetlands and has the potential to add to eutrophication of surface water sources.

The landscape on the site has been divided into areas of different sensitivity (low, medium and high) as a function of land use, agricultural use and wetland zones. From this map it is evident that a number of turbines fall within areas of medium sensitivity. Some of the turbines are situated on the edge of potential wetland zones and should be relocated – as recommended by the ecology study (See Section 7.1.3).

7.3.1.1 Impact Table - Agricultural Potential

Nature of Impact: Loss of land with high agricultural potential and land capability due to the development of the wind energy facility		
	Without mitigation	***With mitigation***
Extent	Low (1) – Site	Low (1) – Site
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (4)
Probability	Highly probable (4)	Highly probable (4)
Significance*	16 **(Low)**	16 **(Low)**
Status (positive or negative)	Negative	Negative
Reversibility	Medium	Medium
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Direct impacts cannot be mitigated but indirect impacts can be minimised and avoided through adequate planning of layout	
Mitigation: The loss of agricultural land is a long term loss and there are no mitigation measures that can be put in place to combat this loss. Mitigation is restricted to the limitation of the extent of the impact to the immediate area of impact and minimisation of off-site impacts.		

Cumulative impacts: Soil erosion may arise due to altered surface water runoff. Adequate management and erosion control measures should be implemented.
Residual Impacts: The loss of agricultural land is a long term loss. , however limited to the footprint of the wind turbine and infrastructure will occupy a minimal percentage of the land, and that agriculture can still continue on the rest of the farm (not occupied by infrastructure for the facility) This loss extends to the post-construction phase. The agricultural potential is variable though and negative impacts can be limited through adequate planning for the layout.

7.3.2 Soil Erosion / Degradation during Construction

Soil degradation is the negative alteration of the natural soil profile, usually directly or indirectly related to human activity. Soil degradation due to construction activity will negatively affect soil formation, natural weathering processes, moisture levels and soil stability. This will, in turn, affect biological processes operating in the soil. Soil degradation includes erosion (i.e. due to water and wind), soil removal, mixing, wetting, compaction, pollution, salinisation, crusting, and acidification.

Soil erosion is a natural process whereby the ground level is lowered by wind or water action and may occur as a result of *inter alia* chemical processes and/or physical transport on the land surface[1]. Soil erosion induced or increased by human activity is termed "accelerated erosion" and is an integral element of global soil degradation. Accelerated soil erosion is generally considered the most important geological impact in any development due to its potential impact on a local and regional scale (i.e. on and off site) and as a potential threat to global agricultural potential. Soil erodability – the susceptibility of soil to erosion – is a complex variable, not only because it depends on soil chemistry, texture, and characteristics, but because it varies with time and other variables[8], such as mode of transport (i.e. wind or water).

Erosion of soil due to water run-off is generally considered as more important due to the magnitude of the potential impact over a relatively short period of time which can be very difficult to control. Erosion by water occurs when the force exerted on the soil by flowing water exceeds the internal shear strength of the soil and the soil fails and becomes mobilised into suspension. Erosion potential is typically increased in areas where soil is loosened and vegetation cover is stripped (e.g. construction sites). Erosion sensitivity can be broadly mapped according to the severity of the potential erosion if land disturbing activities occur and this is generally related to the geology, soil types and the topography. Generally speaking, thick accumulations of unconsolidated or partly consolidated fine-grained soils of low plasticity along drainage lines and on moderate to steep slopes or at the base of steep slopes are most vulnerable to severe levels of erosion due to water run-off. These areas are typically called "highly sensitive" areas.

Specifically relating to the site in question, the majority of the turbines are underlain by hard, resistant quartzite rock of the Peninsula Formation. The northernmost portion of the site (including turbine Nos. 46, 54, 55, 66 & 67) is underlain by slightly softer rocks (sandstone and shale) of the Goudini and Cederberg Formations. The geological setting is generally not prone to severe erosion but minor erosion will occur in areas where run-off is concentrated, such as along roads (side channels) and along natural drainage lines where hydraulic energy is higher and soil deposits are thicker. **The table below** summarises the site sensitivity in terms of water erosion.

Water erosion sensitivity of the site

Sensitivity Level	**Area/Terrain**	**Comments/Recommendations**
High	None	
Moderate	Natural drainage lines & watercourses	Erosion taking place at present. Special engineering measures required.
Low	Remainder of site	Minor natural erosion taking place at present (limited due to underlying rock). Normal erosion mitigating measures apply.

7.3.1.1 Impact Table – Soil erosion / degradation during construction

Nature: Soil degradation – Increased erosion due to construction activity		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium term (3)	Very short term (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (18)**
Status	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes, moderate	Yes, minor
Can impacts be mitigated?	Yes	
Mitigation:		
• Restrict size of authorised disturbance areas.		

• Minimise activity in high erosion-sensitive areas. • Implement effective erosion control measures. • Stage construction in phases to minimise exposed ground. • Keep to existing roads, where practical, to minimise impact on undisturbed ground. • Ensure stable slopes of stockpiles/excavations to minimise slumping. • Stockpiles should not exceed 2m in height unless otherwise permitted by the Engineer. • Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion, only if natural seeding does not occur.
Cumulative impacts: The cumulative impact of soil erosion from all development in the area is considered low if mitigating measures are adhered to.
Residual impacts: Minor – Localised movement of sediment. Slow regeneration of soil processes

7.3.3 Soil Contamination / Soil Erosion during the Operation of the facility

During the maintenance activities (operations) of the site, the possibility for soil contamination exists in the event of spillage of oils, fuels or hydrocarbons used for maintenance of the wind turbines, substation or power line. In addition, spillage of fuels from vehicles may occur. These impacts on soil can be mitigated to a low significance.

7.3.3.1 Impact Table – Soil Contamination / Soil Erosion during the Operation of the facility

Nature: Increased pollution of soil by contaminants (e.g. fuel, oil, chemicals, cement).		
	Without mitigation	***With mitigation***
Extent	Local (1)	Local (1)
Duration	Medium term (2)	Very short term (1)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (12)**
Status	Negative	Negative
Reversibility	Partially reversible	Partially reversible
Irreplaceable loss of resources?	Yes	Minor
Can impacts be mitigated?	Yes, to a certain extent	
Mitigation:	» Control use and disposal of potential contaminants or hazardous materials.	

	» Remove contaminants and contaminated topsoil and replace topsoil in affected areas.
Cumulative impacts:	» The cumulative impact of soil pollution is considered low due to the undeveloped nature of the study area.
Residual impacts:	» Minor negative – slow regeneration of soil processes in and under topsoil

7.3.4 Comparative Assessment of Power Line Routings

All three corridors cross the same underlying geological units (Table Mountain and Bokkeveld Group rocks) which are not considered problematic for such activity. The Central and Eastern alternatives are preferred due to the shorter distance covered and the corresponding lower impact significance due to less infrastructure. These alternatives also largely follow the proposed Eskom Thyspunt-Melkhout corridors.

7.3.5 Comparative Assessment of Substation Alternatives

There are no differences in the significance of impacts for either of the proposed substation alternatives in terms of impacts of soils or geology.

7.3.6. Cumulative impacts

The cumulative impacts as a result of wind energy facility development on soils of the Oyster Bay wind energy facility and Redcap wind energy facility will not be significant if recommended mitigation measures are put into place.

7.3.7 Conclusions and Recommendations

The proposed development of a wind energy facility on the site could have negative impacts in areas of high sensitivity wetlands and pivoted irrigated agricultural land) and these areas are therefore considered no-go areas for development. It is recommended that the following turbines are removed from the areas of high sensitivity (T1, T6, T24, T29, T30, T36, T44, T49, T59, T63, T6).

The following mitigation measures are recommended:

» Minimise activity in erosion-sensitive areas
» Implement effective erosion control measures.
» Stage construction in phases to minimise exposed ground.

- » Keep to existing roads, where practical, to minimise impact on undisturbed ground.
- » Ensure stable slopes of stockpiles/excavations to minimise slumping.
- » Stockpiles should not exceed 2m in height unless otherwise permitted by the Engineer.
- » Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion, only if natural seeding does not occur.
- » Limit physical impacts to as small a footprint as possible;
- » Site management has to be implemented with the appointment of a suitable environmental control officer (ECO) to oversee the process, address problems and recommend and implement corrective measures;
- » Implement site specific erosion and water control measures to prevent excessive surface runoff from the site (turbines and roads);
- » Plan the road and site layout in such a way as to make maximal use of existing roads and fence/border areas to minimise impacts and to keep grazing and natural units as intact as possible; and
- » Implement measures to avoid /reduce chemical spillages during the operation of the facility (such as spill kits).

7.4 Assessment of Potential Social Impacts

7.4.1 Construction - Creation of Employment and Business Opportunities and Opportunity for Skills Development

Based on the information provided by RES the capital expenditure associate with the construction of ~ 50-80 wind turbines would be in the region of R 2.4 billion (2011, Rands). The construction phase is expected to extend over a period of 24 months and create approximately 200 temporary employment opportunities. The work associated with the construction phase will be undertaken by contractors and will include the establishment of the access roads and services and the erection of the wind turbines, substations and power lines.

Based on information provided by the proponents of the 200 construction related jobs, approximately 15 % (30) of opportunities will be available to skilled personnel (engineers, technicians, management and supervisory), ~ 65 % (125) to semi-skilled personnel (drivers, equipment operators), and ~ 20% (40) to low skilled personnel (construction labourers, security staff). Members from the local community are likely to be in a position to qualify for the majority of the low skilled and some of the semi-skilled employment opportunities. The majority of these employment opportunities are also likely to accrue to Historically Disadvantaged (HD) members from the local community. Given the high unemployment levels and limited job opportunities in the area this will represent a significant social benefit. The remainder of the semi-skilled and majority of the skilled employment opportunities are likely to be associated with the contactors appointed to construct the wind energy facility and associated infrastructure.

The proposed development will also create an opportunity to provide on-site training and increase skills levels. However, due to the relatively short timeframe of the construction phase and the low education and skills levels in the area, the opportunities for skills development and training of locals may be limited. In this regard, RES have indicated the assessment of supplier bids will include a requirement for suppliers to include address local skills development and training during both the construction and operations phases. RES have also indicated that they intend to implement a mentoring/shadowing programme in order to develop the capacity of low and semi-skilled personnel. Health and safety training will also be provided for all personnel involved with the project. RES have also indicated that they are committed to engaging with the local community and the municipality with regard to using the project to support job creation and promote skills development.

In addition to the employment benefits the expenditure of R 2.4 billion during the construction phase will create business opportunities for the regional and local economy. However, given the technical nature of the project and the high import content associated with wind turbines the opportunities for the local Oyster Bay, Jeffery's Bay, St Francis Bay and Humansdorp economies are likely to be limited. However, some of the required civil engineering and construction skills are likely to be available in the local area due to the recent boom in the housing sector (2000-2008). In addition, a number of the required engineering and technical skills and expertise are likely to be available in the Nelson Mandela Metro which is located within 150 km of the site.

The sector of the local economy that is most likely to benefit from the proposed development is the local service industry. The potential opportunities for the local service sector would be linked to accommodation, catering, cleaning, transport and security, etc. In terms of accessibility the majority of the construction workers from outside the area are likely to be accommodated in the closest town, which is Humansdorp. In this regard, RES has indicated no workers will be accommodated on the site. This will create potential opportunities for local hotels, restaurants and B&Bs. In addition, a proportion of the total wage bill earned by construction workers over the 24 month construction phase will be spent in the regional and local economy. Based on information from studies undertaken for other wind energy facilities, the total wage bill associated with the construction phase is estimated at R 30-35 million. The injection of income into the area in the form of rental for accommodation and wages will create opportunities for local businesses in Oyster Bay, Jeffery's Bay, St Francis Bay and

Humansdorp. The benefits to the local economy will, however, be confined to the construction period (i.e. 24 months).

The local hospitality industry in Oyster Bay, Jefferies Bay, St Francis Bay and Humansdorp will also benefit from the accommodation and meals for professionals (engineers, quantity surveyors, project managers, product representatives etc.) and other personnel involved on the project. Experience from other construction projects indicates that the potential opportunities are not limited to onsite construction workers but also to consultants and product representatives associated with the project (PPC's Dwaalboom Cement Factory, 2007).

7.4.1.1 Impact Table - Creation of Employment and Business Opportunities during the Construction Phase

Nature: Creation of employment and business opportunities associated with the operational phase		
	Without Mitigation	***With Enhancement***
Extent	Local (1)	Local and Regional (4) (Assumes establishment of a Community Trust as indicated below)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Low **(27)**	Medium **(56)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » Where feasible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi- and low-skilled job categories. In this regard RES have indicated that they are committed to engaging with the local community and the municipality with regard to using the project to support job creation and promote skills development » Before the construction phase commences the proponent should meet with representatives from the Kouga Municipality to establish what skills exist in the area and develop a database. » Where feasible, training and skills development programmes for locals should be initiated prior to the initiation of the construction phase., RES have indicated that they are committed to engaging with the local community and the municipality with regard		

to using the project to support job creation and promote skills development » The recruitment selection process should seek to promote gender equality and the employment of women wherever possible. » The proponent, in consultation with the Kouga Municipality, should develop a database of local companies, specifically companies that qualify as Black Economic Empowerment (BEE) companies that qualify as potential service providers prior to the commencement of the tender process for construction contractors. In this regard RES has indicated that it will investigate BBBEE schemes and/or projects that can form an integral part of the project. RES has indicated that it will engage with the Kouga Municipality and the Kouga Black Chamber of Commerce to identify suitable local companies to work with suppliers. RES has also indicated that as part of its procurement policy, RES will require that its suppliers maximize their local content and the percentage of local content will be an important criteria used when assessing supplier bids.
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area. Creation of revenue stream to fund local projects, thereby enhancing local economic and social development in the area.
Residual impacts: See cumulative impacts

7.4.2 Presence of construction workers in the area

Based on the findings of the SIA, the area can be described as a rural area that is "safe and secure". In terms of affected farmsteads, there are a relatively small number of farmsteads that will be directly affected by the proposed project. However, there are a number of potentially vulnerable farming activities, specifically and cattle and dairy farming. The potential threat to farming activities is discussed below. In addition, the presence of construction workers also poses a potential risk to family structures and social networks in the area (both on farms and in the local towns, such as Oyster Bay and Humansdorp). While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on the local community. In this regard, the most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to the potential behaviour of male construction workers, including:

» An increase in alcohol and drug use;
» An increase in crime levels;
» The loss of girlfriends and or wives to construction workers;
» An increase in teenage and unwanted pregnancies;
» An increase in prostitution;
» An increase in sexually transmitted diseases (STDs).

The local farmers interviewed indicated that they did not feel that the presence of construction workers on the site would be a problem. However, one of the landowners insisted that no construction workers, with the exception of security staff, should be allowed to stay on the site overnight. In this regard, RES have indicated that no construction workers will be housed on the site during the construction phase.

Comments from people interviewed as part of the SIA for the Happy Valley wind project (June 2011) indicated that there were concerns about the influx of employment seekers into the area due to the rumours regarding the proposed construction of the ESKOM nuclear power station at Oyster Bay. The area is therefore already experiencing an influx of employment seekers. However, the potential risk posed by the influx of construction workers associated with the proposed Oyster Bay wind energy facility to local family structures and social networks is likely to be low. This finding is based on the relatively small number of semi and low skilled construction workers associated with the construction phase, namely 160. In addition, the potential impact will be reduced as the majority of low skilled and some of the semi-skilled workers will be sourced from the local area. These workers come from and live in the local community and as such form part of the local family and social network. As a result the potential impacts will be low.

However, there may be impacts associated with the workers from outside the area. While these impacts at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. Given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

7.4.2.1 Impact Table – impact of the presence of construction workers in the area on local communities

Nature: Potential impacts on family structures and social networks associated with the presence of construction workers		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc. (5)	Short term for community as a whole (1) Long term-permanent for individuals who may be affected by STDs etc. (5)
Magnitude	Low for the community as a whole (4)	Low for community as a whole (4)
Probability	Probable (3)	Probable (3)
Significance	Low for the community as a whole **(21)**	Low for the community as a whole **(18)**
Status	Negative	Negative
Reversibility	No in case of HIV and AIDS	No in case of HIV and AIDS
Irreplaceable loss of resources?	Yes, if people contract HIV/AIDS. Human capital plays a critical role in communities that rely on farming for their livelihoods	
Can impact be mitigated?	Yes, to some degree. However, the risk cannot be eliminated	
Mitigation: » Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically semi and low-skilled job categories. This will reduce the potential impact that this category of worker could have on local family and social networks; » Establishment of a Monitoring Forum (MF) for the construction phase. The Forum should be established before the construction phase commences and include representatives from the local farmer's union, local rate payers association, local municipality and the contractor. The role of the Forum would be to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should also be briefed on the potential risks to the local community associated		

with construction workers » The proponent and the contractor should, in consultation with representatives from the MF, develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation » The proponent and the contractor should implement an HIV/AIDS awareness programme for all construction workers at the outset of the construction phase; » The movement of construction workers on and off the site, specifically construction workers from outside the area, should be closely managed and monitored by the contractors. In this regard the contractors should be responsible for making the necessary arrangements for transporting non-local workers to and from site on a daily basis; » The contractor should make the necessary arrangements for allowing workers from outside the area to return home over weekends and or on a regular basis during the 24 month construction phase. This would reduce the risk posed by construction workers from outside the area on local family structures and social networks; » It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.
***Cumulative impacts*:** Impacts on family and community relations that may, in some cases, persist for a long period of time. Also in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.
Residual impacts: See cumulative impacts.

7.4.3 Construction - Risk of stock theft, poaching and damage to farm infrastructure

The presence of construction workers on the site increases the potential risk of stock theft and poaching. The movement of construction workers on and off the site also poses a potential threat to farm infrastructure, such as fences and gates, which may also be damaged. Stock and game losses may also result from gates being left open and/or fences being damaged. In this regard, one of the landowners indicated that stock theft, specifically sheep, was a major concern. The landowner indicated that construction workers should not be housed on the site. The potential impacts associated with stock theft can, however, be effectively managed and mitigated.

RES have indicated that at this stage of the process a confidential, option-to-lease agreement is in place between the landowners. After permitting, the option-to-lease agreements will be transferred to become lease agreements whereby during operation the wind farm owner pays the landowner an annual fee based on the electrical output from the wind farm. It is assumed that the lease agreements also address the issue of compensation for damage during both the construction and operational phase of the project.

7.4.3.1 Impact Table – Stock theft and damage to farm infrastructure

Nature: Potential loss of livestock, poaching and damage to farm infrastructure associated with the presence of construction workers on site		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium **(33)**	Low **(24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock losses etc.	Yes, compensation paid for stock losses etc.
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	Yes
Mitigation: • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences;		

• The proponent should consider the option of establishing a Monitoring Forum that includes local farmers and develop a Code of Conduct for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site; • The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below); • The EMP will outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested; • Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms. • Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock, poaching and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation; • The housing of construction workers on the site should be limited to security personnel.
***Cumulative impacts*:** None**,** provided losses are compensated for.
Residual impacts: See cumulative impacts.

7.4.4 Increased risk of fires during construction

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could in turn pose a threat to livestock, wildlife and farmsteads in the area. In the process, farm infrastructure may also be damaged or destroyed and human lives threatened. The potential risk of grass fires is heightened by the windy conditions in the area, specifically from December to February. The risk of fire related damage is exacerbated by the distance to fire-fighting vehicles located in the larger towns of Humansdorp and St Francis Bay.

7.4.4.1 Impact Table – Increased risk of fires

Nature: Potential loss of livestock, crops and houses, damage to farm infrastructure and threat to human life associated with increased incidence of grass fires		
	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium **(36)**	Low **(24)**
Status	Negative	Negative
Reversibility	Yes, compensation paid for stock and crop losses etc.	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	

Mitigation:

- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- Contractor to ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, windy summer months.
- Contractor to provide adequate fire fighting equipment on-site.
- Contractor to provide fire-fighting training to selected construction staff.
- As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire fighting costs borne by farmers and local authorities.

Cumulative impacts:

None, provided losses are compensated for.

Residual impacts:

See cumulative impacts.

7.4.5 Impact due to increase in traffic during construction

Road access to the proposed wind energy facility site is likely to be from the N2 (between Port Elizabeth and Cape Town) via the R330 (between Humansdorp, St Francis Bay and Oyster Bay). The distance along this route is 33 km. The other options involve gravel roads and are not ideally suited to large, heavy vehicles. The movement of heavy construction vehicles during the construction phase has the potential to damage roads and create noise, dust and safety impacts for other road users. The movement of large, heavy vehicles also has the potential to create delays for other road users, specifically local famers and dairy tankers. Delays to dairy tankers may have economic implications for both the affected farmers and the owners of the dairy tankers.

Based on information from the traffic study ~ 620 trips will be associated with the construction phase. In addition, a crawler crane (~ 750 t) and assembly cranes may also need to be transported onto and off the site. Other heavy equipment will include normal civil engineering construction equipment such as graders, excavators, cement trucks, etc.

Based on the observations during the SIA field visit (August 2011), the existing gravel roads in the area would need to be upgraded to enable the site to be accessed. Following the heavy rains in July 2011, the majority of the gravel roads in the area were in poor condition. This condition was exacerbated by the movement of heavy dairy tankers along the road. However, the typical issues associated with the movement of heavy vehicle traffic during the construction phase can be effectively mitigated. If required, RES will consider upgrade of the roads to the site for the transportation of the wind turbine components during construction. RES will have to apply for a permit to transport abnormal loads on public roads.

7.4.5.1 Impact Table – Increase in traffic during construction

Nature: Potential noise, dust and safety impacts associated with movement of construction related traffic to and from the site on road / private roads.		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (2)
Duration	Short term (2)	Short term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low **(27)**	Low **(18)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	No
Can impact be mitigated?	Yes	
Mitigation: » The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. This should include includes damage to local roads and internal farm roads. The agreement should be signed before the construction phase commences; » The proponent and contactor should meet with the local farmers to identify the best time of the day to transport heavy machinery on to the site so as to minimise potential disturbances to other road users; » The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair should be borne by the proponent; » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers; » All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.		
Cumulative impacts: If damage to roads is not repaired then this will impact on the farming activities in the area and also result in higher maintenance costs for vehicles of local farmers and other road users. The costs will be borne by road users who were not responsible for the damage.		
Residual impacts: See cumulative impacts		

7.4.6 Damage to and loss of farmland during construction

The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines, substations and power lines may damage active farmland. During construction some areas may not be able to be accessed / grazed by the landowner due to construction activities. Furthermore, construction vehicles or personnel could damage farming areas outside of the construction footprint.

The landowner is compensated for leasing of the land by RES. Where properly planned, the final footprint of disturbance associated with a wind energy facility is small and is linked to the foundation of the individual wind turbines, services roads, substations and power line. The impact on farmland associated with the construction phase can therefore be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase and that construction is limited to the area for the facility, so that farming activities may continue on areas that are not utilised by the wind energy facility. The impact can be reversed, as once construction is complete farming activities may resume on the site.

7.4.6.1 Impact Table – Damage to and loss of farmland during construction

Nature: The activities associated with the construction phase, such as establishment of access roads and the construction camp, movement of heavy vehicles and preparation of foundations for the wind turbines, sub stations and power lines will damage farmlands and result in a loss of farmlands for future farming activities.		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (1)
Duration	Long term-permanent if disturbed areas are not rehabilitated (5)	Short term if damaged areas are rehabilitated (1)
Magnitude	Moderate (4)	Minor (2)
Probability	Definite (5)	Highly Probable (4)
Significance	High **(60)**	Low **(16)**
Status	Negative	Negative
Reversibility	Yes, disturbed areas can be rehabilitated	Yes, disturbed areas can be rehabilitated
Irreplaceable loss of resources?	No, disturbed areas can be rehabilitated and farming can resume on the properties once the wind energy facility	No

	construction is complete	
Can impact be mitigated?	Yes, by compensation	Yes

Mitigation:

- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. This should include damage to and loss of farm land. The agreement should be signed before the construction phase commences;
- The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop etc.) should be minimised;
- All areas disturbed by construction related activities, such as access roads, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase;
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed to establish the WEF. The specifications for the rehabilitation programme should be drawn up the botanical specialist appointed as part of the EIA process;
- The implementation of the Rehabilitation Programme should be monitored by the ECO;
- RES compensates farmers for leasing of the land for the wind energy facility, which is included in the rental agreement with the local landowners.

Cumulative impacts:

Overall loss of farmland could impact on the livelihoods of the affected farmers, their families and the workers on the farms and their families. However, disturbed areas can be rehabilitated.

***Residual impacts*:**

See cumulative impacts.

7.4.7 Operational Phase -Creation of Long- Term employment and business opportunities

Based on information provided by RES, approximately 45 permanent and 70 temporary employment opportunities will be created during the operational phase of the project. The operational phase is expected to last 20-25 years.

Due to the need for specialised skills it may be necessary to import the required operational and maintenance skills from other parts of South Africa or even overseas. However, it will be possible to increase the number of local employment opportunities through the implementation of a skills development and training programme linked to the operational phase. Such a programme would support the strategic goals of promoting local employment and skills development contained in the Kouga IDPs. In this regard, RES has indicated that they are committed to the implementation of a training and skills development programme for members from the local community.

Given the location of the proposed wind energy facility, the majority of permanent staff is likely to reside the local towns in the area, such as Oyster Bay, St Francis Bay and Humansdorp. In terms of accommodation options, a percentage of the new permanent employees may purchase houses in one of these towns, while others may decide to rent. Both options would represent a positive economic benefit for the region. In addition, a percentage of the annual wage bill earned by permanent staff would be spent in the regional and local economy. This will benefit local businesses in the local towns in the area. The benefits to the local economy will extend over the 25-year operational lifespan of the project. The local hospitality industry is also likely to benefit from the operational phase. These benefits are associated with site visits by company staff members and other professionals (engineers, technicians etc.) who are involved in the company and the project but who are not linked to the day-to-day operations.

Research undertaken by Warren and Birnie (2009) also highlights the importance of addressing community benefits in the development and implementation of wind energy facilities. The findings of the research found that wind farms in Europe became more socially acceptable when local communities were directly involved in, and benefited from the developments. In Denmark, Germany, the Netherlands and Sweden, where wind farms have typically been funded and controlled by local cooperatives, there has been widespread support for wind power. However, in Britain where the favoured development approach has been the private developer/public subsidy model, many proposals have faced stiff local opposition. This is an issue that should be addressed in the South African context.

In this regard, RES have indicated that confidential, option-to-lease agreements are is in place between the landowners' trusts and the project developer whereby the trusts receive a fixed annual fee. After permitting, the option-to-lease agreements will be transferred to become lease agreements whereby during operation the wind farm owner pays the landowner an annual fee based on the electrical output from the wind farm. RES have indicated that one of the four existing significant recipient trusts is a BBBEE trust. It is unclear at this stage if the BBBEE trust is linked to the local communities in the area. It would also appear that the individual landowners stand to benefit from the project. There appear to be limited benefits associated with the operational phase for the broader community and the Kouga LM. There is reference to a welfare facility, however, the details are limited.

7.4.7.1 Impact Table – Creation of Long- Term employment and business opportunities

Nature: Creation of long-term employment and business opportunities associated with the operational phase		
	Without Mitigation	***With Enhancement***
Extent	Local (1)	Local and Regional (4) (Assumes establishment of a Community Trust as indicated below)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Highly Probable (4)
Significance	Low **(27)**	Moderate **(56)**
Status	Positive	Positive
Reversibility	N/A	
Irreplaceable loss of resources?	No	
Can impact be enhanced?	Yes	
Enhancement: » RES should also investigate the opportunities for establishing a Community Trust. The revenue for the trust would be derived from the income generated from the sale of energy from the WEF and used to support local IDP projects and initiatives. » The establishment of a Community Trust should be discussed with the Kouga Local Municipality. » The proponent should implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's and locals employed during the operational phase of the project. In this regard RES has indicated that it will continue		

discussions with the municipality and local community to identify schemes and projects for skills development and training. BBBEE training schemes will be prioritised in line with Government policy.
Cumulative impacts: Creation of permanent employment and skills and development opportunities for members from the local community and creation of additional business and economic opportunities in the area. Creation of revenue stream to fund local projects, thereby enhancing local economic and social development in the area.
Residual impacts: See cumulative impacts

7.4.8 Development of Renewable Energy Infrastructure

South Africa currently relies on coal-powered energy to meet more than 90% of its energy needs. As a result South Africa is one of the highest per capita producers of carbon emissions in the world and Eskom, as an energy utility, has been identified as the world's second largest producer carbon emissions (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. The IDP Manager of the Kouga LM, Mr Fadane, who was interviewed for the Happy Valley Wind project SIA, located approximately 30 km north-east of the site, indicated that the municipality supports wind energy facility's in the area as they promote sustainable development in the area.

The overall contribution to South Africa's total energy requirements of the proposed wind energy facility is relatively small. However, the ~ 150 MW installed capacity will contribute towards offsetting the total carbon emissions associated with energy generation in South Africa. Given South Africa's reliance on Eskom as a power utility, the benefits associated with an IPP based on renewable energy are regarded as significant.

A member of the Oyster Bay Residents Association indicated that the association was very supportive of the proposed project. However, there were concerns regarding the potential noise and visual impacts and impact on migrating bird species. On the positive side, the proposed development offered an opportunity to un-grade the local roads in the area, which in turn had the potential to make the area more accessible for tourists.

7.4.8.1 Impact Table – Contribution of the project towards Development of Renewable Energy Infrastructure in South Africa

Nature: Promotion of clean, renewable energy		
	Without Mitigation	***With Mitigation***
Extent	Local, Regional and National (4)	Local, Regional and National (4)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Very High (10)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	High **(64)**	High **(72)**
Status	Positive	Positive
Reversibility	Yes	
Irreplaceable loss of resources?	Yes, impact of climate change on ecosystems	
Can impact be mitigated?	Yes	
***Enhancement*:** » Use the project to promote and increase the contribution of renewable energy to the national energy supply; » Implement a training and skills development programme for locals during the first 5 years of the operational phase. The aim of the programme should be to maximise the number of South African's employed during the operational phase of the project.		
Cumulative impacts: Reduce carbon emissions via the use of renewable energy and associated benefits in terms of global warming and climate change.		
Residual impacts: See cumulative impacts		

7.4.9 Long-Term Impact of the project on Existing Farming Activities on the Site

This issue relates to the potential long-term impact of the wind energy facility on existing farming activities, specifically the loss of grazing available for cattle and other livestock. The experience with wind energy facilities is that livestock farming is not affected by the operational wind energy facility. The final footprint of disturbance associated with a wind energy facility also tends to be small and is linked to the foundation of the individual wind turbines, services roads, sub-stations and power lines. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

Mr Griffiths from WESSA, who was interviewed for the Happy Valley SIA, also indicated that WESSA had received complaints from some farmers in the Eastern Cape that wind farms had impacted negatively on their cows. This statement should however be treated with a degree of caution as no wind energy facilities had been established in the Eastern Cape Province at the time of undertaking the interviews (August, 2011). RES have indicated that wind energy facilities that they operate in Scotland have not impacted on the dairy farming operations. There is a pivot irrigation system used on Farm Rhebokrant 715, and no wind turbines / associated infrastructure is located in this area, therefore the impact on the loss of productive agricultural land on the site is mitigated and of acceptable levels. However, RES leases the land from participating landowner; therefore compensation for loss of land is the obvious mitigation measure.

7.4.9.1 Assessment of impact associated with loss of agricultural land in the site

Nature: Loss of agricultural land due to the establishment of a wind energy facility.		
	Without Mitigation	***With Mitigation***
Extent	Local (2)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low **(24)**	Low **(21)**
Status	Negative	Negative
Reversibility	Yes. Land that is lost to footprint associated with wind energy facility (roads, turbines etc.) can be restored to farmland over time if rehabilitated.	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	Yes – it has by compensation to landowners	
Enhancement: • The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. This should include damage to and loss of farm land. The agreement should be signed before the construction phase commences; • The footprint associated with the construction related activities (access roads, turning circles, construction platforms, workshop etc.) should be minimised; • All areas disturbed by construction related activities, such as access roads, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase; • The implementation of a rehabilitation programme should be included in the terms of		

reference for the contractor/s appointed to establish the WEF. The specifications for the rehabilitation programme should be drawn up the botanical specialist appointed as part of the EIA process; • The implementation of the Rehabilitation Programme should be monitored by the ECO; • RES compensates farmers for leasing of the land for the wind energy facility, which is included in the rental agreement with the local landowners.
***Cumulative impacts*:** Potential minor loss of agricultural employment opportunities associated with loss of land, however offset by compensation for leasing of land from landowners.
Residual impacts: See cumulative impacts

7.4.10 Potential Impact of the wind energy facility on tourism in the region

The potential impacts on tourism are closely related to potential visual impacts associated with the proposed wind energy facility. In this regard, sections of the Oyster Bay wind energy facility site will be visible from the N2 (See VIA), which is an important tourist route. The R62, which is located to the north-east of the site, is also an important tourist route and a designated scenic route. The coastal towns in the area, such as Oyster Bay, Jeffery's Bay and St Francis Bay, are also all well-known holiday and tourist destinations.

As indicated in the visual impact assessment (refer to Section 7.5), the region has a rural character and is located within a particularly picturesque part of the country. It is in close proximity to the southern seaboard, and is thus a known tourist destination. In addition, the N2 is a well-known and well used tourist access route, and the arterial and secondary roads make for scenic drives. The anticipated visual impact of the facility on existing tourist routes, as well as on the tourism potential of the region, is expected to be moderate. There is no mitigation for this impact.

However, an advantage of the site over other wind energy facility sites in the area, for example the Happy Valley wind energy facility site, is that the proposed site is not located on prominent ridgelines or hills. The proposed site is located on the gently undulating coastal plain that is located between the N2 to the north and the Indian Ocean to south. The local topography reduces the visual exposure of the site, which in turn reduces the potential impact on tourist routes such as the N2.

However, research in Scotland undertaken by Warren and Birnie (2009) found that there appeared to be no clear evidence that tourists would be put off by the presence of wind farms in tourism areas. In this regard, the research found that far more visitors appeared to associate wind farms with clean energy than with landscape damage, suggesting that they could help to promote an area's reputation as an environmentally friendly area, provided they are sensitively sited. However, the paper notes that this could change as more are built. The key lesson for South Africa is this regard is that wind farms should be located in areas that minimise the potential impact on landscapes and as such also reduce the potential impact on tourism.

7.4.10.1 Impact on tourism industry

Nature: Potential negative impact of the wind energy facility on local tourism		
	Without Mitigation	***With Mitigation***
Extent	Local (3)	Local (3)
Duration	Long term (4)	Long term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium **(33)**	Medium **(33)**
Status	Negative	Negative
Reversibility	Yes	
Irreplaceable loss of resources?	No	
Can impact be mitigated?	No	
Mitigation: In terms of mitigating the visual impacts, it is virtually impossible to hide the facility. The impact on the sense of place of the area cannot therefore be effectively mitigated.		
Cumulative impacts: Potential for fewer tourists to visit the area, and impact on tourist sector (Negative) – however unproven in South Africa		
Residual impacts: See cumulative impacts		

7.4.11 Potential Health Impacts due to the Operation of the wind energy facility

The potential health impacts typically associated wind energy facilities include, noise (discussed as a separate impact in this report), shadow flicker and electromagnetic radiation. The findings of a literature review undertaken by the Australian Health and Medical Research Council published in July 2010 indicate that there is no evidence of wind farms posing a threat to human health. The research also found that wind energy is associated with fewer health effects than other forms of traditional energy generation (WHO, 2004).

Based on these findings it is assumed that the significance of the potential health risks posed by the proposed Oyster Bay wind energy facility is of low significance. In addition, none of the affected farmers interviewed were concerned with health risks associated with the proposed wind energy facility. The potential noise impacts are covered in the specialist Noise Impact Assessment.

7.4.12 Comparative Assessment of Alternative Power Line Routings

The findings of the VIA (MetroGIS, August 2011) indicate the power line will be highly visible along all three alignment options. Small areas of visual screening occur in areas of undulating topography and along incised river valleys. In terms of assessing each alternative the following is of relevance:

» The Western Corridor is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include long stretches of the N2 and shorter stretches the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 50 settlements and homesteads also appear to fall within this viewshed. This corridor follows an existing power line for about half of its length, but crosses 3 rivers, including the upper reaches of the Mpofu Dam.
» The Central Corridor is the second shortest alignment. Visual receptors include short stretches of the N2, the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers, including the lower reaches of the Mpofu Dam (i.e. at the dam wall).
» The Eastern Corridor is the shortest alignment, and therefore displays the smallest extent of potential visual exposure. Visual receptors include short stretches of the N2, the R102, the R330 and 1 secondary road. The eastern parts of Humansdorp and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers.

Based on this and the VIA, the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed.

The **Eastern Corridor** is therefore the preferred option from a social perspective. Despite the fact that the Western Corridor follows existing infrastructure for at least half of its length, its longer length and exposure to long stretches of the N2 renders it the least favourable from a visual perspective. The significance of the visual impact associated with the Eastern Corridor is rated as moderate. The Central Corridor is the second preferred option.

The findings of the SIA support the findings of the VIA, in that the Eastern Corridor is the preferred alternative, specifically given the potential impact on the N2 associated with the Western Corridor option.

7.4.13 Comparative Assessment of Substation Alternatives

There are no differences in the significance of impacts for either of the proposed substation alternatives in terms of impacts of social impacts.

7.4.14. Cumulative Social Impacts

The Australian Wind Farm Development Guidelines (Draft, July 2010) indicate that the cumulative impact of multiple wind farm facilities is likely to become an increasingly important issue for wind farm developments in Australia. This could occur in South Africa. In terms of assessing cumulative impacts, the Scottish Natural Heritage (2005) describes a range of potential cumulative landscape impacts of wind farms on landscapes, including:

- » Combined visibility (whether two or more wind farms will be visible from one location).
- » Sequential visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail).
- » The visual compatibility of different wind farms in the same vicinity.
- » Perceived or actual change in land use across a character type or region.
- » Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

The guidelines also note that cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (National Wind Farm Development Guidelines, DRAFT - July 2010).

Based on the information available at the time of undertaking the SIA, one adjacent wind energy facility (the Redcap project – to the east of the Oyster Bay site) has an environmental authorisation. Atleast three other wind energy facilities proposed in the area. These include the proposed Deep River wind energy facility (which is also authorised and located ~ 10 km to the north-west of the site), the proposed Happy Valley wind energy facility (located ~ 30 north-east of the site), a wind energy facility located on the Farm Dieprivier Mond near the Deep River site.

The cumulative impacts associated with the RedCap project six relevant (adjacent to Oyster Bay) and the proposed Oyster Bay wind facility from a social perspective relate largely to the impact on sense of place and visual impacts. The area designated for the proposed one wind energy facility projects are rural. The dominant current land use activity in the area is livestock and dairy farming. The proposed wind energy facilities will alter the sense of place and the existing landscape which will be dominated by turbines. In this regard, a number of local residents in the area have raised concerns regarding the cumulative impacts associated with the establishment of several wind energy facilities in the Humansdorp, Jeffery's Bay and St Francis Bay area. These residents are not opposed to wind energy per se; however, concerns were raised regarding the number of proposed wind energy facilities in the area.

In terms of visibility to passing motorists, the N2 is an important tourist route. The issue of Sequential Visibility (e.g. the effect of seeing two or more wind farms along a single journey, e.g. road or walking trail) is therefore a concern. The potential cumulative impacts are also highlighted by the findings of the VIA (refer to Section 7.2).

The visual and cumulative impacts on landscape character are highlighted in the research undertaken by Warren and Birnie (2009). The paper notes that given that aesthetic perceptions are a key determinant of people's attitudes, and that these perceptions are subjective, deeply felt and diametrically contrasting, it is not hard to understand why the arguments become so heated. Because landscapes are often an important part of people's sense of place, identity and heritage, perceived threats to familiar vistas have been fiercely resisted for centuries. The paper also identifies two factors that important in shaping people's perceptions of wind farms' landscape impacts. The first of these is the cumulative impact of increasing numbers of wind farms (Campbell, 2008). The research found that if people regard a region as having 'enough' wind farms already, then they may oppose new proposals. The second factor is the cultural context. This relates to people's perception and relationship with the landscape. In the South African context, the majority of South Africans have a strong connection with and affinity for the large, undisturbed open spaces that are characteristic of the South African landscape. The impact of wind energy facilities on the landscape is therefore likely to be a key issue in South Africa, specifically given South African's strong attachment to the land and the growing number of wind farm applications.

In summary, the proposed establishment of three or possibly more wind energy facilities in the area will impact negatively on the landscape and the areas rural sense of place and character. This impact will be exacerbated by the sequential visibility of the sites, specifically for motorists travelling along the N2, which is an important tourist route that links Cape Town with Eastern Cape. As indicated above, it is not possible to effectively mitigate the visual impacts associated with wind energy facilities. As a result, the Australian Guidelines stress the importance of general location and site selection.

The cumulative impact associated with the proposed Oyster Bay wind energy facility will, however, to some extent mitigated by the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.

7.4.15 Conclusions and Recommendations

The proposed development will create employment and business opportunities for locals during both the construction (short to medium term) and operational phase (long term) of the project. In order to enhance the local employment and business opportunities mitigation and enhancement measures listed in the SIA / EMP should be implemented. RES have indicated that agreements are in place between the landowners' trusts and RES. If the project is approved an annual fee based on the electrical output from the wind farm will be paid to the owners of the trusts. One of the four recipient trusts is a BBBEE trust. The beneficiaries of the trust include local farm workers. It is recommended that the Kouga LM, in discussion with all the of potential wind energy facility proponents in this municipality, follow the example of the Theeswaterskloof LM in the Western Cape and investigate the establishment of a Community Trust. In terms of the model a percentage of the revenue from the wind energy facility is allocated to projects in the area that have been identified in the local IDP. Of this total, 50% of the revenue is allocated to infrastructure projects and the remaining 50% to social projects and initiatives, such as skills development and training. It is recommended that a similar model be investigated by the Kouga LM.

The proposed development represents an investment in clean, renewable energy infrastructure, which, given the challenges created by climate change, represents a positive social benefit for society as a whole. However, the cumulative impacts associated with the establishment of a number of proposed wind energy facilities in the area on the local sense of place and landscape cannot be ignored. The cumulative impact of several wind energy facilities on the rural landscapes is an issue that will need to be addressed by the relevant environmental authorities, specifically given the number of applications for wind energy facilities in the region that have been submitted over the last 12 months.

7.5 Assessment of Potential Visual Impacts

The study was undertaken using Geographic Information Systems (GIS) software as a tool to generate viewshed analyses and to apply relevant spatial criteria to the proposed facility. A detailed Digital Terrain Model (DTM) for the study area was created from 20m interval contours supplied by the Surveyor General. The approach utilised to identify issues related to the visual impact included the following activities:

» The creation of a detailed digital terrain model (DTM) of the potentially affected environment;
» The sourcing of relevant spatial data. This included cadastral features, vegetation types, land use activities, topographical features, site placement, etc.;
» The identification of sensitive environments upon which the proposed facility could have a potential impact;
» The creation of viewshed analyses from the proposed development area in order to determine the visual exposure and the topography's potential to absorb the potential visual impact. The viewshed analyses take into account the dimensions of the proposed structures.

7.5.1 Visual Exposure of the facility

The result of the combined viewshed analyses for the proposed wind energy facility's layout is shown on **Figure 7.8 (a). Figure 7.8 (b)** shows a zoomed in view of the viewshed. The viewshed analysis not only indicates areas from where the wind turbines would be visible (any number of turbines with a minimum of one turbine), but also indicates the potential frequency of visibility (i.e. how many turbines are exposed). The highest frequency of potential visual exposure is on the site itself and on the coastal plain surrounding the site in all directions. Areas lying further to the north beyond the plateau are mostly screened by the high lying and mountainous topography. The south facing slopes of these mountains are exposed to potential visual impact, while the north facing slopes are visually screened.

Long strips along the drainage lines, especially the Krom, the Seekoei and the Klipdrift River valleys, are visually screened as incision by the rivers into the landscape effectively shields these areas from potential visual exposure. Similarly, many areas along the coastline are visually screened as the landscape drops down to sea level. Visibility of the wind energy facility will be high, with a high frequency of exposure for long stretches of the N2 and the R102, especially below the plateau in closer proximity to the proposed wind energy facility.

Similarly long stretched of the R330 and the R102 will be exposed to high frequencies of potential visual exposure. The extent of exposure of the R62 further to the north-west is lower, but the frequency of exposure remains high. The towns of Kruisfontein, Humansdorp and Jeffrey's Bay to the north east, are expected to experience a high frequency of visual exposure, both within the towns and in the surrounding area.

The towns of Oyster Bay, Cape St Francis and Sea Vista will be less exposed, with more limited areas likely to be exposed to moderate frequencies of potential visual exposure. The town of Kareedouw will not be exposed to visual impact. A large number of settlements and homesteads, especially those located below the plateau will be potentially visually exposed, with a high frequency of exposure. Some of these, located within the river valleys, will be visually screened by virtue of the topography. The proposed energy facility may also be visible from parts of the Thaba Manzi, the Jumanji and Lombardini Game Farms, as well as from the Kromrivierspoort and Thuyspunt Natural Heritage Sites (moderate to high frequencies).

Very limited parts of the Huisklip Nature Reserve and Rebelsrus may also be exposed to moderate to high frequencies of potential visual exposure, while some of the coastal Cape St Francis reserves may experience low frequencies of potential visual exposure in certain parts. The visibility map illustrates the influence of the topography, and specifically the visual screening the mountains and the plateau offers the facility, which is located on the low lying coastal plain. The wind turbine structures would be easily and comfortably visible to observers (i.e. travelling along roads, residing in towns and at homesteads or visiting the region), especially within a 5 to 10 km radius (i.e. at short to medium distances) of the energy facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

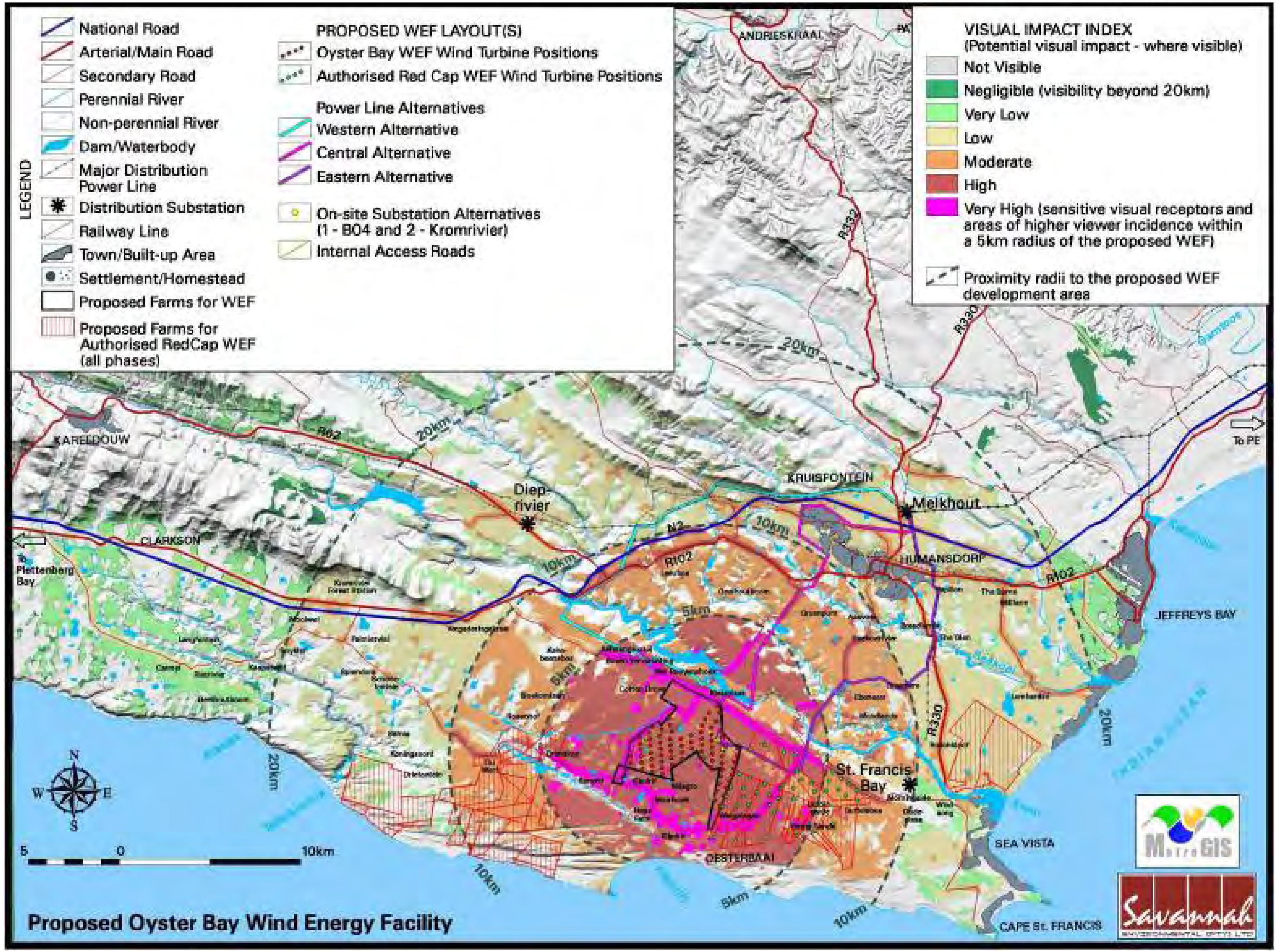

Figure 7.8 (a): Visual impact index of the proposed Oyster Bay wind energy facility

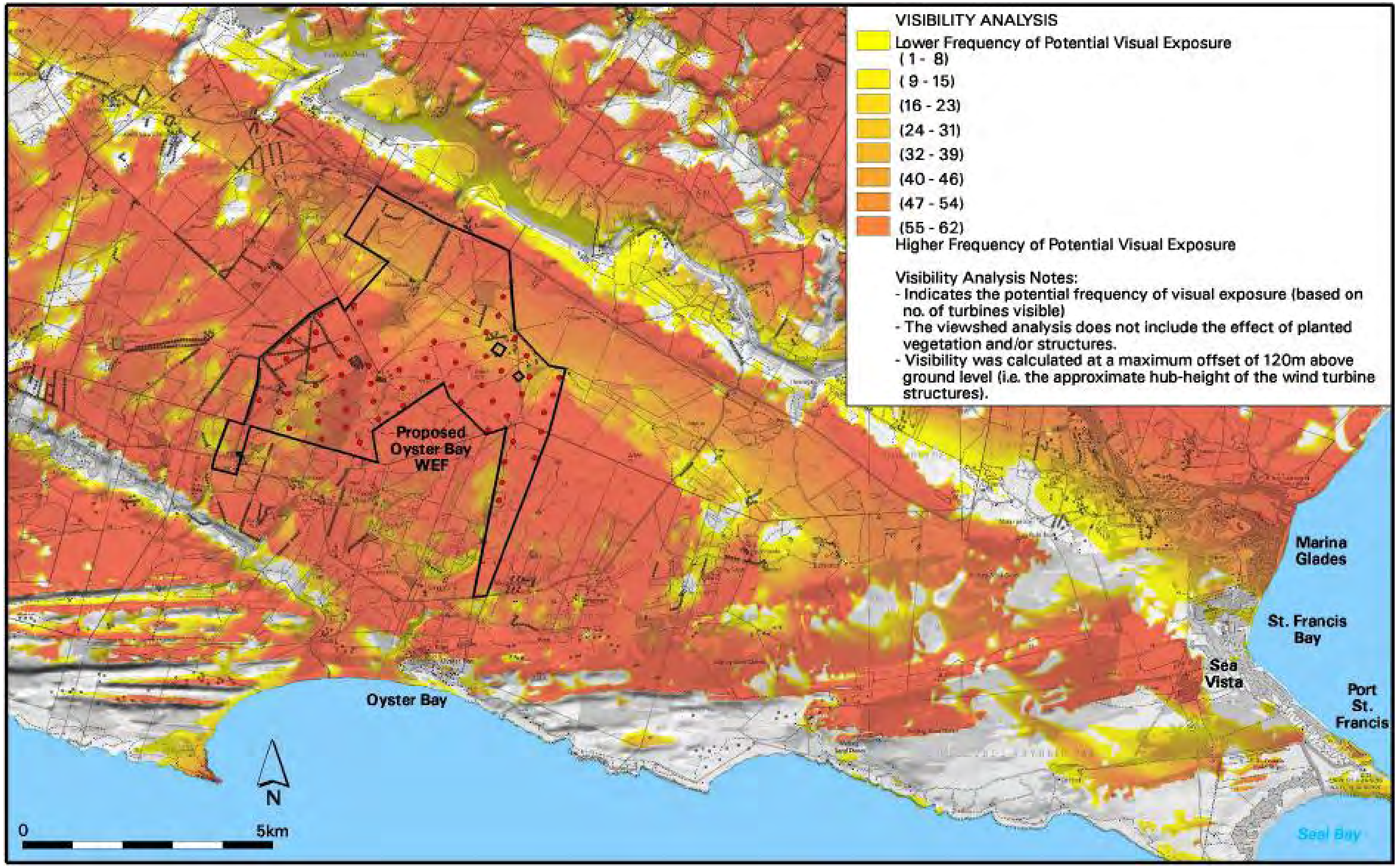

Figure 7.8 (a) Zoomed in Viewshed Analysis for the proposed Oyster Bay wind energy facility

The topography and the placement of the wind turbines on the high ground influence the frequency of exposure. It is evident from the viewshed analyses that the proposed wind energy facility would have a large area of potential visual exposure due to its elevated position in the landscape and the relatively tall wind turbine infrastructure. The wind turbines would be easily and comfortably visible, especially within a 10km radius of the facility and would constitute a high visual prominence, potentially resulting in a high visual impact.

Viewer incidence is calculated to be the highest along the national and arterial roads (i.e. the N2, R102, R62, R330 and R332) as well as the secondary roads within the study area. Commuters and tourists using these roads could be negatively impacted upon by visual exposure to the wind energy facility. Other than along the above roads, viewer incidence within a 10 km radius of the proposed wind energy facility is concentrated in a relatively high number of homesteads and settlements, and in the town of Oyster Bay. The remainder of the study area (beyond 10km from the proposed wind energy facility) consists largely of grazing land (cattle), agricultural land or vacant natural land with potential observers located within homesteads and settlements. It is uncertain whether all of the potentially affected settlements are inhabited or not, and it has therefore been assumed that they are all inhabited.

Kruisfontein, Humansdorp, Sea Vista and Cape St Francis lie between 10 and 20km from the proposed wind energy facility, while Jeffrey's Bay lies further afield beyond the 20km radius. The severity of the visual impact on visual receptors decreases with increased distance from the proposed facility. In terms of viewer perception, the region as a whole has an aesthetic value and inherent sense of place based on the pastoral landscape, the scenic mountains and the picturesque coast. Residents, visitors to this area and tourists residing in holiday towns and making use of the N2 are seen as sensitive visual receptors upon which the construction of the WEF could have a potentially negative visual impact.

The following is of relevance:

» There exists a core area of potentially **high** visual impact on the site itself and within a 5km radius of the proposed WEF. This core area is located entirely on the coastal plain below the plateau, and stretches to the coastline at Oyster Bay. Some low lying areas, strips along the Klipdrift and Krom River valleys and the coast east of Oyster Bay are exposed to only moderate visual impact, or are not exposed at all.

Potential areas of **very high** visual impact within this 5km radius include various secondary roads giving access to Oyster Bay, Humansdorp, Kruisfontein and the N2. In addition, parts of Oyster Bay and a number of settlements and homesteads are likely to experience very high visual impact. These homesteads and settlements include the following:

» Kerstangekraal;
» Boven Verwachting;
» Van Rooyenshoek;
» Cotton Grove;
» Brandkop;
» Sandrif;
» Klipdrif;
» Hope Farm;
» Moolhoek;
» Milagro;
» Welgelegen;
» Penny Sands and Kleinplaas.

Mpofu Dam, especially the lower reaches, will be exposed to moderate to high visual impact, and the northern part of the Thuyspunt National Heritage Site will be exposed to a moderate visual impact. The extent of potential visual impact is slightly reduced between the 5km and 10km radius, but large areas in all directions are still exposed to potentially **moderate** visual impact. The coastline within this zone is mostly screened from potential visual impact, both to the south west and to the south east of the proposed wind energy facility. Clear zones of visual screening also exist along the river valleys within this radius, including the Klipdrift, the Krom and the Seekoei Rivers. Areas of **high** potential visual impact include a continuous stretch of the R102, short parts of the N2 and a number of secondary roads.

No towns or urban areas occur within this zone, but a number of homesteads and settlements are likely to experience a **high** visual impact. Homesteads which lie between 5km and 10km of the proposed facility include the following:

» Lappie-aarde;
» Buffelbos;
» Woodlands;
» Ebenezer;
» Grasmere;
» Seekeioriver;
» Aasvoel;
» Groenpunt;
» Leeubos;
» Rosenhof and
» Ou werf.

Limited parts of the Rebelsrus Private Nature Reserve may potentially be exposed to moderate visual impact. Between 10km and 20km, the extent of potential visual impact decreases in the west and north, as the mountainous and high lying terrain takes form. The extent of potential visual exposure to the east remains high. The magnitude of visual impact in the visually exposed areas (which include the south facing slopes of the mountains) is **low** within this zone.

Exceptions are stretches of the N2, the R102, the R330, the R62, various secondary roads and a number of homesteads and settlements. Potential visual impact for receptors on these roads is expected to be **moderate**. Kruisfontein, Humansdorp, the southern parts of Jeffrey's Bay and the inland parts of Sea Vista are also likely to be visually exposed, but at a **low** magnitude, due to the elevated visual absorption capacity within urban areas.

Protected areas likely to be visually affected include parts of the Jumanji, Thaba Manzi and Lombardini Game Farms and very limited parts of the Huisklip Nature Reserve and of the Kromriveirspoort National Heritage Site. Visual impacts are likely to be of low magnitude in these protected areas. Remaining impacts beyond the 20km radius are expected to be mostly **very low** to **negligible**. The northern parts of Jeffrey's Bay lie within this zone and are likely to experience **very low** visual impact. Stretches of the N2, the R102, the R62 and secondary roads within this zone will potentially experience **low** visual impact.

7.5.1.1 Photo Simulations

Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the wind energy within the receiving environment. Refer to Visual Assessment (Appendix I) for the remainder of the photo-simulations. Photo simulations were undertaken (in addition to the above spatial analyses) in order to illustrate the potential visual impact of the proposed Oyster Bay wind energy facility within the receiving environment. The purpose of the photo simulation exercise is to support the findings of the VIA, and is not an exercise to illustrate what the facility will look like from all directions.

The photo simulations indicate the anticipated visual alteration of the landscape from various sensitive visual receptors located at different distances from the facility. The simulations are based on the wind turbine dimensions and layout as indicated on **Figure 7.9.**

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

» **Short distance view 1**

Viewpoint 1 is located on a secondary road which bypasses the site to the immediate south, linking the N2 in the west, Oyster Bay in the south and Humansdorp in the east. The point is located about 1,6km east of the site boundary.

This position is approximately 1,6km away from the closest turbine and is indicative of a close range view that residents of homesteads living in close proximity to the facility would have of the turbines. It is also representative of what residents of and visitors to Oyster Bay will potentially see when travelling towards the town from the east.

It is also noteworthy that this point is located within the authorised Red Cap WEF site, meaning that turbines from both facilities may ultimately be visible in the short distance. In this respect, **Figure 7.9(a)** shows the pre-construction environment (i.e. no wind turbines are visible), **Figure 7.9 (b)** shows the Red Cap Turbines only and Figure 8c shows the combined Oyster Bay and Red Cap Turbines.

The viewing direction is north westerly and in Figure **Figure 7.9 (c)** , 71 turbines are fully to partially visible in the landscape. 6 of these turbines belong to the authorised Red Cap Facility.

Figure 7.9 a: Pre-construction panoramic overview from Viewpoint 1

Figure 7.9 b: Pre construction panoramic overview from Viewpoint 1 (indicating the authorised Red Cap turbines only).

Figure 7.9 c: Post construction panoramic overview from Viewpoint 1 (indicating the authorised Red Cap turbines as well as the proposed Oyster Bay turbines and enlarged photograph sections).
This viewpoint is located 1,6km away from the closest turbine.

» **Medium distance view**

Viewpoint 3 is located on the R102, about 1km to the east of the junction with the R62. The point is located about 7km north of the site boundary.

This position is approximately 8km away from the closest turbine and is indicative of a medium range view that users of the R102 and residents of homesteads within 10km of the facility would have of the turbines lying to the south.

It is also representative of what users of the N2 would see of the facility (the N2 is located about 1km to the north of the R102 at this point).

It is noteworthy that the authorised Red Cap WEF site will also be visible from this point, meaning that turbines from both facilities may ultimately be visible in the medium distance. In this respect, **Figure 7.10 (a)** shows the pre-construction environment (i.e. no wind turbines are visible), **Figure 7.10 (b)** shows the Red Cap Turbines only and **Figure 7.10 (c)** shows the combined Oyster Bay and Red Cap Turbines.

The viewing direction is south easterly and in **Figure 7.10 (c)**, 98 turbines are fully to partially visible in the landscape. 30 of these turbines belong to the authorised Red Cap Facility.

Figure 7.10 (a): Pre construction panoramic overview from Viewpoint 3

Figure 7.10 (b): Post construction panoramic overview from Viewpoint 3, (indicating enlarged photograph sections).

Figure 10c: Post construction panoramic overview from Viewpoint 3 (indicating the authorised Red Cap turbines as well as the proposed Oyster Bay turbines and enlarged photograph sections).
This viewpoint is located 8km away from the closest turbine.

7.5.1.1 Impact Table - Visual Impact on residents of urban centres and settlements

Nature: Potential visual impact on residents of urban centres and settlements in close proximity to the proposed WEF		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	Very high **(10)**	N/A
Probability	Definite **(5)**	N/A
Significance	High **(90)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A
Mitigation: None.		
Cumulative impacts: The construction of up to 80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap wind energy facility located to the west and east of the site. Although the proposed Oyster Bay wind energy facility will fall within the Red Cap wind energy facility viewshed, the frequency of exposure for receptors within this viewshed will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

7.5.2 Change of visual character and sense of place of the region

Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria and specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.) play a significant role. A visual impact on the "sense of place" is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light.

Specific aspects contributing to the sense of place of this region include the pastoral visual quality of the farmland and the scenic beauty of the coastline and of the mountains inland. The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be moderate. There is no mitigation for this impact.

7.5.2.1 Impact Table - visual character and sense of place

Nature of Impact: Potential visual impact on the visual character and sense of place of the region.		
	No mitigation	***Mitigation Considered***
Extent	Regional **(3)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	Moderate **(6)**	N/A
Probability	Probable **(3)**	N/A
Significance	Moderate **(39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A
Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: The construction of 50-80 wind turbines and the ancillary infrastructure required for the WEF will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site. Although the proposed Oyster Bay WEF will fall within the Red Cap WEF viewshed, the frequency of exposure for receptors within this viewshed will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

7.5.3 Potential Visual Impact on Protected Areas in Close Proximity to the Site

The formally protected areas that occur in the broader study areas are shown in **Figure 7.11**. The potential visual impact on conservation/protected areas within a 10km radius of the proposed WEF (i.e. Thuyspunt National Heritage Site and limited parts of the Rebelsrus Private Nature Reserve) is expected to be of moderate significance as the site itself does not include any record of the nature or status of facilities present within these protected areas, or if indeed any facilities exist at all, the visual assessment assumes that visitor access is possible and permitted, and that the potential exists to develop tourist facilities and amenities of a private or public nature. The limited extent of visual exposure, however, reduces the probability of this impact occurring. No mitigation is possible for this impact.

7.5.2.1 Impact Table - Visual impact on protected areas in close proximity to the proposed site

Nature of Impact: Potential visual impact on protected areas in close proximity to the proposed WEF.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	High **(8)**	N/A
Probability	Improbable **(2)**	N/A
Significance	Low **(16)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A
Mitigation: None.		
Cumulative impacts: The construction of 50-80 wind turbines will increase the cumulative visual impact within the region, specifically in light of the authorised Red Cap WEF located to the west and east of the site. Although the proposed Oyster Bay WEF will fall within the Red Cap WEF viewshed, the frequency of exposure for receptors within this viewshed will increase.		
Residual impacts: None. The visual impact of the wind turbines will be removed after decommissioning.		

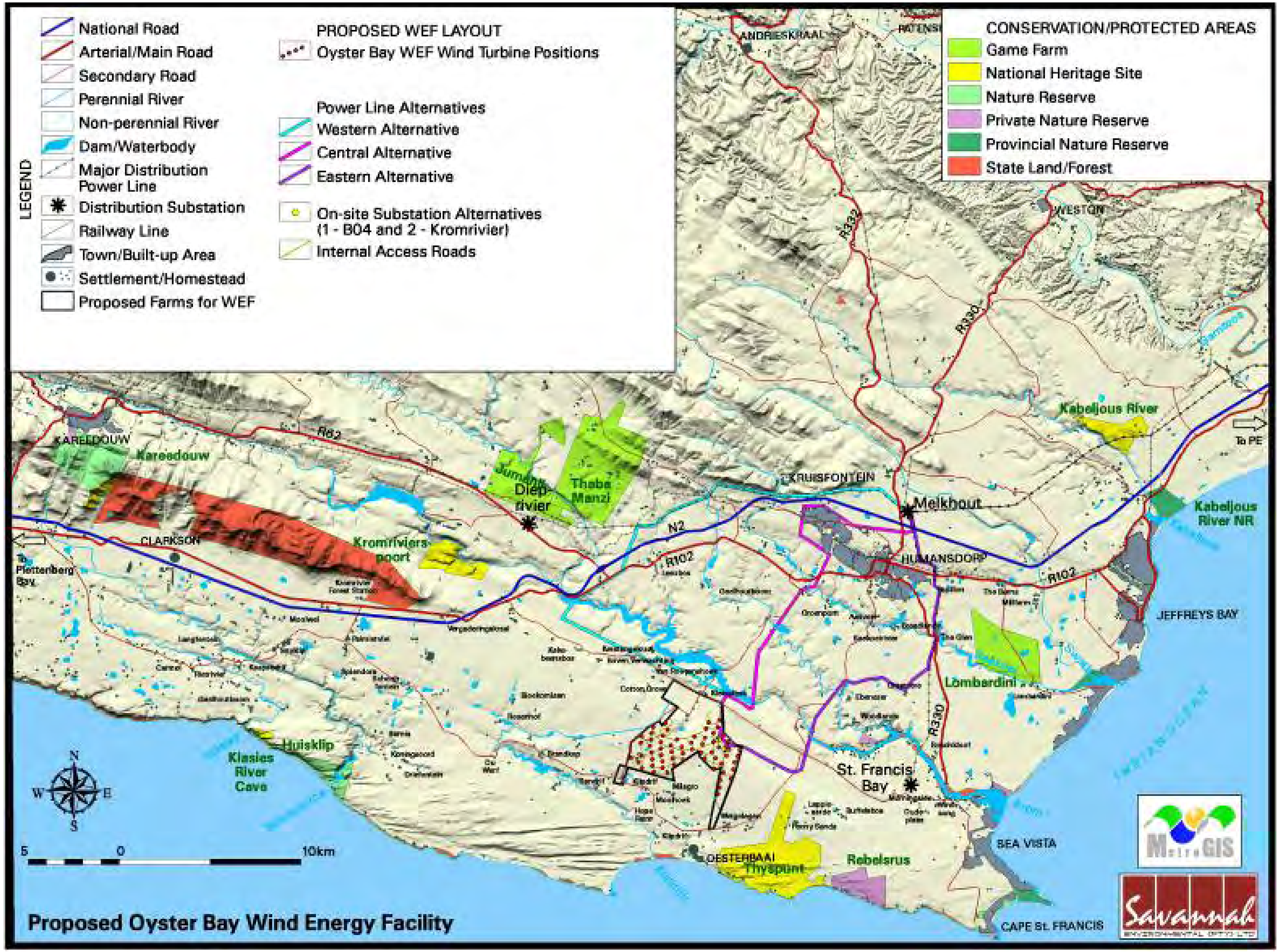

Figure 7.11: Formally protected areas in the broader study area

7.5.4 Potential Visual Impact on tourist routes, tourist destinations and tourism potential within the region

The study area has a pastoral character and is located within a particularly picturesque part of the country. The site also lies less than 3km from the coastline, and more specifically the coastal town of Oyster Bay. In addition to Oyster Bay, other towns in the study area such as Jeffrey's Bay, Sea Vista and Cape St Francis enjoy status as coastal holiday towns and tourist destinations.

The Eastern Cape also has 9 tourism routes of which the *Kouga Route*, encompassing Jeffrey's Bay, Cape St Francis and the Gamtoos River Valley, is of relevance within in the study area. In addition, the N2 is a well-known and well used tourist access route, and many arterial and secondary roads make for scenic drives.

Visual intrusion through the development of industrial type infrastructure within this environment could have a negative effect on the area's tourism value and potential. However, the SIA literature review revealed that the negative / positive impact on wind energy facilities in other countries have not proven any negative / positive impact, however the potential for negative impacts on the tourism sector in South Africa may exist, and is unknown at this stage in the absence of any large scale commercial wind energy facility in the country.

However, the visibility of the facility on existing tourist routes, coastal holiday towns is evident. There is no mitigation for this impact.

7.5.4.1 Impact Table - Impact of the facility on tourism

Nature of Impact: Potential visual impact of the proposed facility on tourist routes, tourist destinations and tourist potential within the region.		
	No mitigation	***Mitigation considered***
Extent	Regional **(3)**	N/A
Duration	Long term **(4)**	N/A
Magnitude	Moderate **(6)**	N/A
Probability	Probable **(3)**	N/A
Significance	Moderate **(39)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	Recoverable **(3)**	N/A
Irreplaceable loss of resources?	No	N/A
Can impacts be mitigated?	No	N/A

Mitigation: Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years
Cumulative impacts: The construction of up to 80 wind turbines and the ancillary infrastructure required for the WEF will increase the cumulative visual impact on tourism and tourism potential within the region. This is specifically in light of the authorised Red Cap WEF located to the west and east of the site. Although the proposed Oyster Bay WEF will fall within the Red Cap WEF viewshed, the frequency of exposure for receptors within this viewshed will increase.
Residual impacts: The visual impact of the wind turbines will be removed after decommissioning.

7.5.5. Lighting Impacts

The receiving environment in close proximity to the proposed wind energy facility has a relatively small number of dwellings (i.e. mostly settlements and homesteads) and it can be expected that the light trespass and glare from the security and after-hours operational lighting (flood lights) for the substation and other WEF infrastructure will have some significance. Furthermore, the sense of place and rural coastal ambiance of the local area increases its sensitivity to such lighting intrusions. It is also important that note be taken of the protected areas and the tourist town of Oyster Bay within close proximity to the proposed WEF.

Another source of glare light, albeit not as intense as flood lighting, is the aircraft warning lights mounted on top of the hub of the wind turbines. These lights are less aggravating due to the toned-down red colour, but have the potential to be visible from a great distance. The Civil Aviation Authority (CAA) prescribes these warning lights and the potential to mitigate their visual impacts is low.

Last is the potential lighting impact known as 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, contributes to the increase in sky glow. The WEF may contribute to the effect of sky glow in an otherwise dark environment. Lighting impacts will be moderate significance both before and after mitigation.

7.5.5.1 Impact Table - Significance of visual impact of lighting at night on visual receptors in close proximity to the proposed WEF

Nature of Impact: Potential visual impact on of lighting at night on visual receptors in close proximity to the proposed wind energy facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Moderate **(6)**	Low **(4)**
Probability	Probable **(3)**	Probable **(3)**
Significance	Moderate **(42)**	Moderate **(36)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Planning: mounting aircraft warning on the turbines representing the outer perimeter of the facility. Planning: pro-active lighting design and planning. Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years.		
Cumulative impacts: The construction of up to 80 wind turbines with their aircraft warning lights will increase the cumulative visual impact of such warning lights within the region. This is specifically relevant in context of the authorised Red Cap WEF located to the west and east of the site.		
Residual impacts: None. The visual impact of lighting will be removed after decommissioning and the removal of the wind turbines.		

7.5.6. Shadow flicker

Shadow flicker occurs when the sky is clear, and when the rotor blades are between the sun and the receptor (i.e. when the sun is low). De Gryse in Scenic Landscape Architecture (2006) found that "most shadow impact is associated with 3-4 times the height of the object". Based on this research, a 500m buffer along the edge of the facility is submitted as the zone within which there is a risk of shadow flicker occurring. In this respect, inhabited settlements and homesteads within the WEF site, as well as those within 500m of the property boundary may experience a visual impact of low significance both before and after mitigation.

Shadow flicker only becomes an issue if a wind turbine is in close proximity to houses / dwelling. To avoid shadow flicker, RES has put in a turbine separation distances to avoid shadow flicker. Taking into account site constraints RES will be using a minimum spacing of 5 rotor diameters (approximately 560m) based on our maximum turbine envelope in the prevailing (bi-directional east west) wind directions, 3 rotor diameters (approximately 336m) for non-predominant.

7.5.6.1 Impact Table - Significance of visual impact of shadow flicker

Nature of Impact: Potential visual impact of shadow flicker on visual receptors in close proximity to the proposed wind energy facility.		
	No mitigation	***Mitigation considered***
Extent	Local **(4)**	Local **(4)**
Duration	Long term **(4)**	Long term **(4)**
Magnitude	Low **(4)**	Low **(4)**
Probability	Improbable **(2)**	Improbable **(1)**
Significance	Low **(24)**	Low **(12)**
Status (positive or negative)	Negative	Negative
Reversibility	Recoverable **(3)**	Recoverable **(3)**
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	N/a
Mitigation: Planning: ensure that all wind turbines are 500m or further from the nearest inhabited homestead of settlement. Decommissioning: removal of the wind turbines and ancillary infrastructure after 20 to 30 years		
Cumulative impacts: None.		
Residual impacts: None. The visual impact of shadow flicker will be removed after decommissioning and the removal of the wind turbines.		

7.5.6. The potential to mitigate visual impacts

It is not possible to mitigate the primary visual impact, namely the appearance of the Wind Energy Facility (the wind turbines). The functional design of the turbines 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 overall potential for mitigation is generally low or non-existent. Mitigation of visual impacts associated with the construction of roads includes the use of existing roads wherever possible.

Where new roads are required, these should be planned taking due cognisance of the topography. Construction of roads should be undertaken properly, with adequate drainage structures in place to forego potential erosion problems. Access roads not required for the post-decommissioning use of the site should be ripped and rehabilitated during decommissioning. It is recommended that the substation design makes use of low profile construction technology to mitigate visual impact on the surrounding area.

The Civil Aviation Authority (CAA) prescribes that aircraft warning lights be mounted on the turbines. However, it is possible to mount these lights on the turbines representing the outer perimeter of the facility. In this manner, fewer warning lights can be utilised to delineate the facility as one large obstruction, thereby lessening the potential visual impact. The regulations for the CAA's *Marking of Obstacles* should be strictly adhered to, as the failure of complying with these guidelines may result in the developer being required to fit additional light fixtures at closer intervals thereby aggravating the visual impact.

Mitigation of other lighting impacts includes the pro-active design, planning and specification lighting for the facility by a lighting engineer. The correct specification and placement of lighting and light fixtures for the turbines and the ancillary infrastructure will go far to contain rather than spread the light. Additional measures include the following:

» Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
» Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
» Making use of minimum lumen or wattage in fixtures;
» Making use of down-lighters, or shielded fixtures;
» Making use of Low Pressure Sodium lighting or other types of low impact lighting.
» Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

Mitigation of potential shadow flicker impacts includes ensuring that all wind turbines are located 500m or further from the nearest inhabited homestead of settlement. Mitigation of visual impacts associated with the construction phase, albeit temporary, entails proper planning, management and rehabilitation of the construction site. Construction should be managed according to the following principles:

» Reduce the construction period through careful planning and productive implementation of resources.
» Plan the placement of lay-down areas and any potential temporary construction camps in order to minimise vegetation clearing.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Ensure that rubble, litter and disused construction materials are managed and removed regularly.
» Ensure that all infrastructure and the site and general surrounds are maintained in a neat and appealing way
» Reduce and control construction dust through the use of approved dust suppression techniques.
» Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
» Rehabilitate all disturbed areas, construction areas, road servitudes and cut and fill slopes to acceptable visual standards.
» Secondary impacts anticipated as a result of the proposed WEF (i.e. visual character and sense of place) are not possible to mitigate.
» There is no mitigation to ameliorate the negative visual impacts on tourist routes, destinations and potential of the region.
» Once the WEF has exhausted its life span, the main facility and all associated infrastructure not required for the post rehabilitation use of the site should be removed and all disturbed areas appropriately rehabilitated.

The possible mitigation of both primary and secondary visual impacts as listed above should be implemented and maintained on an on-going basis.

7.5.7. Cumulative impacts

In terms of potential Cumulative Visual Impact, **Figure 7.12** shows the potential cumulative visual exposure of both the proposed Oyster Bay wind energy facility and the adjacent authorised RedCap Wind energy facility (authorised turbines only).

The map indicates areas within which turbines from both facilities would potentially be visible (yellow shaded), areas from which only Oyster Bay turbines will be visible (red shaded) and areas from which only Red Cap turbines will be visible (green shaded). The viewsheds of the two facilities largely correspond, meaning that the potential visual impact of the proposed Oyster Bay wind energy facility lies mostly within that of the authorised Red Cap facility. Additional areas within which the Oyster Bay facility alone will be visible are limited in extent, and lie mostly on the site itself and to the north-west.

From a visual perspective, this overlapping viewshed is considered favourable, as it represents the consolidation and concentration of potential visual impacts within an existing wind energy facility viewshed. Within these visually exposed areas, the frequency of visual exposure to turbines will be higher with the addition of the Oyster Bay facility, but the extent of the existing Red Cap viewshed remains largely unchanged.

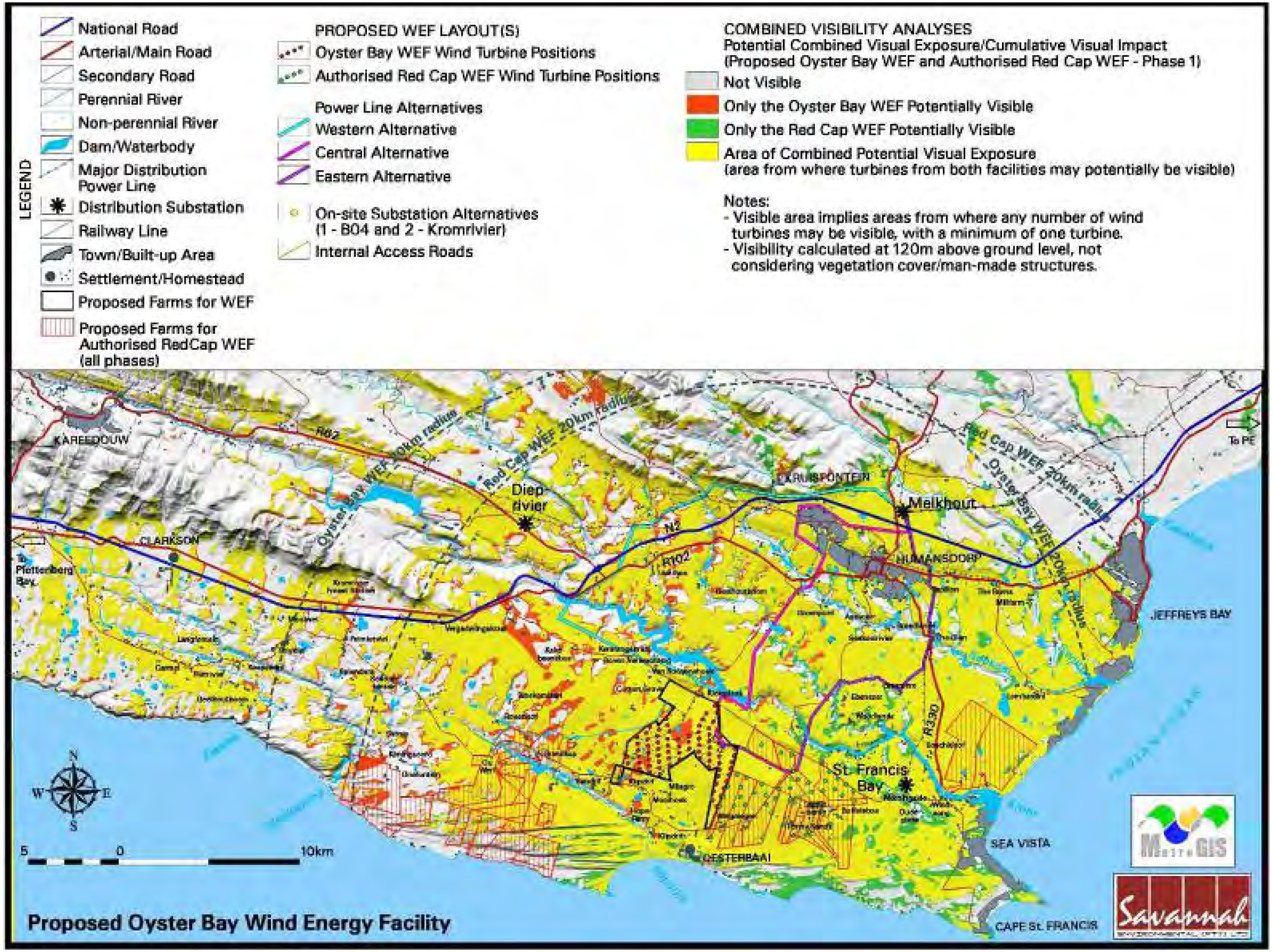

Figure 7.12: Cumulative Visibility analyses (Oyster Bay site & authorised RedCap site)

7.5.8. Comparative Assessment of Alternative Power Line Routings

The 3 power line corridor options have been indicated on **Figure 7.13**. This map also shows the potential visual exposure of all three power line options, calculated at a height of 20m above ground level, for a distance of 2km on either side of the alignment. The power line will be visible along all three alignment options. Small areas of visual screening occur in areas of undulating topography and along incised river valleys. The following is of relevance from a visual perspective:

» The Western Corridor is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include long stretches of the N2 and shorter stretches the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 50 settlements and homesteads also appear to fall within this viewshed. This corridor follows an existing power line for about half of its length, but crosses 3 rivers, including the upper reaches of the Mpofu Dam.
» The Central Corridor is the second shortest alignment. Visual receptors include short stretches of the N2, the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers, including the lower reaches of the Mpofu Dam (i.e. at the dam wall).
» The Eastern Corridor is the shortest alignment, and therefore displays the smallest extent of potential visual exposure. Visual receptors include short stretches of the N2, the R102, the R330 and 1 secondary road. The eastern parts of Humansdorp and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers.

The above comparison reveals that the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed. In order of preference, the **Eastern Corridor** is favoured from a visual perspective. Despite the fact that the Western Corridor follows existing infrastructure for at least half of its length, its longer length and exposure to long stretches of the N2 renders it the least favourable from a visual perspective. The preferred power line alternative from a visual perspective is therefore the Easter Corridor in order to minimise potential visual impact.

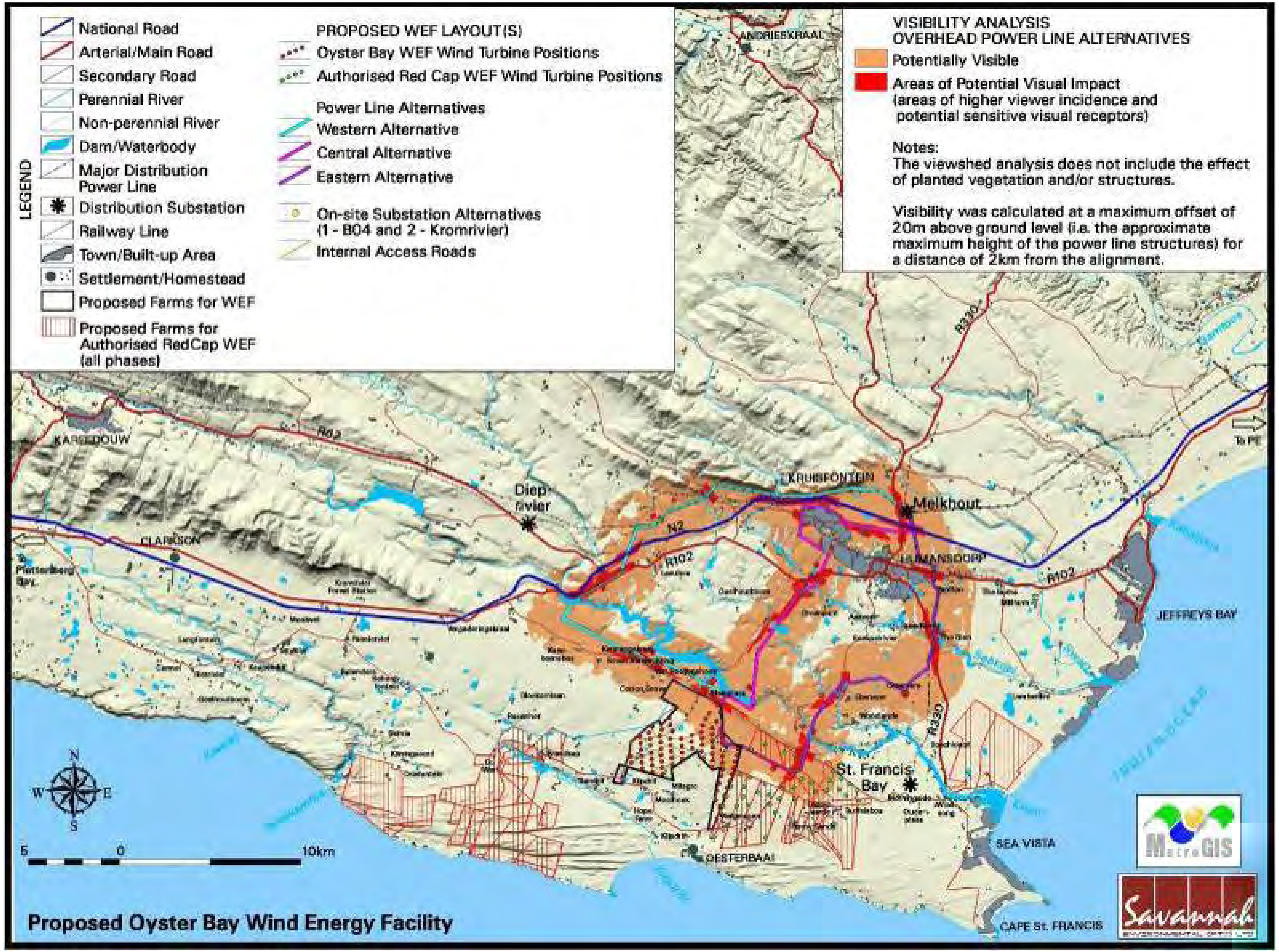

Figure 7.13: Potential visual exposure the proposed power line alternatives

7.5.9. Conclusions and Recommendations

The substation, regardless of which alternative location is selected, and the workshop areas required for this wind energy facility could present a visual impact.

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

The facility and associated infrastructure would be visible within an area that is generally seen as having a high quality natural and pastoral landscape character. Within this context, visual receptors include residents of Oyster Bay and surrounds, as well as a number of rural settlements and homesteads in close proximity to the proposed facility. The N2 is a known tourist access route to the east coast and the scenic nature of the area and the proximity to coastal holiday towns lends the study area some tourism value. The potential to promote scenic drives and to tie in with the Kouga Tourism Route add to the potential of the area to develop in terms of tourism in the future.

Conservation areas in close proximity to the proposed wind energy facility are limited to the Thuyspunt National Heritage Site and the Rebelsrus Private Nature Reserve. These represent part of a picturesque and undeveloped coastline. The facility would thus visually impact on various sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive.

Furthermore, in light of the authorise Red Cap WEF located adjacent to the proposed Oyster Bay WEF, these visual receptors would be subject to a cumulative visual impact (i.e. turbines from 2 rather than 1 facility will be visible). There also are not many options as to the mitigation of the visual impact of the core facility. No amount of vegetation screening or landscaping would be able to hide structures of these dimensions.

The following is a summary of impacts, assuming mitigation as recommended in the EMP and VIA is exercised:

» The anticipated visual impact on residents of settlements and homesteads in close proximity to the proposed facility will also be of **high** significance.

» The anticipated visual impact on residents of towns beyond the 10km of the proposed facility will be of **low** significance.
» Conservation / protected areas in close proximity to the proposed facility will experience visual impacts of **low** significance, as will those within the greater region.
» In terms of ancillary infrastructure, the anticipated visual impact of the substation and workshop will be of **low** significance, as will that of the internal access roads.
» Visual impacts of the proposed power line will be of **moderate** significance.
» Anticipated visual impacts related to lighting will be of **moderate** significance, while that of shadow flicker will be **low**.
» Similarly, the visual impact of construction is also expected to be of **low** significance.
» In terms of secondary visual impacts, the significance of the anticipated impact on the visual character and sense of place of the region will be of **moderate** significance, as will the anticipated impact on tourist routes, tourist destinations and tourism potential.

This anticipated visual impact is not, however, considered to be a fatal flaw from a visual perspective, considering the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure.

From a visual perspective, the proximity of the proposed wind energy facility to the authorised Red Cap facility, and their corresponding zones of potential visual exposure and overlapping viewshed is considered favourable, as it represents the consolidation and concentration of potential visual impacts within an existing facility viewshed. Within these visually exposed areas, the frequency of visual exposure to turbines will be higher with the addition of the Oyster Bay facility, but the extent of the existing Red Cap viewshed will remain largely unchanged.

The potential visual impact is not likely to detract from the regional tourism appeal, numbers of tourists or tourism potential of the existing centres such as Jeffrey's Bay, Sea Vista or Cape St Francis. Only the settlement of Oyster Bay is close enough to the proposed WEF to be affected, but only limited outlying parts of the town will be visually exposed. Furthermore, it is assumed that holiday homes within this town would orientate towards the ocean, and not inland towards the WEF. Therefore, receptors are not likely to be exposed permanently or even for long periods of time.

7.6 Assessment of Potential Noise Impacts

7.6.1 Relevant Noise Receptors

Potentially Sensitive Receptors (PSRs), also known as Noise-Sensitive Developments (NSDs) were initially identified using Google Earth®, supported by a site visit to confirm the status of the identified dwellings.

The reason for the site visit, apart from sampling ambient sound levels, is that there could be a number of derelict or abandoned dwellings that could be seen as a sensitive receptor, or small dwellings that could not be identified on the aerial image, or those that were built after the date of the aerial photograph.

Potential receptors in and around the proposed wind energy facility were identified and are presented in **Figure 7.14**. The locations of the PSRs are defined in the Noise study (Appendix L).

Comments received from I&AP during the public participation phase of this project are summarised below as per the requirements of SANS 10328:2008.

Table 7.1: I&AP Comments and Response

Stakeholder	**Issue / Comment / Concern**	**Response / Section dealt**
C. Tregoning	Concerned about Noise Pollution.	Dealt in this document
N. Fowler	Distance between Oyster Bay and closest wind Turbines	Please refer to Locality Map in Chapter 2 of the EIA report
N. Fowler	Noise levels of wind turbine at maximum speed	See also Error! Reference source not found.
H. Stoffberg	Worried that noise study would only investigate site-specific noise and not surrounding environment	Noise study investigated in detail area up to 2,000 meters from boundary of WEF. Covered in this section of the EIA.
J. Botha	What is the situation in terms of noise in Europe in particular with regard to low frequency noise?	This noise study is based on the requirements of SANS 10328:2008 which is based on the World Heath Organization recommendations. The SANS standards also covers LF noise.

Figure 7.14: Aerial image indicating potential noise sensitive receptors and property boundaries in the proposed WEF

7.6.2 Noise from Construction activities

Noise sources during construction include the following:

» **Construction equipment**
Construction equipment likely to be required will typically include excavator/graders, bulldozers, dump trucks, vibratory roller, bucket loader, rock breaker(s), drill rig, flat-bed truck(s), pile drivers, concrete trucks, cranes, fork lift(s) and various 4WD and service vehicles. Octave sound power levels typical for this equipment are presented in the Noise report.

» **Blasting**
Blasting may be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered during the EIA phase for the following reasons:

* Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.
* People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.
* Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relative fast results in a higher acceptance of the noise. Note that with the selection of explosives and blasting methods, noise levels from blasting is relatively easy to control

» **Traffic due to construction vehicles**
A source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. This will include trucks transporting equipment, aggregate and cement as well as various components used to develop the wind turbine. Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period. Noise levels due to additional traffic will be estimated using the methods stipulated in SANS 10210:2004 (Calculating and predicting road traffic noise).

7.6.2.1 Results of Noise Modelling – Construction Noise

Only the calculated day time ambient noise levels are presented, as construction activities that might impact on sensitive receptors should be limited to the 06:00 – 22:00 time period. The worst-case scenario is presented with the entire activities taking place simultaneously during wind-still conditions, in good sound propagation conditions (20^{o}C and 80% humidity).

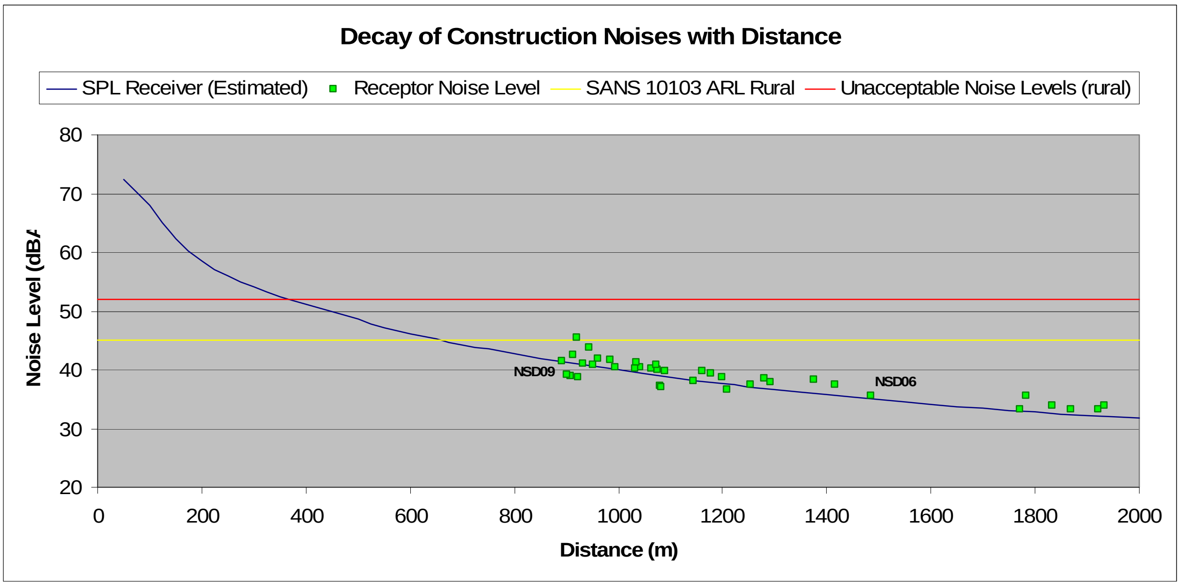

Figure 0.15: Construction noise: Projected Construction Noise Levels as distances increase between NSDs and locations where construction can take place

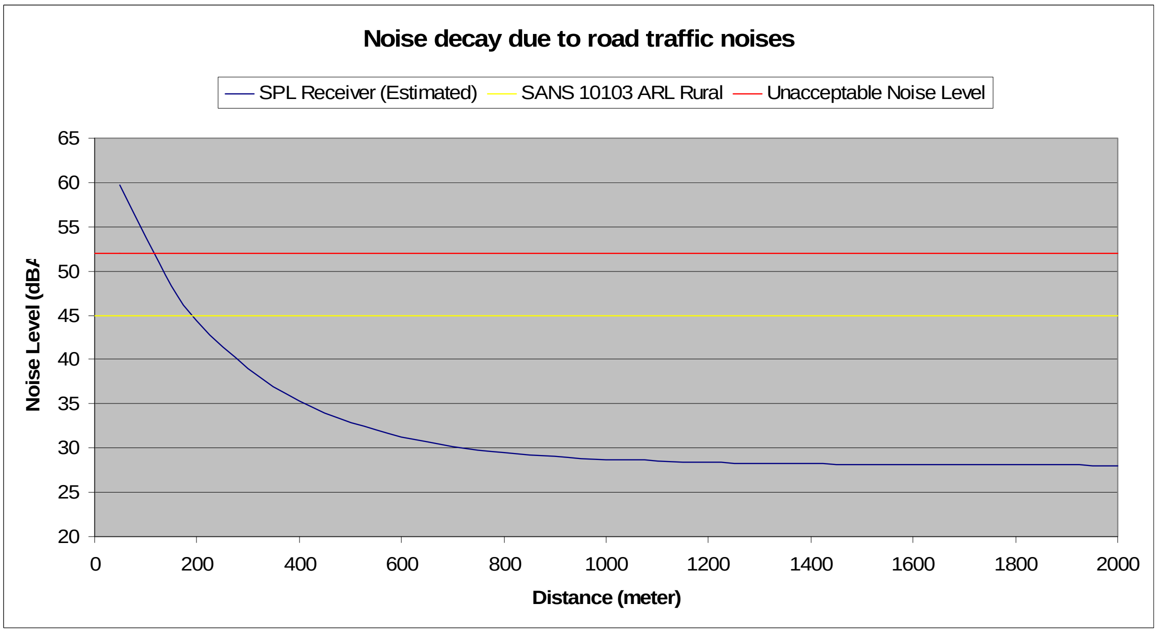

Figure 0.16: Construction noise: Projected Road Traffic Noise Levels as distances increase between NSDs and access roads (5 LDV and 5x Trucks travelling at 50 km/hr on a gravel road)

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

Nature: Numerous simultaneous construction activities that could impact on PSRs.	
Acceptable Rating Level	Rural district with little road traffic: 45 dBA outside during day. Us of $L_{Req,d}$ of 45 dBA for rural areas.
Extent ($\Delta L_{Aeq,d}$>7dBA)	**Regional** – Change in ambient sound levels would extend further than 1,000 meters from activity **(3).**
Duration	**Long term** – Noisy activities in the vicinity of the receptors could last up to a month **(4).**
Magnitude	**Low (2).**
Probability	**Improbable (1).**
Significance	**Low (9)**
Status	Negative.
Reversibility	High
Irreplaceable loss of resources?	Not relevant.
Can impacts be mitigated?	Yes, though mitigation not required.
Mitigation:	The following mitigation may be used: » Ensure a good working relationship between the developer and all potentially sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them. Information that should be provided to the potential sensitive receptor(s) include: o Proposed working times; o how long the activity is anticipated to take place; o what is being done, or why the activity is taking place; o contact details of a responsible person where any complaints can be lodged should there be an issue of concern. » When working near (within 500 meters – potential construction of access roads and trenches) to a potential sensitive receptor(s), limit the number of simultaneous activities to the minimum as far as possible; » When working near to potentially sensitive receptors, coordinate the working time with periods when the receptors are not at home where possible. » Potential receptors are most likely at school or at work, minimizing the probability of an impact happening; » Normal daily activities will generate other noises that would most likely mask construction noises, minimizing

	the probability of an impact happening. » Technical solutions to reduce the noise impact during the construction phase include: o Using the smallest/quietest equipment for the particular purpose. For modelling purposes the noise emission characteristics of large earth-moving equipment (typically of mining operations) were used, that would most likely over-estimate the noise levels. The use of smaller equipment therefore would have a significantly lower noise impact; o Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures.
Cumulative impacts:	This impact is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area.
Residual Impacts:	This impact will only disappear once construction activities cease.

7.6.3 Noise Sources: Operational Phase

Noise emitted by wind turbines can be associated with two types of noise sources:

» Aerodynamic sources: due to the passage of air over the wind turbine blades; and
» Mechanical sources that are associated with components of the power train within the turbine, such as the gearbox and generator and control equipment for yaw, blade pitch, etc. These sources generally have different characteristics and can be considered separately. In addition there are other lesser noise sources, such as the substations themselves, traffic (maintenance) as well as transmission line noise.

» **Noise from the Wind Turbines: Aerodynamic sources10**
Aerodynamic noise is emitted by a wind turbine blade through a number of sources such as:
1. Self noise due to the interaction of the turbulent boundary layer with the blade trailing edge
2. Noise due to inflow turbulence (turbulence in the wind interacting with the blades)
3. Discrete frequency noise due to trailing edge thickness

[10] *Renewable Energy Research Laboratory, 2006; ETSU R97: 1996*

4. Discrete frequency noise due to laminar boundary layer instabilities (unstable flow close to the surface of the blade)
5. Noise generated by the rotor tips

These types of noise are discussed in more detail in the Noise Impact Assessment report contained in Appendix L.

7.6.5.1 Results of Noise Modelling – Operational Phase

During times when a quiet environment is desired (at night for sleeping, weekends etc.) ambient sound levels are more critical. The time period investigated in terms of possible impact therefore would be a quieter period, normally associated with the 22:00 – 06:00 timeslot. Maintenance activities would therefore not be considered, concentrating on the ambient sound levels created due to the operation of the various Wind Turbine Generators (WTGs) at night.

RES indicated that amongst others, the Vestas V90 1.8MW wind turbine is considered for the wind energy facility. As the Red Cap Kouga Wind Farm has an environmental authorisation, the potential cumulative noise impact must also be considered. As per the communication with the Red Cap and the Safetech (2010) report prepared for the proposed Red Cap facility, the proposed wind turbine is the Vestas V90 3.0MW turbine. Modelling therefore included the potential cumulative noise impacts of both the proposed Oyster Bay and authorised Red Cap Kouga facilities (**both layouts are shown in Figure 7.17**)

It should be noted that SANS 10357:2004 does not provide methods to estimate sound propagation below 63 Hz. While this assessment does calculate the sound power levels at lower frequency bands (to allow the calculation of the C-weighted Sound Power Levels to estimate the potential/probability for low frequency noises), the reader should realise that this is for information purposes only. In terms of accuracy, the sound power level at these frequency bands is estimated at ±5-15 dBA (due to the unknown adjustment factor for meteorological effects at the 16 and 31.5Hz octave band frequencies).

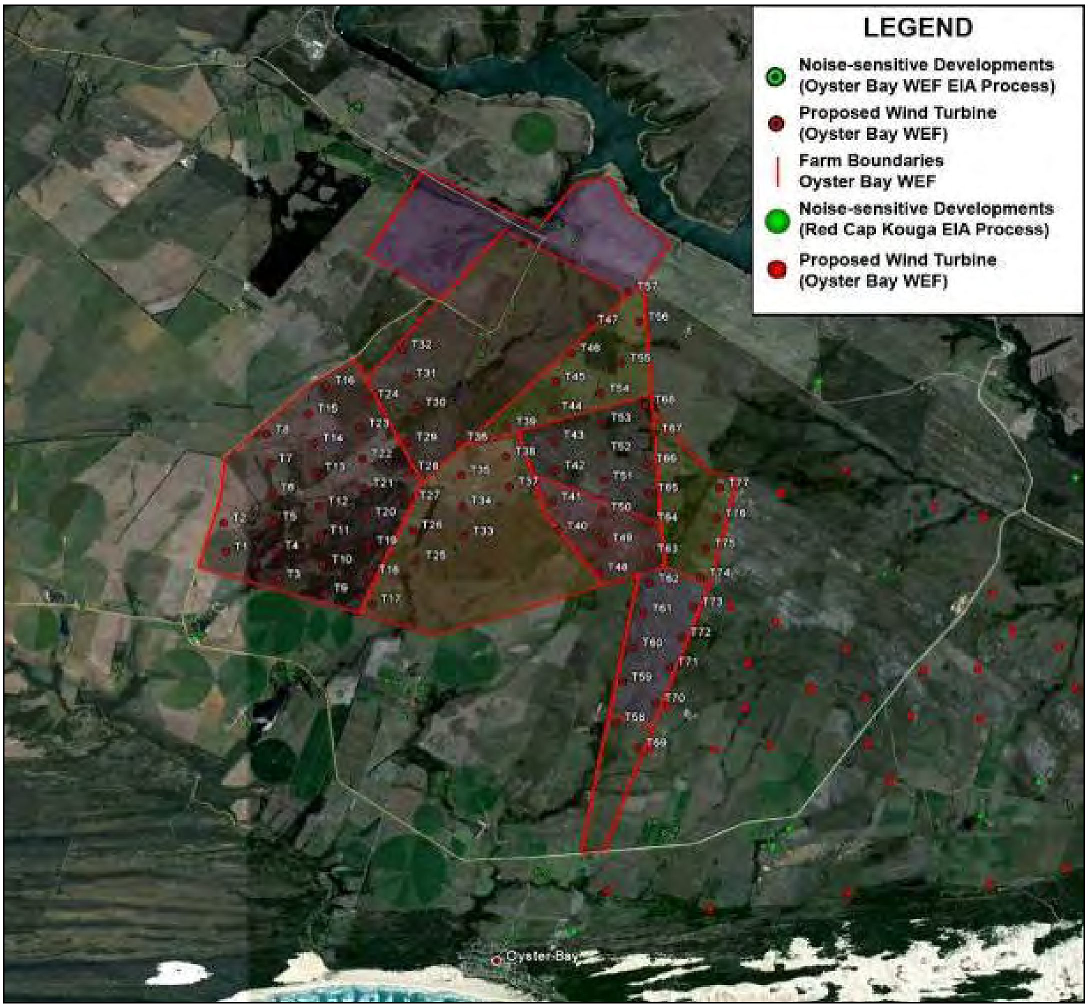

Figure 7.17: Layout of Oyster Bay WEF indicating the relevant turbines of the Red Cap Kouga WEF (Eastern Cluster only relevant)

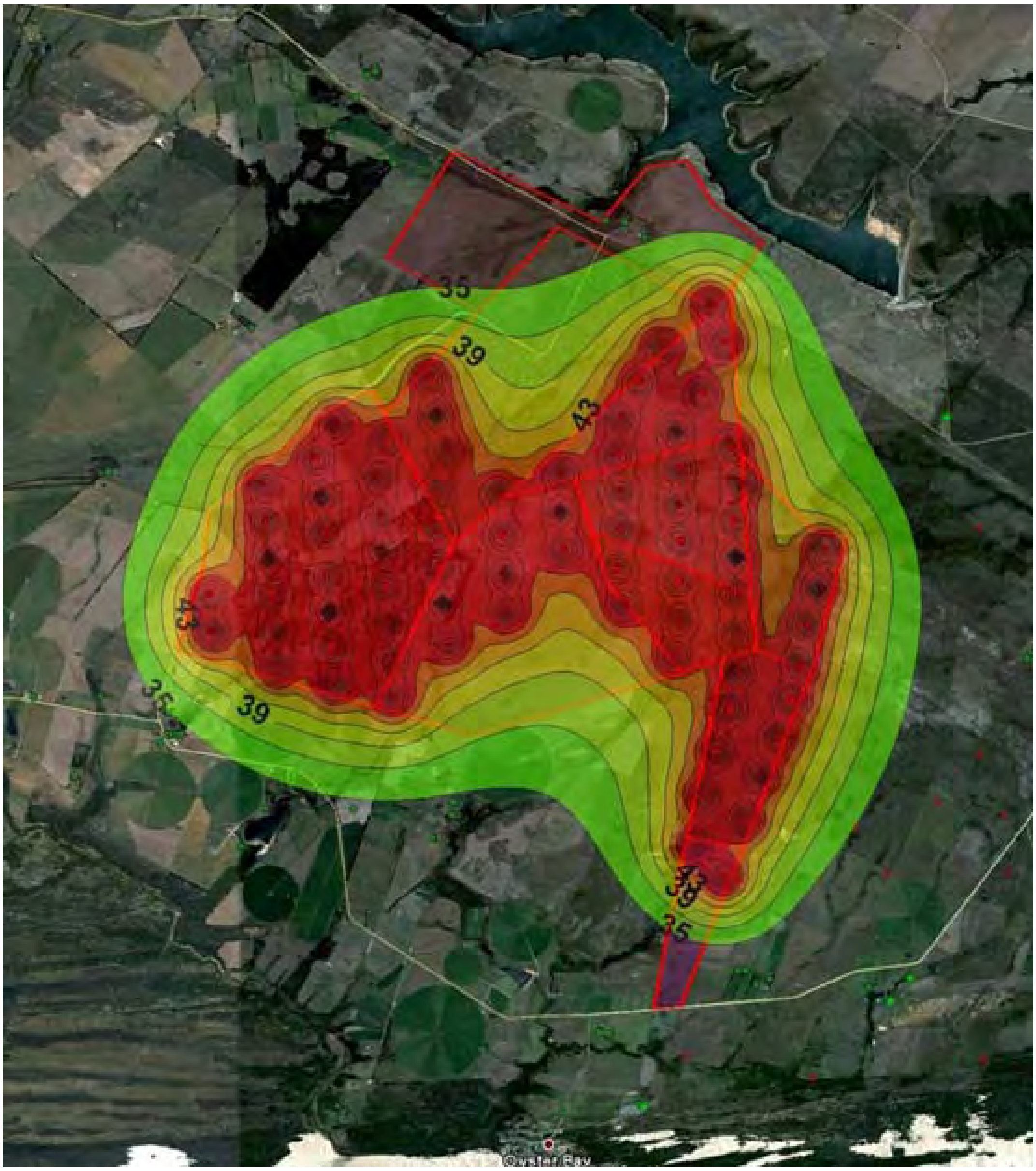

Figure 7.18: Projected Noise Levels (ISO model) from Oyster Bay wind turbines; Contours of constant sound levels for a 5 m/s wind (WTGs marked as red dots, PSRs as green dots)

The change in ambient sound levels is illustrated in **Figure 7.19.**

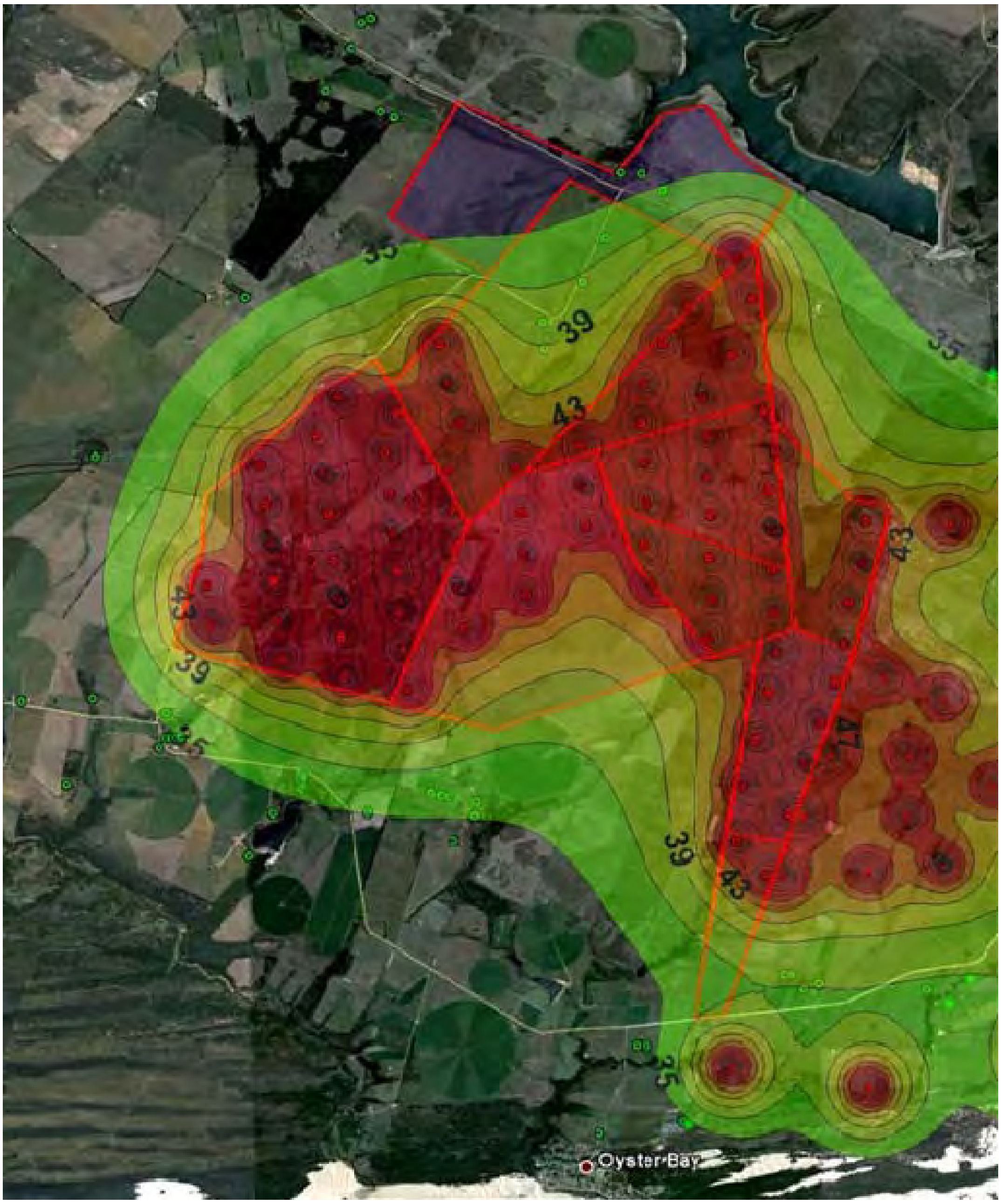

Figure 7.19 Change in ambient sound levels (ISO model), contours of constant noise levels for a 5 m/s wind (turbines marked as red dots, NSDs as green dots)

7.6.5.2 Impact tables summarising the significance of noise impacts (with and without mitigation) from the wind turbines – operational phase

Nature: Numerous turbines operating simultaneously during a period when a quiet environment is desirable.	
Acceptable Rating Level	Rural district with little road traffic. Refer to Error! Reference source not found. for the proposed Night Rating Level that varies with wind speed.
Extent ($\Delta L_{Aeq,n}$>7dBA)	**Local** – Impact will extend less than 1,000 meters from activity. **(2).**
Duration	Permanent **(5).**
Magnitude	**Low (2) – low-medium (4) -** Vestas V90 1.8MW WTG.
Probability	**Improbable (1) - Possible (2).**
Significance	**9 - 22 (Low)** for all NSD using the Vestas V90 1.8MW WTG.
Status	Negative.
Reversibility	High.
Irreplaceable loss of resources?	Not relevant.
Can impacts be mitigated?	Yes, though mitigation not required.
Mitigation:	Mitigation measures that would reduce a potential noise impact after the implementation of the facility includes (if a noise complaint is registered): » Operating all, or selected wind turbines in a different mode. For the purpose of the Impact Assessment (with mitigation) the Vestas V90 1.8MW turbine operating in mode 0 was used. The Vestas as well as most other manufacturers allow the turbines to be operated in a different mode. This allows the wind turbine generator to operate more silently, albeit with a slight reduction of electrical power generation capability. » Problematic wind turbines could also be disabled, or the rotational speeds significantly decreased during periods when a quieter environment is desired (and complaints registered). » Good public relations are essential. At all stages surrounding receptors should be educated with respect to the sound generated by wind turbines. The information presented to stakeholders should be factual and should not set unrealistic expectations. It is counterproductive to suggest that the wind turbines will be inaudible, or to use vague terms like "quiet". Modern wind turbines produce a sound due to the aerodynamic

	interaction of the wind with the turbine blades, audible as a "swoosh", which can be heard at some distance from the turbines. The magnitude of the sound will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the wind turbines and the ambient background sound level. » Community involvement needs to continue throughout the project. » The developer must implement a line of communication (i.e. a help line where complaints could be lodged. All potential sensitive receptors should be made aware of these contact numbers. The Wind Energy Facility should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop.
Cumulative impacts:	This impact is cumulative with existing ambient background noises and the approved Red Cap wind project (eastern section only relevant)
Residual Impacts:	This impact will only disappear once the operation of the facility stops, or the sensitive receptor no longer exists.

7.6.6 Comparative Assessment of Alternative Power Line Routings

There will be no differences in the significance of noise impacts for any of the alternative power line routings. Therefore any of the proposed alternatives are considered acceptable from a noise perspective.

7.6.7 Comparative Assessment of Substation Alternatives

There are no differences in the significance of impacts for either of the proposed substation alternatives in terms of noise impacts.

7.6.8. Cumulative impacts

This is covered in Section 7.6.3 , as the noise modelling has been done for both the RedCap wind project (Eastern section only relevant for noise impacts) and RES site cumulatively.

7.6.9 Conclusions and Recommendations

By making use of predictive models to identify noise issues of concern, the noise assessment indicated that the proposed project will have a noise impact of low significance on all NSDs in the area during both the construction and operational phases using the Vestas V90 1.8MW wind turbine. However, mitigation measures are still proposed to reduce the potential noise impacts and risks to receptors.

With its potential for environmental and economic advantages, wind power generation has significant potential to become a large industry in South Africa. However, when wind farms are near to potential sensitive receptors, consideration must be given to ensuring a compatible co-existence. The potential sensitive receptors identified should not be adversely affected and yet, at the same time the wind farms need to reach an optimal scale in terms of layout and number of units.

Wind turbines produce sound, primarily due to mechanical operations and aerodynamics effects at the blades. Modern wind turbine manufacturers have virtually eliminated the noise impact caused by mechanical sources and instituted measures to reduce the aerodynamic effects. But, as with many other activities, the wind turbines emit sound power levels at a level that can impact on areas at some distance away. When potentially sensitive receptors are nearby, care must be taken to ensure that the operations at the wind farm do not cause undue annoyance or otherwise interfere with the quality of life of the receptors.

It should be noted that this does not suggest that the sound from the wind turbines should not be audible under all circumstances - this is an unrealistic expectation that is not required or expected from any other agricultural, commercial, industrial or transportation related noise source – but rather that the sound due to the wind turbines should be at a reasonable level in relation to the ambient sound levels.

Should the layout (or type of wind turbines used) change significantly, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist. It should be noted that the noise impact was determined based on the outcome of a regression analysis that indicated that the likely long-term ambient sound levels would be significant during periods when wind speeds exceeds 4 m/s. The regression analysis is based on a number of measurements taken at various sites during periods when the wind was blowing, but when there were little other noise sources. As such, it is recommended that the developer implement a monitoring programme before the development of the wind energy facility confirming the validity of the regression analysis of non-site specific data. It is therefore recommended that the ambient sound environment be defined over a longer period as per the environmental management plan (refer to Appendix O).

In addition quarterly monitoring noise monitoring should be conducted an acoustic consultant for the first year of operation. This monitoring is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured at a 10 meter height. These samples should be collected when the Wind Turbines are operational. Quarterly monitoring is recommended at NSD32 and one in the vicinity of NSD31 for the first year, as well as any other NSDs that have complained to the developer regarding noise originating from the facility.

Annual feedback regarding noise monitoring should be presented to all stakeholders and other Interested and Affected parties in the area. Noise monitoring must be continued as long as noise complaints are registered. This report should also be made available to all potentially noise-sensitive developments in the area, or the contents explained to them to ensure that they understand all the potential risks that the development of a wind energy facility may have on them and their families. While the potential noise impact was determined to be insignificant, the implementation of the proposed mitigation measures could further reduce the potential noise impact as well as potential noise risks to the absolute minimum (a conservatively acceptable approach).

7.7 Assessment of Potential Impacts on Heritage - Archaeology

7.7.1 Impact of Construction on Pre-colonial Archaeology

A few Earlier and Middle Stone Age quartzite stone tools (1,5 million – 30 000 years old) were observed eroding from a sub-surface ferricrete palaeosol at a farm dam and among the exposed sandstone outcrops on the ridge overlooking the coast. The Earlier Stone Age stone tools included hand axes, cores, flaked cobbles and flakes (date between 1.5 and 250 000 years old) (GPS reading: 34.07.249S; 24.37.548E). The quartzite Middle Stone Age stone tools were weathered and it is estimated that they may date between 120 000 and 250 000and years old. The tools included small irregular broken blades, flakes, chunks, cores and 'small hand axes' which displayed typical facetted striking platforms. The flakes and some flakes displayed utilisation damage, but few were 'formally' retouched (GPS reading: 34.06.722S; 24.39.432E) (**Figure 7.20**). The stone tools were in secondary context and of low cultural significance.

Figure 7.20: Earlier Stone Age hand axes observed on an exposed ferricrete palaeosol near a dam (top row) and weathered Middle Stone Age stone tools observed among the sandstone outcrops on the ridge overlooking the coast (bottom row).

Most of the proposed area for the construction of the Oyster Bay Wind Energy Facility is further than five kilometres from the coast and falls outside the maximum distance coastal archaeological features such as shell middens are expected to be located from the beach. Apart from a few Earlier and Middle Stone Age stone tools, no other archaeological sites/materials were observed and in general the area appears to be of low archaeological sensitivity. This is surprising, taking in to account that there are hundreds of archaeological sites and thousands of stone tools in the adjacent Thysbaai pre-colonial archaeological cultural landscape. Previous surveys in the wider area also identified Earlier and Middle Stone Age stone tools in the exposed gravels and surrounding hill tops throughout the region, but these were in secondary context and not associated with any other archaeological materials. However, sites/materials may be covered by soil and grass and there is always a possibility that human remains and/or other archaeological material may be uncovered during the development. Should such material be exposed then it must be reported to the nearest museum, archaeologist or to the South African Heritage Resources Agency (see general remarks and conditions below).

The investigation of the proposed Oyster Bay Wind Energy Facility site would appear to be of low archaeological sensitivity and apart from a few stone tools no sites/remains of significance were recorded, but material may be covered by soil and grass. The main impact to archaeological sites/remains (if any) will be the physical disturbance of the archaeological material and its context. The construction of the turbine foundations, substation, cabling between the turbines and access roads may expose, disturb and displace archaeological sites/material. Construction of the turbine foundations, substation, cabling between the turbines and access roads may impact on remains which are buried, but these impacts will be limited and restricted to the local area. The construction of the turbine bases will disturb small areas and the negative impact on possible archaeological sites/materials may be relatively small. Other projects such as the construction of roads, buildings and underground lines will disturb large areas and may expose sites/materials on a larger scale. In both cases further disturbances of sites/materials can be limited by mitigation.

7.7.1.1 Impact Table – Impact of Construction on Pre-colonial archaeology

***Nature**: The potential impact of the construction of the turbines, substation, cabling between the turbines, access roads and workshop on above and below ground archaeology.*		
	Without Mitigation	***With Mitigation***
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Unlikely (2)	Unlikely (2)
Significance	Low **(16)**	Low **(16)**
Status (positive or negative)	Negative	Neutral
Reversibility	No	No
Irreplaceable loss of resources?	No, but in some cases, yes	No
Can impacts be mitigated?	Yes	
Mitigation If concentrations of archaeological materials are exposed during construction then all work must stop for an archaeologist to investigate. If any human remains (or any other concentrations of archaeological heritage material) are exposed during construction, all work must cease and it must be reported immediately to the nearest museum/archaeologist or to the South African Heritage Resources Agency, so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material. Recommendations will follow from the investigation.		
Cumulative impacts: Insignificant		
Residual impacts: Insignificant		

7.7.2 Cultural landscape Impacts Related to visual impacts

Cultural landscapes "... are cultural properties" and represent the "combined works of nature and of man". They are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (UNESCO, Operational Guidelines for the Implementation of the World Heritage Convention, 2008).

The concept of cultural landscapes comprises different fields and definitions (well-discussed in the literature and will not be repeated here). This study only discusses the pre-colonial cultural landscape which includes the Earlier, Middle and Later Stone Age. These different fields are present throughout the region.

The significance of the pre-colonial archaeology between Cape St Francis in the east and Klippepunt in the west, has been illustrated by research over many years (see the desktop study and brief literature review), and more recently by a Heritage Impact Assessment conducted at Thyspunt for the proposed nuclear power facility (ACO, 2010). The survey concluded that the Thyspunt/Cape St Francis area is one of the richest and best preserved archaeological sites in south Africa. The importance of the archaeology of the region was maintained by SAHRA when they recently stated that on the proposed nuclear site at Thyspunt, that within their mandate they:

" ...cannot approve any developments that will have a major deleterious effect on the heritage of a highly significant cultural landscape such as Thyspunt. It is the belief of the SAHRA that the impact on the heritage resources will be too severe and that that mitigation will not achieve the desired effect" (SAHRA 2010, Review comments on the Environmental Impact Assessment for three proposed nuclear power station sites and associated infrastructure: Heritage Impact Assessment: Archaeological Component).

However, Thyspunt is only a small part of the much larger and elaborate pre-colonial cultural landscape which is situated between Cape St Francis in the east to Klasies River in the west – shown in **Figure 7.21**.

The proposed Oyster Bay development is also situated close to other significant archaeological rich areas, such as the Brandewynkop dunes (Lange Fontein dunes). These dunes are small exposed remnants of the Plio-Pleistocene Geelhoutboom dune bypass system west of the Tsitsikamma River. A modern day example is the fast disappearing shifting dune system between Oyster Bay and the St Francis Bay coast (Deacon & Geleijnse 1988). The Geelhoutboom dunes are rich in delicately worked symmetrical Middle Pleistocene Acheulian bifaces and Middle and Later Stone Age stone tools and features. The bulk of the artefacts in this area are from the Middle Stone Age and densities of upwards of 50 artefacts per square metre have been observed. The exposures which are several kilometres in length and several hundred metres in width, is the largest artefact scatter observed along this part of the south-eastern Cape coast (Deacon & Geleijnse 1988). The archaeological context for these dunes is similar to that of the Geelhoutboom dunes (Deacon & Geleijnse 1988; personal observations, 1980s).

Approximately 20 km south-west from the Oyster Bay Wind Energy Facility site is the Klasies River complex of caves (1-5) and several open air shell middens. This is one of the most significant archaeological cave complexes in the world, and home to the oldest anatomically modern human skeletal remains (Homo sapiens sapiens) (Singer & Wymer 1982; Rightmire & Deacon 1991; Deacon 1992, 1993, 1995, 2001; Deacon, H. J & Shuurman, R. 1992; Deacon & Deacon 1999). The archaeological deposits at the Klasies River Caves (1-5) date to 120 000 years old (Deacon & Geleijnse 1988).

The immediate coastal zone between the Tsitsikamma River and Klippepunt has never been researched/surveyed in any detail. However, several visits over the years demonstrated that this stretch of coast is similar to the Thysbaai coast and exceptionally rich in shell middens and other features. Large complexes of shell middens were observed especially at the Tsitsikamma River mouth and Klippepunt area.

The region east of the Oyster Bay Wind Energy Facility site is a unique cultural landscape, rich in pre-colonial archaeological sites and remains (see Binneman 1985, 1996, 2001, 2005; Nilssen 2006). The Thyspunt/Klippepunt region represents one of the most unique pre-colonial archaeological landscapes in the world. Anatomically modern human populations originated here in the wider region and spread to Europe and other parts of the globe. Notwithstanding, a wind farm facility which includes 41 turbines and situated adjacent to the Thyspunt cultural landscape has been approved for development – the RedCap site. The proposed Oyster Bay Wind Energy Facility development which includes 31 turbines is located inland adjacent (west) from this project. The increase of a large number of turbines in the area will contribute to significant changes to the cultural landscape of the area as well as an overall 'sense of place'.

The v visibility of the turbines will change to the Thyspunt/Klippepunt pre-colonial archaeological landscape and result in a negative impact on the 'sense of place'. The proposed Oyster Bay Wind Energy Facility will contribute to the 'accumulative visual impact' on the pre-colonial cultural landscape and change to the 'significance of place'. Although this impact will be negative and long term to permanent, it can be mitigated to decrease the impact.

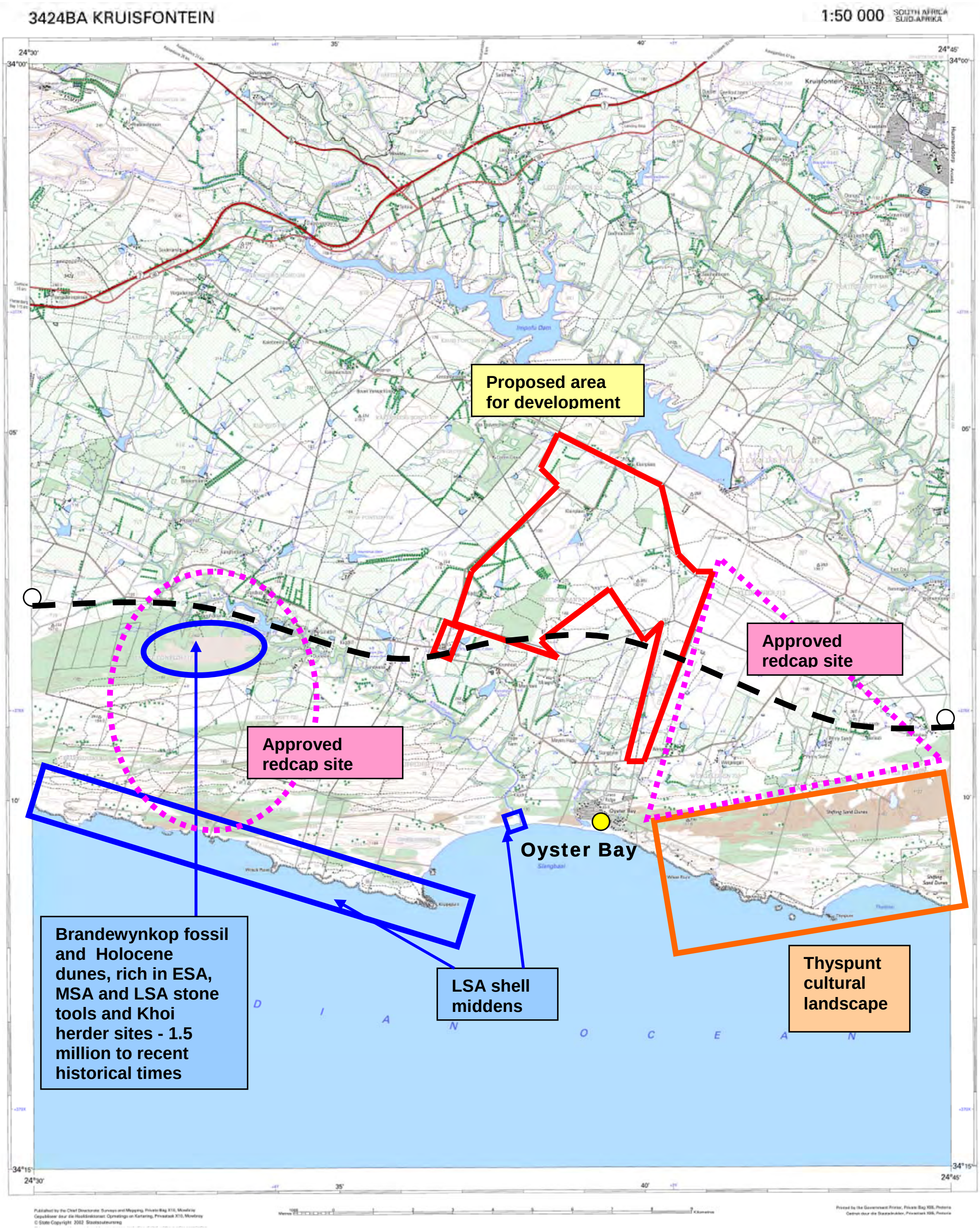

Figure 7.21: Map indicating the location of the proposed Oyster Bay Wind Energy Facility in relation to the adjacent areas with archaeological sites and the Thyspunt cultural landscape. The black broken line marks the proposed 5 km pre-colonial archaeological cultural landscape boundary parallel to the coast

7.7.2.1 Impact Table – Visual - Cultural Impacts on Thyspunt/Klippepunt pre-colonial archaeological landscape

Nature*:* The large number of turbines will impact on one of the most unique pre-colonial cultural landscape in the world in terms of visual impacts and changes to 'sense of place'.		
	Without Mitigation	***With Mitigation***
Extent	Local (4)	Local (3)
Duration	Long term/permanent (5)	Long term/permanent (5)
Magnitude	High (8)	Low (4)
Probability	Highly probable (4)	Highly probable (3)
Significance	**Medium (68)**	**Low (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	yes
Mitigation: It is recommended that due to the significance of the pre-colonial cultural landscape, the closest turbines be pushed further inland to reduce the accumulative visual effect - Turbines 58-61 and 69-72.		
Cumulative impacts: The cumulative impacts may be increasing as further wind farms are planned for adjoining areas. The large number of turbines will bring permanent changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place'. The RedCap wind energy facility is already authorised and will impact on the cultural landscape as it is closer to the coasts that the Oyster Bay project.		
Residual impacts: None		

7.7.3 Comparative Assessment of Alternative Power Line Routings

There will be no differences in the significance of heritage impacts for any of the alternative power line routings. Therefore all alternatives are considered acceptable from a heritage perspective.

7.7.4 Comparative Assessment of Substation Alternatives

There are no differences in the significance of impacts for either of the proposed substation alternatives in terms of impacts of heritage resources.

7.7.5. Cumulative impacts

Several developments have been proposed for this region of the southern part of the Eastern Cape coast. Apart from the proposed nuclear power station development at Thyspunt, there are also several wind energy facilities proposed for the region and two in the immediate area have already been approved for development. The RedCap wind energy development is situated adjacent to the Thyspunt cultural landscape, and has been approved by DEA with the condition that two turbines are constructed further inland. Another proposed wind energy facility (another phase of the RedCap development), which includes 53 turbines, is situated inside the pre-colonial archaeological cultural landscape near the Tsitsikamma River Mouth (Van Ryneveld 2010). All these proposed developments will have a cumulative effect on the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape, not only in terms of the disturbance of archaeological heritage sites/materials, but also in terms of the visual impact and changes to ‘sense of place’.

The Redcap site is authorised, and will impact on the Thyspunt cultural landscape. Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to ‘sense of place’ will occur. To decrease the cumulative impacts and effects on the Thyspunt cultural landscape to an acceptable level from the Oyster Bay project, the following is recommended:

» To reduce the visual impact, turbines 58-61 and 69-72 should be constructed further inland. A minimum distance of 1 km from the 5 km boundary is recommended. If the visual impact is still dominating, then the turbines must be pushed further back, or the number of the turbines reduced.
» If any concentrations of archaeological material or human remains are uncovered during further development of the site, all work must immediately cease and be should reported to the Albany Museum and/or the South African Heritage Resources Agency so that systematic and professional investigation/excavations can be undertaken. Sufficient time should be allowed to remove/collect such material (See Appendix B of the Heritage specialist report for a list of possible archaeological sites that maybe found in the area).
» Construction managers/foremen should be informed before the start of construction on the possible types of heritage sites and cultural material they may encounter and the correct procedures to follow when they encounter sites.

7.6.4. Conclusions and Recommendations

The proposed Oyster Bay Wind Energy Facility site is situated approximately 5 km from the coast (nearest point) and adjacent to the Thyspunt/Klippepunt heritage sites. Research along the Klasies River/Cape St Francis coastal zone indicated that shell middens and other archaeological features occur up to 5 km inland (Binneman 1985, 1996, 2001, 2005; Nilssen 2006). Based on this observation, the pre-colonial cultural landscape is set at this distance from the coast which provide the criteria for recommendations for developments along the south-eastern Cape coast, including the current proposed Oyster Bay Wind Energy Facility site.

If the distance of 5km from and parallel to the coast is used for the Klasies River/Cape St Francis pre-colonial archaeological cultural landscape, then the positions of a number of turbines as proposed in the preliminary layout provided by RES are on or close to the boundary. Due to the size and visibility of the turbines it is impossible to ‘shade/hide’ their dominate influence in the environment, but the impact on the pre-colonial archaeological cultural landscape can be ‘softened’ by reducing the number of turbines and/or relocating them further inland.

7.8 Assessment of Potential Impacts on Palaeontology

7.7.1. Findings or Loss of Fossils during Construction

The construction phase of the wind energy facility will entail excavations into the superficial sediment cover (soils, etc.) and perhaps also into the underlying bedrock. These include excavations for the turbine foundations, buried cables, new internal access roads and foundations for associated infrastructure such as an on-site substation and workshop / administration building. In addition, sizeable areas of potentially fossiliferous bedrock may be sealed-in or sterilised by infrastructure such as hard standing areas for each wind turbine, lay down areas and internal access roads. All these developments may adversely affect potential fossil heritage within the study area by damaging, destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good. Once constructed, the operational and decommissioning phases of the wind energy facility will not involve further adverse impacts on palaeontological heritage.

The proposed Oyster Bay Wind Energy Facility is located in an area of the southern Cape coastal plain that is underlain by a number of geological formations of Palaeozoic to Late Caenozoic age, three of which are known to contain important fossil heritage resources, viz. the Cedarberg, Baviaanskloof and Gydo Formations. Only small sectors in the south-western and north-eastern portions of the study area for the power line are considered to be potentially palaeontologically sensitive (areas outlined with dashed orange rectangles in **Figure 7.22**) because the Cedarberg Formation may crop out here. However, the outcrop area of the Cedarberg Formation is likely to be narrow, covered with a mantle of superficial deposits, deeply-weathered and possible highly cleaved, so its effective palaeontological sensitivity is now low.

Both location options for the on-site electricity substation are situated within the outcrop area of the Peninsula Formation (low palaeontological sensitivity). There is no preference for one site or the other on palaeontological grounds. Likewise, neither of the two alternative entrances to the wind energy facility site, one on the south side and the other on the north-western side, will have a material effect on the local fossil heritage resources and there is therefore no preferred option on palaeontological grounds.

In general, the destruction, damage or disturbance out of context of fossils preserved at the ground surface or below ground that may occur during construction represents a negative impact that is limited to the development footprint. Such impacts can usually be mitigated but cannot be fully rectified (i.e.

permanent). Because of the generally sparse occurrence of fossils within most of the formations concerned as well as within the overlying superficial sediments (soil, etc.), as inferred from better exposed localities elsewhere, the magnitude and probability of impacts are conservatively rated as low.

The overall impact significance of the construction phase of the proposed wind farm project is assessed as low (negative) without mitigation. There are no fatal flaws in the development proposal as far as fossil heritage is concerned.

It should be noted that, should fossils be discovered before or during construction and reported by the responsible ECO to the responsible heritage management authority (SAHRA) for professional recording and collection, as recommended here, the overall impact significance of the project would be further reduced. Residual negative impacts from any loss of fossil heritage would be partially offset by an improved palaeontological database as a direct result of appropriate mitigation. This is a positive outcome because any new, well-recorded and suitably curated fossil material from this palaeontologically under-recorded region would constitute a useful addition to our scientific understanding of the fossil heritage here.

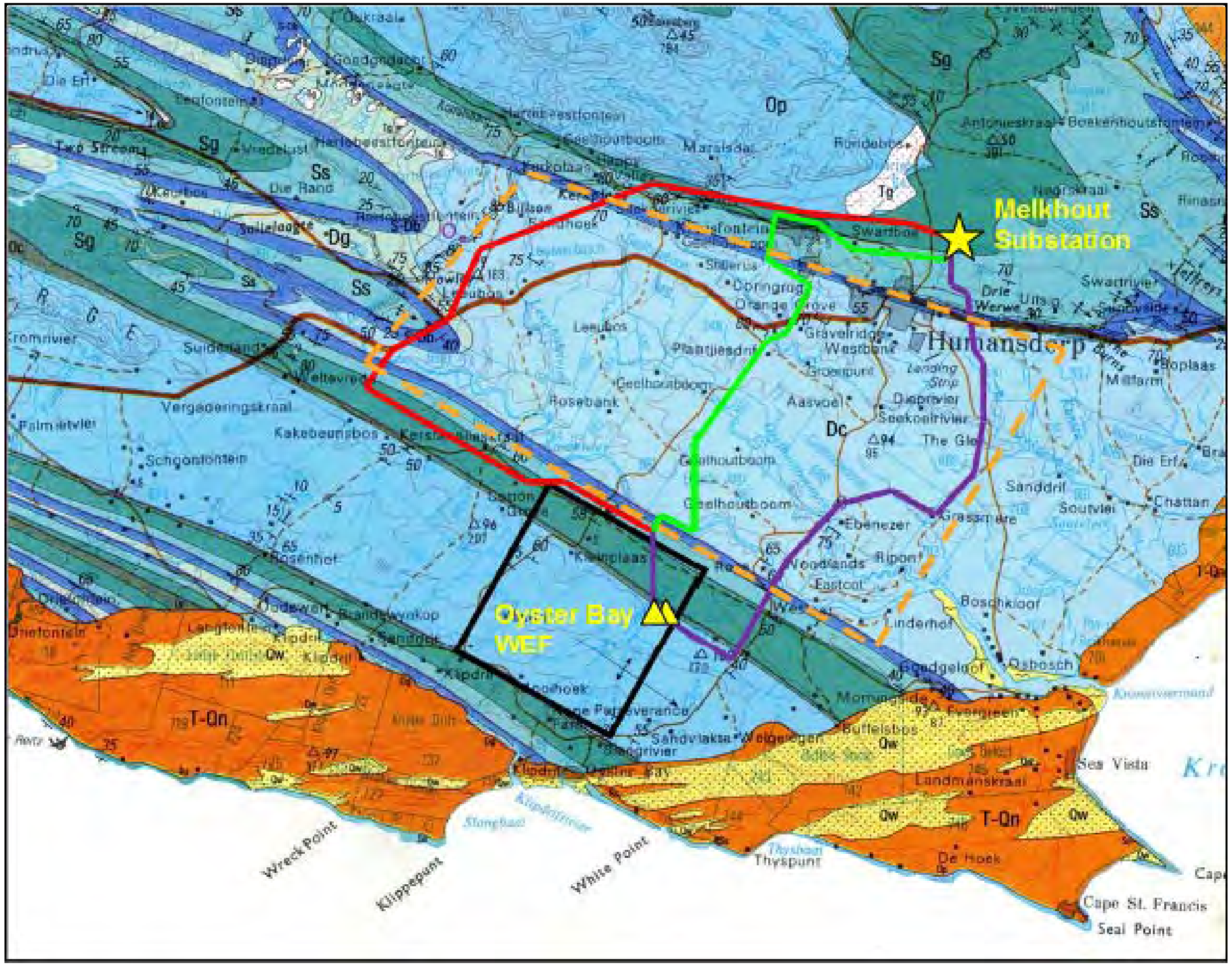

Figure 7.22: Extract from 1: 250 000 geology sheet 3324 Port Elizabeth (Council for Geoscience, Pretoria) showing *approximate* routes of the three alternative transmission line corridors linking the proposed Oyster Bay Wind Energy Facility with the existing Melkhout substation (yellow star) north of Humansdorp. These are the western corridor (red line), central corridor (green line) and eastern corridor (purple line). There are two, closely-spaced alternative sites for an on-site substation (small yellow triangles).

The main geological units represented within the study area include the following formations (Palaeontologically-sensitive marine units indicated in **bold**):

» Table Mountain Group (Ordovician to Early Devonian)
» Peninsula Formation (Op, middle blue)
» **Cedarberg Formation (Oc, grey-brown)**
» Goudini Formation (Og, dark green)
» Skurweberg Formation (Ss, middle blue)
» **Baviaanskloof Formation (S-Db, purple)**
» BOKKEVELD GROUP (Early Devonian)
» **Ceres Subgroup (Dc, v. pale blue**

7.7.1.1 Impact Table – Impact on fossil heritage resources during the construction phase

Nature of impact: Disturbance, damage, destruction or sealing-in of fossil remains preserved on or beneath the ground surface within the development area, notably by bedrock excavations during the construction phase of the wind energy facility.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Low (2)
Probability	Improbable (2)	Improbable (2)
Significance	Low **(20)**	Low **(18)**
Status	Negative	Negative (loss of fossils) & positive (improved fossil database following mitigation)
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes (minor)	Yes (minor)
Can impacts be mitigated?	Yes	Yes.
Mitigation: • Monitoring of all substantial bedrock excavations for fossil remains by ECO, with reporting of new finds to SAHRA and / or a professional palaeontologist for possible specialist mitigation (*i.e.* recording, judicious sampling of fossil material).		
Cumulative impacts: Unknown (Insufficient data on local wind farm developments available)		
Residual impacts: Partially offset by *positive* impacts resulting from mitigation (*i.e.* improved palaeontological database).		

7.7.2. Comparative Assessment of Alternative Power Line Routings

The proposed new 132 kV transmission line may have negative impacts on local fossil heritage during the construction phase, notably as a result of excavations into fossil-bearing bedrocks for the pylon foundations and new service roads. The approximate routes of the three alternative transmission line corridors are shown on **Figure 7.23.**

The following comparative assessment applies:

- » The western corridor (traverses the outcrop area of the Baviaanskloof Formation at several points as well as a wide area of Lower Bokkeveld Group rocks.
- » The central corridor crosses a wide area of Lower Bokkeveld Group rocks, as well as the Baviaanskloof Formation at two points.
- » The eastern corridor crosses the Cedarberg Formation at two points, the Baviaanskloof Formation at two points, as well as a wide area of Lower Bokkeveld Group rocks.

The impact significance of all three alternative corridors will be similar. There is a slight preference for the western or central route over the eastern route since the eastern route crosses the sensitive Cedarberg Formation.

As noted earlier, and also in the field assessment report by De Klerk (2010), the fossil heritage within the Ceres Subgroup rocks in the Humansdorp area has usually been compromised by tectonic deformation (e.g. cleavage development) and protracted post-Gondwana weathering. No fossils were recorded from rare exposures of these rocks in the study region – such as roadcuttings along the R330 - by De Klerk (2010). The same author also noted that natural exposures of the recessive-weathering Bokkeveld Group sediments are not found in the wide outcrop area south of Humansdorp. Rare Bokkeveld Group fossil sites on the coastal plain do occur, however, as outlined in Section 3.2 of the palaeontology Report (Appendix N). Any new fossil remains exposed in the Bokkeveld Group during the proposed wind energy facility would be of scientific interest; hence the recommendation here for specialist mitigation for the relevant sections of the new transmission line.

Given the scientific importance of any new fossil records from rocks in this region, the following monitoring and mitigation measures are recommended for the construction phase of the chosen transmission line route:

- » Monitoring by a professional palaeontologist of excavations into fresh bedrock of the Cedarberg Formation, Baviaanskloof Formation & Lower Bokkeveld

Group ONLY. Note that monitoring of highly weathered, near-surface bedrocks is pointless from a palaeontological viewpoint.

» Recording and judicious sampling of representative, as well as any exceptional, fossil material from the transmission line development footprint (i.e. pylon footings, new roads) by the contracted palaeontologist. All fossil specimens collected must be curated at an approved repository (e.g. Albany Museum). A final (Phase 2) technical report on palaeontological heritage within study area must be submitted by the contracted palaeontologist to SAHRA;
» All bedrock excavations should be monitored by the ECO for fossil material with action as indicated above (notification of SAHRA, etc.) in the case of significant fossil finds.

7.7.3 Comparative Assessment of Substation Alternatives

Both location options for the on-site electricity substation are situated within the outcrop area of the Peninsula Formation (i.e. low palaeontological sensitivity). There is no preference for one site or the other on palaeontological grounds. Likewise, neither of the two alternative entrances to the wind energy facility site, one on the south side and the other on the north-western side, will have a material effect on the local fossil heritage resources and there is therefore no preferred option on palaeontological grounds.

7.7.4. Cumulative impacts

The cumulative impact on fossils from the Oyster Bay wind energy facility and RedCap wind energy is not significant.

7.7.5. Conclusions and Recommendations

The wind energy facility footprint (i.e. wind turbines and associated infrastructure) is entirely underlain by Early to Middle Palaeozoic sedimentary rocks of the Table Mountain Group – notably the Peninsula Formation of Ordovician age - that are predominantly fluvial in origin and of low palaeontological sensitivity. The mudrocks of the Cederberg Formation, that have yielded important post-glacial fossil assemblages elsewhere in South Africa, crop out in the south-western and north-eastern sectors of the study area. However, their palaeontological sensitivity here is probably low due to intense tectonic deformation, weathering and soil cover.

The Oyster Bay Wind Energy Facility development is of LOW impact significance and without fatal flaws as far as fossil heritage is concerned. Confidence levels for this assessment are high, in part because a palaeontological field assessment of the study area has recently been carried out by Dr W.J. de Klerk of the Albany Museum, Grahamstown. Therefore no further specialist palaeontological studies, or specialist mitigation measures, are recommended for this part of the proposed development. The following general monitoring and mitigation measures by the responsible ECO during the construction phase are necessary, however:

» Monitoring of all substantial bedrock excavations for fossil remains by the ECO;
» In the case of any significant fossil finds (e.g. shell beds, vertebrate teeth, bones, burrows, petrified wood) during construction, these should be safeguarded - preferably in situ - and reported by the ECO as soon as possible to the relevant heritage management authority (SAHRA) so that any appropriate mitigation by a palaeontological specialist (e.g. recording, judicious sampling of fossils) can be considered and implemented, at the developer's expense.

All three of the proposed new 132 kV transmission line alternatives between the Oyster Bay wind energy facility and the existing Melkhout substation north of Humansdorp are of comparable, medium impact significance in fossil heritage terms. This is because they all traverse successions of marine sedimentary rocks that might contain fossils - i.e. the Cederberg Formation, Baviaanskloof Formation and the Lower Bokkeveld Group. The impact significance would be reduced to LOW if the suggested mitigation measures are implemented. No particular transmission line corridor is preferred on palaeontological grounds, although the impact significance of the eastern corridor is marginally greater than that of the other routes under consideration. It is noted, however, that the palaeontological sensitivity of rocks along all three corridors may well have been greatly reduced due to high levels of tectonic cleavage and near-surface weathering, as well as a thick cover of unfossiliferous superficial sediments (soil, alluvium, etc.).

The palaeontologist concerned with mitigation work will need a valid collection permit from SAHRA. All work would have to conform to international best practice for palaeontological fieldwork and the study (e.g. data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies currently being developed by SAHRA. Providing that the recommended mitigation measures are carried through, it is likely that any potentially negative impacts of the proposed development on local fossil resources will be substantially reduced and, furthermore, they will partially offset by the positive impact represented by increased understanding of the palaeontological heritage of the Humansdorp region

7.9 Summary of Potential Cumulative Impacts

7.9.1 Approach to Cumulative Effects Assessment

Based on the information available at the time of undertaking this EIA, one relevant wind energy facility in close proximity to the site (the RedCap project – to the east of the Oyster Bay site) has an environmental authorisation. Atleast three other wind energy facilities are proposed in the Overberg region. These include the authorised Deep River wind energy facility (located ~ 10 km to the north-west of the site), the proposed Happy Valley wind energy facility (located ~ 30 north-east of the site), a wind energy facility located on the Farm Dieprivier Mond near the Deep River site.

Cumulative impacts, in relation to an activity, refer 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. For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited to effects that can be evaluated meaningfully (DEAT, 2004). Boundaries must be set so analysts are not attempting to measure effects on everything. Therefore, the cumulative impacts associated with the proposed wind energy facility north of Oyster Bay have been viewed from two perspectives within this EIA:

1. Cumulative impacts associated with the scale of the project, i.e. that up to 80 wind turbines will be located on one site; and
2. Cumulative impacts associated with other relevant approved or existing wind developments in the area. (In the case of the latter, no existing commercial or large scale wind energy facilities exist in South Africa, therefore the focus of the EIA had to be on EIA authorised wind energy projects in close proiximity to the Oyster Bay site – in this case the one EIA approved RedCap wind energy facility).

Cumulative effects are commonly understood as the impacts which combine from different projects and which result in significant change, which is larger than the sum of all the impacts (DEAT, 2004). The complicating factor is that the projects that need to be considered are from past, present and reasonably foreseeable future development. Cumulative effects can be characterised according to the pathway they follow. One pathway could be the persistent additions from one process. Another pathway could be the compounding effect from one or more processes. Cumulative effects can therefore occur when impacts are:

1. additive (incremental);
2. interactive;

3. sequential; or
4. synergistic.

Canter and Sadler (1997) describe a three step process for addressing cumulative effects in an EIA:

» delineating potential sources of cumulative change (i.e. GIS to map the 2 relevant wind energy facilities in close proximity to one another (i.e. Redcap site & RES site))
» identifying the pathways of possible change (direct impacts)
» indirect, non-linear or synergistic processes; and
» Classification of resultant cumulative changes.

7.9.2 Impacts

In the case of the RES wind energy facility project to the north of Oyster Bay and the RedCap Kouga wind farm, the cumulative negative ecological impacts will be additive (due to having two wind energy facilities next to each other - only a section on the Kouga wind project is directly next to the Oyster Bay project). The negative impacts on avifauna will be interactive and synergistic due to the birds that occur in the area and flight paths. The cumulative visual impacts of the facility will also be additive. These are discussed below and have been considered within the detailed specialist studies, where applicable (refer to Appendices F - N) and are covered under the various sections above and are not repeated below:

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

» *Visual* impact: This impact will be sequential and additive, due to having turbines from two projects in the area. The viewsheds of the two facilities largely correspond, meaning that the potential visual impact of the proposed Oyster Bay wind energy facility lies mostly within that of the authorised Red Cap facility. Additional areas within which the Oyster Bay facility alone will be visible are limited in extent, and lie mostly on the site itself and to the north west. From a visual perspective, this overlapping viewshed is considered favourable, as it represents the consolidation and concentration of potential visual impacts within an existing WEF viewshed. Within these visually exposed areas, the frequency of visual exposure to turbines will be higher with the addition of the Oyster Bay facility, but the extent of the existing Red Cap viewshed as a result of the addition of the Oyster Bay facility remains largely unchanged. This therefore also mitigates the potential impact on the cultural landscape as a result of the Oyster Bay facility to some extent.

» *Social* (linked to Visual) - The establishment of two or more wind energy facilities in the area will impact negatively on the landscape and the areas rural sense of place and character. The cumulative impact associated with the proposed Oyster Bay wind energy facility will however to some extent mitigated by the relatively low incidence of visual receptors in the region, the low lying locality of the proposed site and the relatively contained area of potential visual exposure. On the other hand, cumulative positive socio-economic impacts from the two wind energy facilities in terms of job creation and economic growth and development of infrastructure will occur in a local and district municipality that is in need of this growth and development.

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

» *Flora, fauna, and ecological processes* - (impacts that cause loss of habitat may exacerbate the impact of the proposed facility impact) at a regional level driven mostly by the possibility of other similar facilities being under construction simultaneously. Impacts related to disturbance, habitat loss and collision related mortality of avifauna may become cumulative if other wind energy facilities are developed in the region.
» *Avifauna* - The cumulative effect of the two or more wind energy facilities on bird species of conservation concern may be moderate to high, without mitigation. It is therefore imperative that pre-construction and post-construction monitoring is implemented using any accepted or endorsed bird monitoring guidelines or standards to provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species. This will provide the data necessary to improve the assessment of the cumulative impact of wind development on priority species. At this stage, indications are that displacement may emerge as a significant impact, particularly for species such as Denham's Bustard, White-bellied Korhaan and (possibly) Secretary bird. Collision rates may appear relatively low in many instances, however cumulative effects over time, especially when applied to large, long lived, slow reproducing and/or threatened species (many of which are collision-prone), may be of considerable conservation significance. Furthermore, when viewed in isolation, one wind energy facility may pose only a limited threat to the avifauna of the region. However, in combination they may result in the formation of significant barriers to energy-efficient travel between resource areas for regionally important bird populations, and/or significant levels of mortality in these populations in collisions with what may become repeated arrays of turbines spread across foraging areas and/or flight paths of priority species.
» *Cumulative geology, soil and erosion potential* - although the impact of soil removal for the proposed activity has a low - moderate significance, the

cumulative impact of soil removal in the area is considered low due to undeveloped nature of the area. The cumulative impact of soil pollution in the area is considered moderate due to the severely degraded by mining operations to the south of the study area. The cumulative impact of siltation and dust in the area is considered low.

» *Cumulative noise impacts* - the impact of numerous simultaneous construction activities that could affect potential sensitive receptors is cumulative with existing ambient background noises as well as other noisy activities conducted in the same area. The potential for cumulative impacts is low.
» *Infrastructure* - Increased pressure on existing roads and other infrastructure.
» *Heritage* – The Oyster Bay site is further removed from the Thyspunt natural heritage site than the central section of the RedCap facility. The Redcap site is authorised, and will impact on the Thyspunt cultural landscape from a visual perspective (refer to Figure 7.11). Cumulative changes to the pre-colonial cultural landscape in terms of visual impacts and changes to 'sense of place' will occur from having two projects in the region. However, according to the visual impact assessment, the extent of the existing Red Cap viewshed as a result of the addition of the Oyster Bay facility remains largely unchanged. This therefore also mitigates the potential impact on the cultural landscape as a result of the Oyster Bay facility to some extent.

CONCLUSIONS AND RECOMMENDATIONS CHAPTER 8

Renewable Energy Systems (RES) Southern Africa (Pty) Ltd is proposing to establish a commercial wind energy facility and associated infrastructure on a site located north approximately 6 km north of Oyster Bay in the Eastern Cape Province. The proposed development site is located within the Kouga Local Municipality.

The primary components of the project (i.e. areas of activity) include the following:

» The wind energy facility was proposed to accommodate up to **80 wind turbines** but has now been reduced to **62 wind turbines** after feedback from the EIA specialist studies, appropriately spaced to make use of the wind resource on the site. The facility would be operated as a single facility with each turbine being between 1,8MW and 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades between 45 to 55m long attached to the hub.
» Possibly small transformer outside each turbine tower, depending on the type of turbine deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
» Crane hardstandings (approximately 60x 40m depending on turbine choice, crane choice and geotechnical considerations).
» Cabling between the components, laid approximately 1 m underground where feasible. In as far as possible, cabling will follow the internal access roads.
» Internal roads (approximately 5-6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
» An on-site substation to facilitate the connection between the facility and the grid. Two options are being considered, namely:
  - Option 1: the B04 and
  - Option 2: KromRivier Intake/Switching Substation

  This proposed substation will have a high-voltage (HV) yard footprint of approximately 120m x 120m.
» A new 132kV overhead power line to connect to Eskom's existing Melkhout (132kV) substation which is approximately 20km from the site. Three corridor options are under consideration for this power line

» **Operations and service building area** for control, maintenance and storage (approximately 20 x 40m depending on turbine choice).

The environmental impact assessment (EIA) for the proposed wind energy facility north of Oyster Bay 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)[11] and the EIA Regulations of June 2010.

The EIA Phase aimed to achieve the following:

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

8.1. Evaluation of the Proposed Project

The preceding chapters of this report together with the specialist studies contained within Appendices F - N provide a detailed assessment of the environmental impacts on the social and biophysical environment as a result of the proposed project. This chapter concludes the Draft EIA Report by providing a summary of the conclusions of the assessment of the proposed site for the wind energy facility and the associated infrastructure such as the substation and overhead power line. In so doing, it draws on the information gathered as part of the EIA process and the knowledge gained by the environmental team during the course of the EIA and presents an informed opinion of the environmental impacts associated with the proposed project.

The assessment of potential environmental impacts presented in this report is based on a preliminary layout of the turbines and associated infrastructure provided by RES Southern Africa. This layout included 77 wind turbines as well as temporary and permanent infrastructure. No environmental fatal flaws were identified to be associated with the proposed wind energy facility. However a number of impacts of medium - high significance were identified which require

[11] Note that these EIA Regulations were current at the time of submitting the Application for Authorisation and therefore this process has been completed in terms of these Regulations.

mitigation (thereafter the impacts can be reduced to medium – low significance). Mitigation to avoid impacts is mainly associated with the relocation or elimination of certain turbine positions of concern. These are discussed in more detail in the sections which follow. Where impacts cannot be avoided, appropriate environmental management measures are required to be implemented. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within Appendix O).

The sections which follow provide a summary of the most significant environmental impacts associated with the proposed project, as identified through the EIA.

8.2. Summary of All Impacts

As a summary of the potential impacts identified and assessed through the EIA process, the following tables indicate the significance ratings for the potential biophysical, ecological, visual and social impacts.

As indicated in Chapter 3, the significance weightings for potential impact have been rated as follows:

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

Table 8.1 provides a summary of the potential impacts identified and assessed through the EIA process in terms of the preliminary layout of 77 turbines and associated infrastructure.

Table 8.1: Summary of potential impacts identified and assessed through the EIA process

Nature	Without mitigation	With mitigation
Impacts on Ecology		
Loss or fragmentation of indigenous natural vegetation	Medium	Medium
Impact on threatened plants	Medium	Low
Impact on Wetlands	High	Low
Impact on threatened animals species / habitat	Low	Low
Impact on bats	Medium	Low
Alien vegetation growth due to disturbance	Medium	Low
Impacts on Avifauna		
Bird mortalities due to collisions with wind turbines	Medium	Low
Impact on birds due to disturbance	Medium	Medium
Loss of avifauna habitat	Medium	Low
Electrocution/ collision of birds with the power line	Medium	Medium
Impacts on Soil, Land Use, Land Capability and Agricultural Potential		
Loss of land with high agricultural potential and land capability	Low	Low
Soil Erosion / degradation during Construction	Medium	Low
Soil contamination / soil erosion during the operation of the facility	Medium	Low
Social Impacts		
Creation of Employment and Business Opportunities during the Construction Phase	Low	Medium
Impact of the presence of construction workers in the area on local communities	Low	Low
Risk of Stock theft and damage to farm infrastructure	Medium	Low
Increased risk of fires during construction	Medium	Low
Increases traffic on roads due to construction	Low	Low
Operational Phase -Creation of Long- Term employment and business opportunities	Low	Medium
Contribution of the project towards Development of Renewable Energy	High	High

Nature	Without mitigation	With mitigation
Infrastructure in South Africa		
Long-Term Impact of the project on Existing Farming Activities on the Site	Low	Low
Impact of the wind energy facility on tourism in the region	Medium	Medium
Health Impacts due to the Operation of the wind energy facility	Low	Low
Visual Impacts		
Visual Impact on residents of urban centres and settlements	High	N/A
Change in visual character and sense of place	Moderate	N/A
Visual Impact on Protected Areas in Close Proximity to the Site	Low	N/A
Impact of the facility on tourism in the region	Medium	Medium
Visual impact of lighting at night on visual receptors in close proximity to the proposed facility	Medium	Moderate
Shadow Flicker	Low	Low
Noise Impacts		
Noise impacts due to construction activities	Low	Low
Noise impacts from the wind turbines – operational phase	Low	Low
Impacts on Heritage		
Impact of construction on pre-colonial archaeology	Low	Low
Visual - Cultural Impacts on Thyspunt/Klippepunt pre-colonial archaeological landscape	Medium	Low
Potential Impacts on Palaeontology		
Findings or Loss of Fossils during Construction	Low	Low

8.1.1. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the proposed wind energy facility relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat and impacts on soils. A wind energy facility is however dissimilar to other power generation facilities in that it does not result in whole-scale disturbance to a site. A site of 23 km^2 was considered for the facility. 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. This is explained further below.

Permanently affected areas comprise 77 turbine footprints (77 foundation areas of 7m in diameter in extent), access roads (up to 6 m in width), one 33/132kV substation footprint (120m x 120m in extent), one 132 kV power line and an operations and service building area (20 x 40m). The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
77 turbine footprints (each 7m in diameter)	2963
Permanent access roads within the site (6 m in width) ~44.4km	266400
One on-substation footprint (120m x 120m)	14400
Operations and service building area (20 x 40m)	800
TOTAL	284563 (of a total area of 23km^2) **i.e. 1.24% of site**

Temporarily affected areas comprise 77 foundation areas of 25m in diameter in extent), laydown areas for turbines (each laydown area assumed to have a footprint of 60 m x 40 m) and possibly a track of 13 m in width if a crawler crane is required to move across the site (i.e. an additional 6 m width to the permanent road of 6 m in width). The use of a crawler crane is not desirable and will be avoided if at all possible. The area of temporary disturbance is as follows:

Facility component - temporary	**Approximate area/extent (in m^2)**
77 temporary turbine foundation areas (25m diameter)	37797
77 turbine laydown areas (60 m x 40m)	184800
Temporary crane travel (13 m) track (will be avoided if possible) on top off the permanent access road (6m in width) ~44.4km	577200
TOTAL	799797 (of a total area of 23km^2) **=** **3.48 % of site**

Therefore, a total area of 799,797 m^2 can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to ~3.48% of the total 23 km^2 area which will form part of the total wind energy facility site.

In addition to the impact on the facility site itself, the proposed powerline will have a linear development footprint for the tower positions (depending which alignment is selected by RES), with a 35 metre servitude.

8.3 Comparative Assessment of Layout Options

8.3.1 Power line Layout Alternatives

The three power line corridor alternatives include:

» The **Western Corridor** option is approximately 38km in length. The route heads north along the eastern boundary of the site, crosses the ridge and turns north-west just before the Mpofu Dam. It follows the boundary of the water purification plant and aligns itself with the existing 22kV power line running north westward. It continues along the 22kV power line and crosses the upper reaches of the Mpofu Dam. The corridor then follows the R102 for approximately 2.8km turning north over the R102 and heads north-easterly to cross the N2. The corridor continues in a north easterly direction until it reaches the 66kV power line feeding into the Melkhout Substation. It then follows this 66kV power line alignment to the Melkhout Substation.

» The **Central Corridor** is approximately 26km in length. The route heads north along the Eastern boundary of the wind farm, crosses the ridge and turns south east just before the Mpofu Dam. It then heads towards the dam wall where it aligns itself with the proposed Eskom A-route from Thuyspunt to Melkhout Substation.

» The **Eastern Corridor** option is approximately 25km in length. The route heads south east, exiting the farm boundary until it reaches the proposed Eskom B-route from Thuyspunt to Melkhout Substation. It follows the Eskom route option north for approximately 5.5km then turns east towards the R330. At the R330 the line turns north and aligns itself with the existing 66kV power line. It follows this alignment to the Melkhout Substation.

In terms of the findings of the impact assessment undertaken, **the Eastern and Central alignments are preferred over the Western alignment.** A summary of the comparative assessment of these alternatives is presented in Table 8.2 overleaf.

Table 8.2: Comparison of recommendations for Power Line Alternatives

	1. Western Corridor Power line : Recommendations	**2. Central Corridor Power line : Recommendations**	**3. Eastern Corridor Power line : Recommendations**
Ecology (Flora)	» The known location of the Critically Endangered species (*Erica humansdorpensis*) is directly adjacent to a section of the powerline servitude for the Western alternative and this species is very likely to be affected. Unless this population can be avoided by finding an alternative route past this local site, this route would potentially result in an impact of high significance on a threatened plant species. This would make the western route unacceptable from the point of view of impacts on threatened plant species. » The western overhead powerline route makes 21 wetland crossings, the widest of which is approximately 300 m. The central overhead powerline route makes 16 wetland crossings, the widest of which is approximately 300 m.	» The central overhead power line route makes 16 wetland crossings, the widest of which is approximately 300 m. » The **Eastern and Central power line** routes are **favoured** from an ecological perspective compared to the Western route.	» The eastern overhead powerline route makes 15 wetland crossings, the widest of which is approximately 600 m. » The Eastern route crosses a wetland (more than 500 m across). It would not be possible to cross this wetland without placing a tower structure within the wetland, which could potentially result in an impact. This issue is easily overcome by shifting the alignment slightly to cross the wetland at a narrower point. » The **Eastern and Central power line** routes are **favoured** from an ecological perspective compared to the Western route.
Avifauna	» From a potential avifaunal collision risk perspective, all the powerline alternatives run through basically the same avifaunal habitat.	» From a potential avifaunal collision risk perspective, all the powerline alternatives run through basically the same avifaunal habitat	» From a potential avifaunal collision risk perspective, all the powerline alternatives run through basically the same avifaunal habitat. However, the **Eastern alignment** is **slightly preferred** over the other two alignments for the following reasons: o It is the shortest length of power line.

	1. Western Corridor Power line : Recommendations	2. Central Corridor Power line : Recommendations	3. Eastern Corridor Power line : Recommendations
			o It runs next to an existing overhead power line for approximately 10km. Evidence suggests that placing a new line next to an existing line reduces the risk of collisions to birds. The reasons for that are two-fold namely it creates a more visible obstacle to birds and the resident birds, particularly breeding adults, are used to an obstacle in that geographic location and have learnt to avoid it (APLIC 1994; Sundar & Choudhury 2005). Other transmission lines running parallel to the proposed alignments were therefore treated as a risk reducing factor.
Soils	» There are no differences in the significance of impacts for either of the proposed power line route alternatives in terms of soils.	» There are no differences in the significance of impacts for either of the proposed power line route alternatives in terms of soils.	» There are no differences in the significance of impacts for either of the proposed power line route alternatives in terms of soils.
Social	» The Western Corridor is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include long stretches of the N2 and shorter stretches the R102, the R330 and 3 secondary	» The Central Corridor is the second shortest alignment. Visual receptors include short stretches of the N2, the R102, the R330 and 3 secondary roads. The town of	» The **Eastern Corridor** is the shortest alignment and therefore **preferred,** and therefore displays the smallest extent of potential visual exposure. Visual receptors

	1. Western Corridor Power line : Recommendations	2. Central Corridor Power line : Recommendations	3. Eastern Corridor Power line : Recommendations
	roads. The town of Kruisfontein and up to 50 settlements and homesteads also appear to fall within this viewshed. This corridor follows an existing power line for about half of its length, but crosses 3 rivers, including the upper reaches of the Mpofu Dam. » Based on VIA, the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed.	Kruisfontein and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers, including the lower reaches of the Mpofu Dam (i.e. at the dam wall). » Based on VIA, the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed.	include short stretches of the N2, the R102, the R330 and 1 secondary road. The eastern parts of Humansdorp and up to 40 settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers. » The **Eastern Corridor** is therefore the **preferred option** from a social perspective. Despite the fact that the Western Corridor follows existing infrastructure for at least half of its length, its longer length and exposure to long stretches of the N2 renders it the least favourable from a visual perspective. The significance of the visual impact associated with the Eastern Corridor is rated as moderate. The Central Corridor is the second preferred option.
Visual	» The Western Corridor is the longest alignment, and therefore displays the largest extent of potential visual exposure. Visual receptors include long stretches of the N2 and shorter stretches the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 50 settlements and homesteads also appear to fall within this viewshed. This corridor follows an	» The Central Corridor is the second shortest alignment. Visual receptors include short stretches of the N2, the R102, the R330 and 3 secondary roads. The town of Kruisfontein and up to 40 settlements and homesteads also appear to fall within this viewshed.	» The Eastern Corridor is the shortest alignment, and therefore displays the smallest extent of potential visual exposure. Visual receptors include short stretches of the N2, the R102, the R330 and 1 secondary road. The eastern parts of Humansdorp and up to 40

	1. Western Corridor Power line : Recommendations	2. Central Corridor Power line : Recommendations	3. Eastern Corridor Power line : Recommendations
	existing power line for about half of its length, but crosses 3 rivers, including the upper reaches of the Mpofu Dam. » Despite the fact that the Western Corridor follows existing infrastructure for at least half of its length, its longer length and exposure to long stretches of the N2 renders it the least favourable from a visual perspective.	This corridor crosses 3 rivers, including the lower reaches of the Mpofu Dam (i.e. at the dam wall). » The above comparison reveals that the Western and Central Corridors are likely to result in a higher potential visual impact than the Eastern Corridor. This is based both on the anticipated extent of visual exposure (i.e. the length of the line) and the number of potential visual receptors likely to be visually exposed.	settlements and homesteads also appear to fall within this viewshed. This corridor crosses 3 rivers. » In order of **preference**, the **Eastern Corridor is favoured** from a visual perspective.
Noise	» There will be no significant differences in the significance of noise impacts for any of the alternative power line routings.	» There will be no significant differences in the significance of noise impacts for any of the alternative power line routings.	» There will be no significant differences in the significance of noise impacts for any of the alternative power line routings.
Heritage	» There will be no significant differences in the significance of heritage impacts for any of the alternative power line routings.	» There will be no significant differences in the significance of heritage impacts for any of the alternative power line routings.	» There will be no significant differences in the significance of heritage impacts for any of the alternative power line routings.
Palaeontology	» The western corridor (traverses the outcrop area of the Baviaanskloof Formation at several points as well as a wide area of Lower Bokkeveld Group rocks.	» The central corridor crosses a wide area of Lower Bokkeveld Group rocks, as well as the Baviaanskloof Formation at two points. » The impact significance of all three alternative corridors will be similar. There is a **slight preference** the **western or central route** over the	» The eastern corridor crosses the Cedarberg Formation at two points, the Baviaanskloof Formation at two points, as well as a wide area of Lower Bokkeveld Group rocks. » The impact significance of all three alternative corridors will be similar. There is a **slight preference** the

	1. Western Corridor Power line : Recommendations	2. Central Corridor Power line : Recommendations	3. Eastern Corridor Power line : Recommendations
		eastern route since the eastern route crosses the sensitive Cedarberg Formation.	**western or central route** over the eastern route since the eastern route crosses the sensitive Cedarberg Formation.

8.1.2 Alternative locations of on-site substation

Two options are being considered for the on-site substation to facilitate the connection between the facility and the grid, namely:

» Option 1 (northern substation) : the B04 and
» Option 2 (southern substation): KromRivier Intake/Switching Substation.

These substation locations are also shown in **Figure 7.1.**

Option 1 (northern substation) is situated within an area of high ecological sensitivity and Option 2 (southern substation) is located in an area of low sensitivity. Therefore **substation Option 2 is preferred from an ecological perspective.** No other biophysical or social parameters revealed any preference for the comparative assessment of the substation locations. Therefore, substation Option 2 is nominated as the preferred option.

8.3.3 Alternative Entrances to Wind Energy Facility Site

The wind energy facility site will be accessed via existing tar and gravel roads within the study area. Two alternative entrances to the site are proposed as follows (refer to Figure 2.3):

- An entrance to the south of the site along the R330 (tarred), via Humansdorp and St Francis Bay, a distance of approximately 33 km from the N2 (purple line on Figure 2.3).
- An entrance on the north-western side of the site along the R102 and then south east along the DR01765, a distance of approximately 23 km from the N2 (yellow line on Figure 2.3).

Neither of the two alternative entrances to the wind energy facility site, will have a significantly different environmental impact, therefore both entrances are acceptable.

8.4 Cumulative Impacts

Based on the information available at the time of undertaking the EIA, it would appear that at least four other wind energy facilities are proposed in the immediate region. These include:

» the authorised RedCap Kouga Wind Energy Facility located ~9 km south of the site,
» the authorised Deep River Wind Energy Facility located ~10 km west of the site,
» the proposed Tsitsikamma Wind Energy Facility located further than 10km west of the site, and
» the authorised Jeffrey's Bay Wind Energy Facility located ~20 km east of the site.

The cumulative impacts associated with the proposed wind energy facilities from a social perspective relate largely to the impact on sense of place and visual impacts. The area designated for the proposed facility projects is rural and agricultural in nature. This impact will be exacerbated by the sequential visibility of the sites. The dominant current land use activity in the area is livestock farming. The proposed wind energy facilities will alter the sense of place and the existing landscape which will be dominated by turbines. In this regard a number of residents in the immediate/local area to this site raised concerns regarding the cumulative impacts associated with the establishment of multiple wind energy facilities in the Hummansdorp, Jeffreys Bay, St Francis Bay and Cape St Francis area. They were not opposed to wind energy *per se*, however, concerns were raised regarding the number of proposed facilities being mooted in the area.

8.5 Environmental Sensitivity Mapping and Recommendations

From the specialist investigations undertaken for the proposed wind energy facility development site, a number of potentially sensitive areas were identified (refer to **Figure 8.1**) where further surveys are required to be undertaken to confirm the final placement of turbines, once this is known.

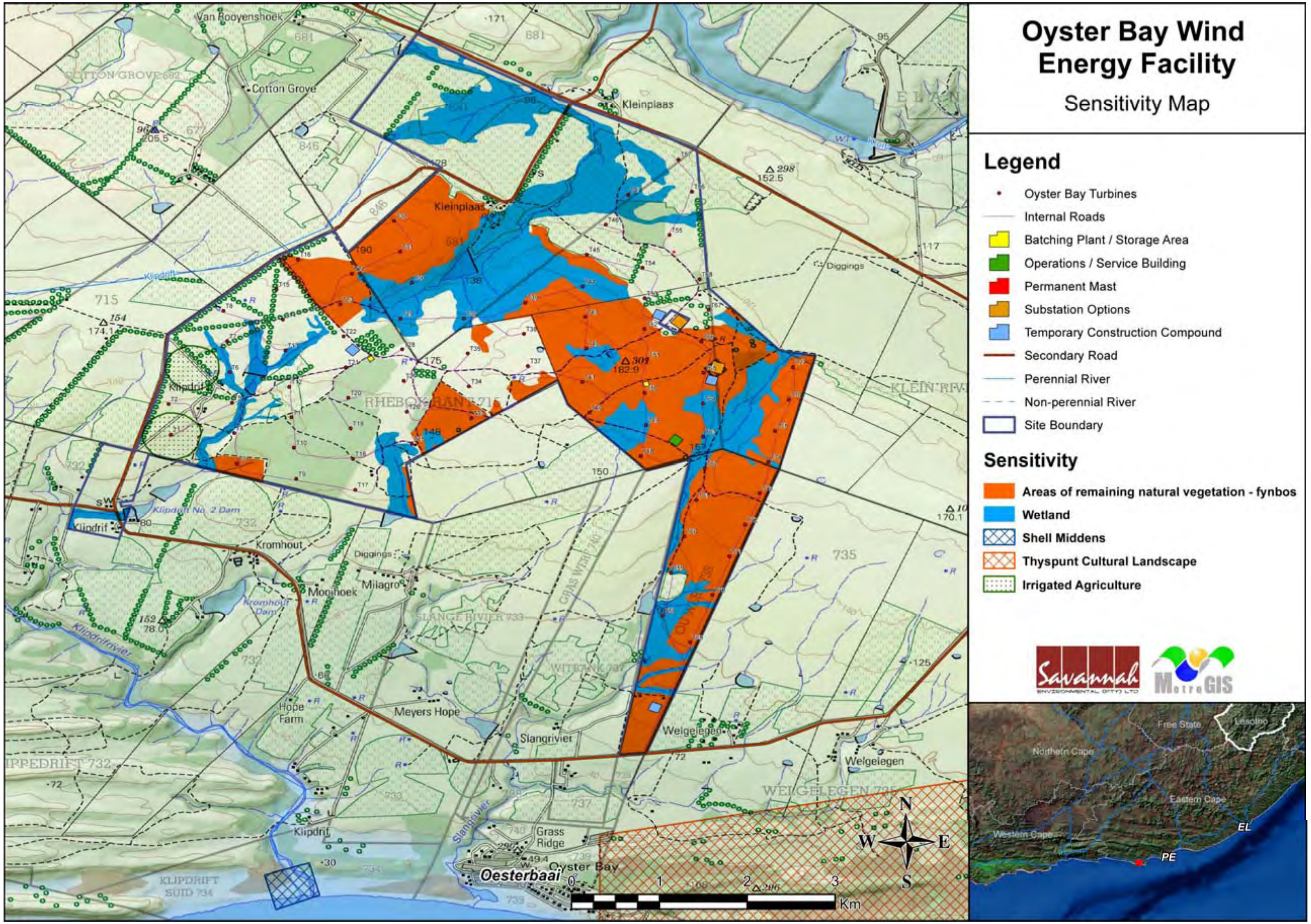

Figure 8.1: Environmental Sensitivity map for the project study area illustrating sensitive areas in relation to the Oyster Bay wind energy facility layout

In order to avoid and minimise impacts on sensitive areas or receptors, it has been recommended that:

» Turbine positioning takes cognisance of sensitive areas (as indicated on **Figure 8.1**) by relocating the following turbine positions:
  * Turbines 4, 6, 13, 25, 29, 30, 36, 39, 42, 44, 47, 49, 58, 59, 60, 62, 63, 64, 70 and 74 should be moved in order to avoid / minimise impacts on wetlands. These turbines should be placed a minimum of 50 metres outside the outer edge of wetlands in terms of the National Water Act 107.
  * Turbine 1 should be removed from the agricultural land which has a pivoted irrigation system.
  * The following turbines are removed from the areas of high soil / land-use sensitivity (1, 6, 24, 29, 30, 36, 44, 49, 59, and 63).
  * Turbines 58-61 and 69-72 should be constructed further inland as recommended by the heritage specialist due to the Thyspunt cultural landscape / heritage site to reduce the visual impact.

8.6. Revision to the Design Layout in Response to the findings of the EIA

In response to the recommendations made through the specialist investigations undertaken, and based on the areas / sensitive environmental receptors identified in Section 8.5, RES has revised the layout, including the positioning of the turbines substation locations, and internal road routes (refer to Figure 8.2). This has been done in order to demonstrate the feasibility of implementing the recommended mitigation measures, resulting in the minimisation of predicted impacts as far as possible.

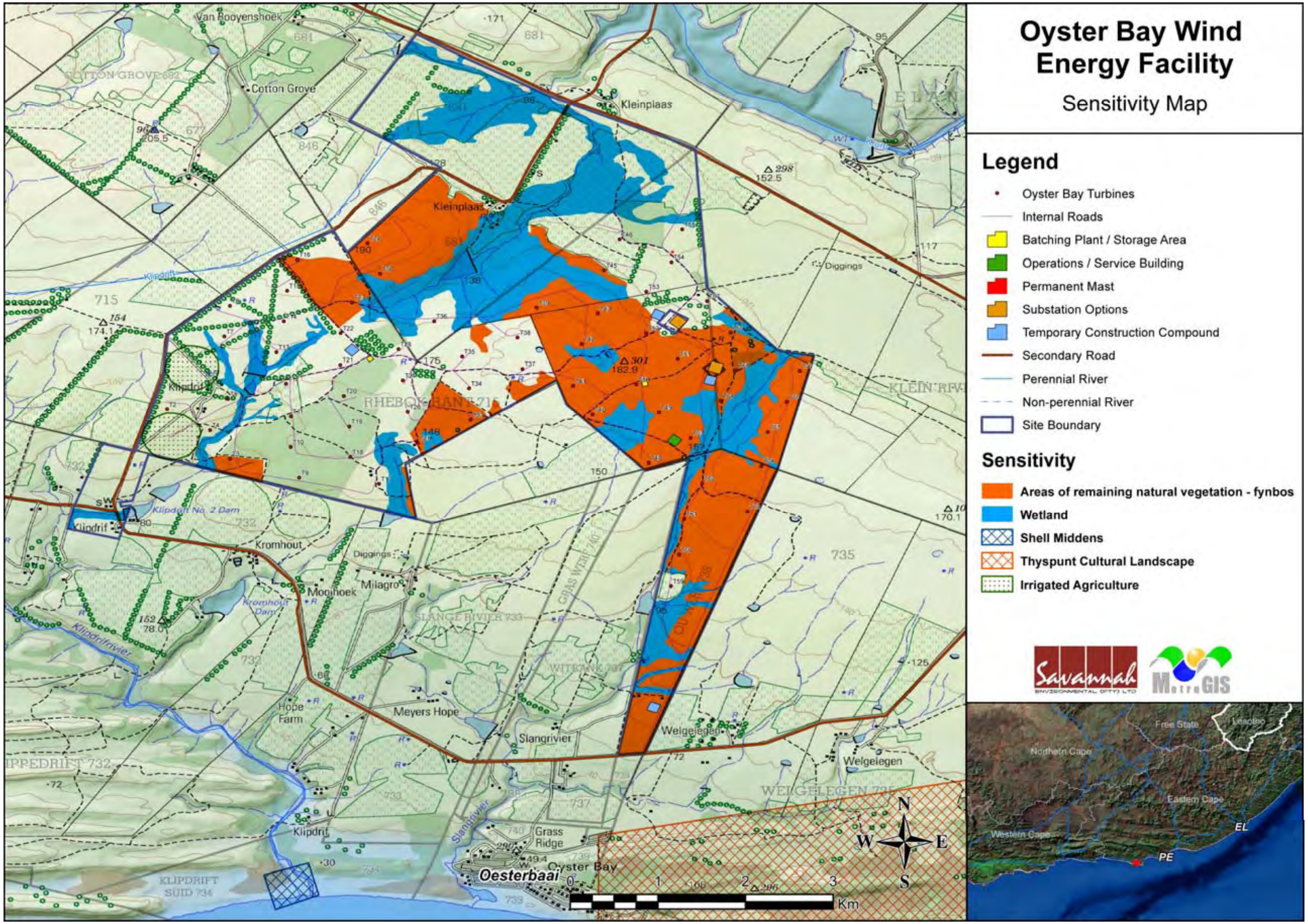

Figure 8.2: Combined sensitivity map for the project illustrating a **revised layout** taking into account the identified potentially sensitive areas

Relevant amendments to the layout for the proposed Oyster Bay wind energy facility include the following:

- A reduction in the number of turbines from **77 to 62** (due to relocation / removal of turbines)
- Turbines 6, 29, 36, 44, 47, 58, 59 and 70, have been removed from the layout, as they were previously located within wetlands.
- Turbines 4, 25, 30, 13, 39, 42, 49, 60, 62, 63, 64 and 74 has been relocated at least 50 metres outside the outer edge of wetlands in terms of the National Water Act 107.
- Turbine 1 has been removed from the agricultural land which has a pivoted irrigation system.
- The following turbines were removed/ relocated from the areas of high soil / land-use sensitivity (6, 24, 29, 30, 36, 44, 49, 59 and 63).
- Turbines 58, 69, 70 and 71 have been removed from the layout in line with the recommendations by the heritage specialist due to the Thyspunt cultural landscape / heritage site (to reduce the visual impact).

In this regard, the following impacts have been minimised through this revised layout:

- ***Impacts on wetlands:*** turbines have been relocated such that identified wetland areas are avoided. It may however still be necessary to cross some wetland areas with roads and/or cables. In these instances, the recommended mitigation measures will be required to be implemented. In addition, a water use license will be required to be obtained from the Department of Water Affairs.
- ***Impacts on agricultural potential:*** turbines have been relocated such that they are outside of areas of high soil / land-use sensitivity, and outside of actively cultivated areas. In consultation with the landowner, it has been determined that the actively cultivated areas currently on site cannot be moved or expanded for the following reasons:
  - The apparatus would not physically fit anywhere else on the land, and is also restricted by wind direction and strength, and distance from the dairy.
- ***Impacts on cultural landscape:*** turbines within the culturally sensitive area have been reduced. Although not totally removed, this is considered acceptable from a visual perspective as the existing Red Cap viewshed as a result of the addition of the Oyster Bay facility remains largely unchanged. This therefore also mitigates the potential impact on the cultural landscape as a result of the Oyster Bay facility to some extent.

With the implementation of this revised layout, the predicted impacts will effectively be reduced to the post-mitigation significance ratings as detailed in

Table 8.2. Therefore, this revised layout is preferred from an environmental perspective.

8.6.2. Revised Layout - Quantification of Areas of Disturbance on the Site

A site of 23 km^2 was considered for the facility. 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. This is explained further below.

Permanently affected areas comprise **62 turbine footprints** (62 foundation areas of 7m in diameter in extent), access roads (up to 6 m in width), one 33/132kV substation footprint (120m x 120m in extent), one 132 kV powerline and an operations and service building area (20 x 40m). The area of permanent disturbance is approximated as follows:

Facility component - permanent	**Approximate area/extent (in m^2)**
62 turbine footprints (7m in diameter per turbine)	2386
Permanent access roads within the site (6 m in width) ~42km	252000
One on-substation footprint (120m x 120m)	14400
Operations and service building area (20 x 40m)	800
TOTAL	269 586 (of a total area of 23km^2) **i.e. 1.17 % of site**

Temporarily affected areas comprise 62 foundation areas of 25m in diameter in extent, laydown areas for turbines (each laydown area assumed to have a footprint of 60 m x 40 m) as well as a track of 13 m in width if a crawler crane is required to move across the site (i.e. an additional 7 m width to the permanent road of 6 m in width). A crawler crane is not desirable and will be avoided if possible. The area of temporary disturbance is as follows:

Facility component - temporary	Approximate area/extent (in m^2)
62 temporary turbine foundation areas (25m in diameter)	30434
62 turbine laydown areas (60 x 40m each)	158400
Temporary crane travel (13 m) track (if required for a crawler crane) on top of the permanent access road (6m in width) ~42km	546000
TOTAL	734 834 (of a total area of $23km^2$) **= 3.19 % of site**

Therefore, a total area of 734,834 m^2 can be anticipated to be disturbed to some extent during the construction of the wind energy facility. This amounts to ~3.19% of the total 23 km^2 area which will form part of the total wind energy facility site.

Based on the revised layout the **permanently** affected area would be reduced from 1.24% to 1.17% (reduced by 0.07%) and the **temporarily** affected area would be reduced from 3.48% to 3.19% (reduced by 0.29).

In addition to the impact on the facility site itself, the proposed powerline will have a linear development footprint for the tower positions (depending which alignment is selected by RES), with a 35 metre servitude.

8.4. 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. In order to meet the long-term goal of a sustainable renewable energy industry in South Africa, a goal of 17,8GW of renewables by 2030 has been set by the Department of Energy (DoE) within the Integrated Resource Plan (IRP) 2010. This energy will be produced mainly from wind, solar, biomass, and small-scale hydro (with wind and solar comprising the bulk of the power generation capacity). This amounts to ~42% of all new power generation capacity being derived from renewable energy forms by 2030.

Through pre-feasibility assessments and research, the viability of establishing a wind energy facility near Oyster Bay, in the Eastern Cape has been established by RES SA. The positive implications of establishing a wind energy facility on the demarcated site within the Eastern Cape include:

» The project would assist the South African government in reaching their set targets for renewable energy.
» The potential to harness and utilise good coastal wind energy resources on this site would be realised.
» The National electricity grid in the Eastern Cape would benefit from the additional generated power.
» Promotion of clean, renewable energy in South Africa.
» Creation of local employment and business opportunities for the area.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation, monitoring and management measures are implemented.
» Based on the findings of the Social Impact Assessment, none of the landowners who stand to be directly affected by the proposed wind energy facility are opposed to the development, as they will benefit from the leasing of the land by RES SA. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures and recommendations listed in the report to address the potential negative impacts during the construction phase, specifically the presence of construction workers, should also be implemented.
» The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society as a whole.

The significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. This is demonstrated through the development of the revised layout, as discussed in Section 8.6. 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**.

8.5. Overall Recommendation

Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility and associated substation and power line, the findings of the EIA, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the application for the proposed Wind Energy Facility north of Oyster Bay and associated infrastructure can be mitigated to an acceptable level, provided appropriate mitigation is implemented and adequate regard for the recommendations of this report and the associated specialist studies is taken during the final design phase and should be authorised.

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

» A **wind energy facility** including wind turbine generator units as indicated in the **revised layout (shown in Figure 8.2) which is nominated as the preferred option for implementation**. The facility would be operated as a single facility with each turbine being between 1,8MW and 3MW in capacity.
» Each wind turbine is expected to consist of a concrete foundation, a steel tower, a hub (between 80m and 120m above ground level, depending on the turbine size decided upon) and three blades between 45 to 55m long attached to the hub.
» Associated infrastructure, including:
    - Possibly a small transformer outside each turbine tower, depending on the type of turbine deemed most suitable for the site. Such a transformer would have its own foundation and housing around it.
    - Crane hardstandings (approximately 60 x 40m depending on turbine choice, crane choice and geotechnical considerations).
    - Cabling between the components, laid approximately 1 m underground where feasible. In as far as possible, cabling will follow the internal access roads.
    - Internal roads (approximately 5-6 m in width) linking the wind turbines and other infrastructure on the site. Existing farm roads will be used as far as possible. However, the dispersed distribution pattern of wind turbines will necessitate the construction of new access roads in some areas.
    - An on-site substation to facilitate the connection between the facility and the grid. This proposed substation will have a high-voltage (HV) yard footprint of approximately 120m x 120m. **Substation Option 2: KromRivier Intake/Switching Substation is nominated as the preferred option**.
    - A new 132kV overhead power line to connect to Eskom's existing Melkhout (132kV) substation which is approximately 20km from the site. **The Eastern and Central alignments are preferred over the Western alignment.**
    - **Operation and service building area** for control, maintenance and storage (approximately 20 x 40m depending on turbine choice).

The following conditions would be required to be included within an authorisation issued for the project:

» All mitigation measures detailed within this report and the specialist reports contained within Appendices F to N must be implemented.
» The draft Environmental Management Plan (EMP) as contained within Appendix O 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.
» RES to continue with the long-term bird monitoring programme already commenced with in order to understand the nature of impacts on avifauna due to wind energy facilities on the site and in South Africa. Pre-construction bird monitoring should continue for a 12-month period as planned, to establish an adequate baseline for comparative purposes. Pre-construction and post-construction monitoring is implemented any accepted or endorsed bird monitoring guidelines or standard.
» The power line should be marked with Double Loop Bird Flight Diverters on the earth wire of the line, 5m apart, alternating black and white to mitigate against impacts on birds.
» Quarterly noise monitoring should be conducted an acoustic consultant for the first year of operation. This monitoring is to take place over a period of 24 hours in 10 minute bins, with the resulting data co-ordinated with wind speeds as measured at a 10 meter height. These samples should be collected when the Wind Turbines are operational. Quarterly monitoring is recommended at NSD32 and one in the vicinity of NSD31 for the first year, as well as any other NSDs that have complained to the developer regarding noise originating from the facility.
» Should the layout (or type of wind turbines used) change significantly during the final design, it is recommended that the new layout be remodelled/reviewed in terms of the potential noise impact by an independent acoustics specialist.
» The final location of the wind turbines and associated infrastructure within identified sensitive areas (if any) must be informed by surveys undertaken by ecological and avifaunal specialists. The findings of these surveys must be included in the site-specific EMP to be compiled for the project.
» Following the final design of the facility, a revised layout must be submitted to DEA for review and approval prior to commencing with construction.

- Disturbed areas should be kept to a minimum and rehabilitated as quickly as possible and an on-going monitoring programme should be established to detect and quantify any alien species.
- An on-going monitoring programme should be established to detect and quantify any alien species. During construction, unnecessary disturbance to habitats should be strictly controlled and the footprint of the impact should be kept to a minimum.
- A comprehensive stormwater management plan should be compiled for the substation footprints prior to construction.
- Applications for all other relevant and required permits if required to be obtained by RES SA must be submitted to the relevant regulating authorities. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to heritage sites, disturbance of protected vegetation, and disturbance to any riparian vegetation or wetlands.

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- Mr Charl DU Plessis, Landowner – Klein Plaas, 08/08/2011;
- Nick Bornman, Oyster Bay Resident's Association, 08/08/2011.

Interviews UNDERTAKEN AS PART OF Sia FOR Tsitsikamma Wef RELEVANT TO Oyster Bay Wef

- Mr B. Biggs, Landowner – Suiderland, 27/07/2011;
- Mr D. Ferreira, Landowner - Fredrickskraal Estate, 27/07/2011;
- Mr Mark Scheepers, Wattenergy, 03/08/2011;
- Mr N.J. O'connel, Kou-Kamma Lm Mayor, 30/11/2010;
- Mr N. Anderson, Landowner – The Valley, 27/07/2011;
- Mr Sabilo Nkuhlu, Kou Kamma Municipal Manager, 28/07/2011;
- Mr T Cilliers, Landowner - Kliprug Family Trust, 26/07/2011;
- Mr J. Vermaak, Landowner - Rosenhof Trust, 26/07/2011;
- Mr J. Strydom, Landowner - John Strydom Family Trust, 28/07/2011.

Interviews undertaken as part of Happy Valley WEF relevant to the Oyster Bay WEF

- Mr Arderne, Cape St Frances, 21/07/2011;
- Mr AND Mrs Donnelly, St Frances Residents, 21/07/2011;
- Mrs Elton, Cape St Frances, 21/07/2011;
- Mr Fadane, Idp Manager Kouga Municipality, 21/07/2011;
- Mr Griffiths, Wessa Eastern Cape, 21/07/2011;
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